Tampere University

ALEKSI NEUVONEN

Re-focusing on the Future

Backcasting Carbon Neutral Cities

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ACADEMIC DISSERTATION
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Responsible supervisor and Custos	Professor Panu Lehtovuori Tampere University Finland
Supervisor	Professor Peter Ache Radboud University The Netherlands
Pre-examiners	Professor Mark Tewdwr-Jones University College London The United Kingdom
	Professor Niki Frantzeskaki Utrecht University The Netherlands
Opponent	Associate Professor Robert Goodspeed University of Michigan The United States

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PREFACE

This PhD thesis is closely interwoven with my attempts to drive societal change over the past 25 years. Awareness of the climate crisis as the defining challenge of our time has framed much of what I've done in my professional and personal life. Furthermore, my strongly-held belief is that the climate crisis will be solved in cities: urbanization will globally be an unstoppable force over the stretch of the coming decisive decades. This renders cities the context in which infrastructure and practices for a post-fossil world will be built, which entails that we develop new methods for planning our cities. In these methods, our actions today will be guided and steered by ideas on what the future should be like. This line of reasoning has largely motivated my practical work, as a professional, volunteer and social entrepreneur.

Several academic disciplines have influenced this work, but out of those disciplines futures studies has been the most prominent. Conducting a variety of scenario exercises at differing scales over the years has taught me the value and purpose of the scenario approach. A conviction that we are at the moment living through a transformative period in history has led me to focus on this approach. I strongly believe that backcasting is a necessary tool for organizations and societies to agree on and plan their steps in this transformative period, toward futures worth pursuing.

Hence, this PhD thesis has been built around case studies on the backcasting approach. It elaborates on a number of issues I've encountered in my work within the academic discourse and intends to identify some broader patterns and concepts arising from these experiences.

My intention with this preface is to describe some parts of my journey leading up to the PhD thesis and to help in (re-)connecting some of my academic findings to their original context in practical work.

Academically, the roots of this thesis lie in 2005, when I was working on a master's thesis in Philosophy at the University of Helsinki. The thesis compared futures studies and the scenario method, with notions of scientific predictions presented within (traditions of) philosophy of science. The main claim was that scenarios as a way of constructing alternative futures place a special emphasis on the

role of people as learning actors (Kuusi 1999) that are capable of changing their behaviour as a consequence of new information.

The years following the master's degree were spent teaching a course on the foundations of futures studies and the scenario method at the University of Helsinki, coordinated by Finland Futures Academy. That allowed deeper dwelling upon theories in futures studies, including also a comparison between forecasting scenarios and backcasting scenarios, elaborated mainly by Karl Henrik Dreborg's 'Essence of Backcasting' (1996).

In those same years, I founded the Demos Helsinki think tank together with my dear friend Roope Mokka. One of the very first projects Demos Helsinki undertook was a competition entry for the Greater Helsinki Vision 2050 ideas competition in 2007, teaming up with young architects Hans Park and Tuomas Toivonen. The GHV2050, organized jointly by the fourteen municipalities of the Helsinki region, aimed to create a joint vision for the sustainable development of land use, housing and transportation for the metropolitan region, an entity that did not (and still doesn't) have formal administrative structure nor planning power.

Our GHV2050 competition team chose not to focus on presenting one comprehensive idea on spatial macro-structures of the region. Instead, our entry, called "City 2.0 – Towards a Social Silicon Valley", created an entirely new governance structure for the metropolitan region, which in many ways departed from the Nordic tradition of the strong public sector and structures of representative (party politics-led) democracy. This new governance model was to be based on a number of social innovations, such as long-term foresight as the core function of the mayor's office, neighbourhood-level emissions reduction targets, risk capital funds for social innovations by citizens, special experimentation zones with looser regulation but stricter time-bound targets on social and environmental goals etc.

The radical, profound idea behind the vision was that in the 21st century, cities will increasingly be defined by people and their communities, through their 'voice' and collaboration. This bottom-up approach echoed the 'Web 2.0' phenomenon on the user-produced internet and digital content - the revolutionary idea of the first decade of the new millennium that for a while was a symbol of ever-expanding democratisation and growing autonomy and capabilities of people.

Because the competition entry did not include one iconic image synthesizing the essence of the spatial design idea we decided to use a diagram presenting the temporal structure of our vision as the visual centrepiece of our proposal. Sketching this timeline reaching from 2010 to 2050, including both the social innovations we were suggesting and a scenario on a possible sequence of events in the surrounding

world, was a memorable, educating exercise to make. In the beginning, 40 years felt like a long period of time. Yet. when thinking about it from the perspective of planning, this approach unfolded temporal relations between various events and delays often included in the implementation of plans. For instance, it is highly unlikely that any large project, including, for instance, the building of new rail infrastructure, would evolve from the first plans to launch in less than a decade.

So, if all the transformative ideas of the entry were to be squeezed into this timeline, backcasting was needed, starting from the year 2050, placing the completion of many projects in the 2030s and 2040s. It then suggests that decisions on these projects are being made during the 2010s or early 2020s at the latest. This is a big revelation and provides a powerful argument on why thinking long-term and deploying scenario thinking is valuable. More precisely, this exercise showcased how creating alternative futures can be something more than just a 'nice-to-know' thing. Instead, they can be linked to the hard, tangible conditions of the planning.

City 2.0 – Towards a Social Silicon Valley was awarded the second prize in the GHV2050 competition and resulted in a further assignment in harvesting, analyzing and synthesizing ideas of the awarded proposals and continuing the vision process. In this assignment, the team partnered with the competition team from WSP Finland and a group of researchers from Helsinki University of Technology (later Aalto University), led by Panu Lehtovuori and Peter Ache, who would one day become my PhD supervisors.

That follow-up process included several co-creational activities with different stakeholders of metropolitan planning. In this work, the remarks and innovations on the use of backcasting from City 2.0 entry were utilized and further developed. The article "Metropolitan Vision making - Using backcasting as a strategic learning process to shape metropolitan futures" (Neuvonen & Ache 2017), included in this thesis, as well as the final report of the follow-up process (WSP Finland Oy et al., 2008), provide a more detailed description on the process and how backcasting was used in it.

Later, Demos Helsinki received research funding from EC FP7 as part of the SPREAD - Sustainable lifestyles 2050 consortium to run a major scenario process on future sustainable lifestyles. SPREAD was a so-called European social platform project. It aimed to gather existing academic research and social innovations and engage different societal stakeholders from business, research, policy and civil society in dialogue. The goal of this dialogue was to create a vision for sustainable lifestyles in 2050. The project included plenty of workshops with a wide variety of experts (and normal citizens) from different parts of Europe. The research

conducted in the project was supposed to synthesize previous studies on the topic and conjoin it with promising practices with the potential of advancing sustainable lifestyles.

The mission was to construct several scenarios in societies where sustainable lifestyles would be the norm. In other words, there would be a plurality of social models, economic systems and technological regimes under which society and the various lifestyles of its members would meet our normative targets on sustainability. In order to emphasize this plurality, a 2x2 matrix on key future uncertainties was used in defining our scenario landscapes. After a thorough internal process of workshopping, the following critical uncertainties were chosen: 1.) Technology is either pandemic or endemic, meaning that the dominant technological solutions defining societies, their infrastructure, production and practices either tend to spread and be used globally OR they evolve into radically contextual, locally used versions. 2.) Society's governing principle is either humancentric or meritocratic, meaning that the value and position of an individual either circles around professional skills OR around the wider use of human capital in all its forms.

The process of constructing the backcasting scenarios and their visualized timelines, using Delphi surveys, a two-day long expert workshop, and citizen workshops in five European countries as the main methods, has been described in detail in the article "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach" (Neuvonen et al 2014), which included in this thesis, and in the report "Scenarios for Sustainable Lifestyles 2050: From Global Champions to Local Loops" (Leppänen et al 2012). The scenarios appear in the report as visualized timelines that include both major events in politics, technology and the economy, but also snapshots of lifestyles that somehow illustrate the transition to sustainable lifestyles in a society enabling them.

Looking back on the SPREAD scenarios and the process leading to them in retrospect, it is fair to say that it was a rather unique exercise: After having read a number of scenario reports and journal articles describing scenarios and especially backcasting studies, it appears that most of them have a significantly narrower focus, include many details, and depict more conventional narratives of change than our contribution did. Also, our workshops, both with experts and citizens, were ambitious in the level of engagement and creativity that we expected from participants. Quite often, participants are requested to merely imagine alternative futures and then abstract some characteristics of desirable futures. Engaging participants in creating an entire scenario pathway seems to be much less common. One character that differentiated these scenarios from many other scenario

publications was the visualized timeline that contained an extensive amount of images of scenario events and lifestyle bits, something that was based largely on the work of our project partner from Politecnico di Milano.

After the SPREAD report publication, professor Lehtovuori invited me to give lectures on the scenario method and use of scenarios in his urban studies courses at the Estonian Academy of Arts and later in urban planning courses at Tampere University of Technology. Around the same time, professor Peter Ache asked whether I was interested in writing a PhD and suggested that we could co-author an article together on our experiences in Greater Helsinki Vision 2050. Also, professor Lehtovuori offered me a PhD position. These opportunities encouraged me to focus my interest on backcasting, scenarios and futures studies methods in the context of cities and research on planning systems. I managed to get a small grant for my PhD and initiated my post-graduate studies at both Tampere University of Technology and Radboud University Nijmegen.

During the process of writing the articles for this PhD thesis, several other scenario projects on the future of cities eventually did not end up being part of this study. For instance, Smart Retro, was a project aiming to identify tools supporting the update of 20th-century neighbourhoods to smart cities and to enable sustainable lifestyle practices. It included a large backcasting scenario exercise depicting three alternative futures for two areas, the city centre of Lahti (Finland), and Bagarmossen in southern Stockholm (Sweden). Later, in a project called ENCORE, a scenario workshop was organized for civil servants of the city of Turku, contextualising the Smart Retro scenarios to two strategically important areas and neighbourhoods in the city.

By far my most extensive enterprise in those years was a process called The Next Era, an initiative to create a vision aimed at reforming our current societal model. The core findings of the work shaped the societal vision of the Finnish Innovation Fund Sitra. Over two years we built a common understanding of the change taking place in our societies through numerous publications and events. People were engaged in numerous workshops in Finland and several other countries to imagine a just future in which values such as the broad participation of people, a high level of trust and fairness are paramount, all within planetary boundaries.

That unique and ambitious process took me deeper into analyzing the purposes and functions of normative futures. Furthermore, it enabled me to build a very broad, yet detailed, understanding on aspects and dynamics of the historical transformation from the era of fossil fuel-based industrial nation-states to the era of post-fossil, digital and global society.

In those same years, a research project called URMI took place, funded by the Strategic Research Council of Finland. This project created a scenario on the future of urbanization in Finland til 2040. These scenarios were not strictly speaking done through backcasting. Instead, we picked a reference scenario (which was the standard baseline scenario on the future of Finnish urbanization by the Finnish Environment Centre Syke, built as an extrapolation from historical time series) against which three scenarios depicting alternative developments were created. The main task was to identify what events could act as turning points away from this historical pathway.

In 2016-2018 took place a project called Bemine, also funded by the same program of the Strategic Research Council of Finland, focused on understanding the ambiguities and dynamics of Finnish urbanization, as well as visionary and anticipatory strategic planning. Several researchers in the project had either used or studied the use of scenario techniques in planning. That led to writing a co-authored journal article with professor Raine Mäntysalo from Aalto University and Joe Ravetz from the University of Manchester. Prof. Mäntysalo had studied different aspects and cases of strategic planning and used such conceptual tools as trading zones and boundary objects to make sense of what the conditions, factors and platforms are that help in building coalitions and how the future is being represented in these cases. Mr Ravetz has developed an extensive practice around the scenario method and developed it towards a comprehensive toolbox and process of synergetic planning, a future-oriented variant of participatory/strategic planning methods.

These conceptual frameworks were put together in order to explain how carbon neutrality targets as normative goals of planning can shape (strategic) planning practices and what additional methods and approaches are needed if these normative goals were to be taken seriously as the defining principles guiding all the planning and the future of cities. Mr Ravetz had been following and participating in Greater Manchester's efforts to make plans for transformation towards a carbon-neutral/low-carbon region. Therefore, GM was chosen to be the case through which we illustrate our hypothesis. This co-authored article, "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions" was published in Regional Studies and is included in this PhD thesis.

My journey with futures studies, the scenario method and the future of cities has now lasted almost two decades. It consists of well over a dozen ambitious scenario exercises, testing of various scenario methods (mainly qualitative ones) and collaboration with people who have vast experience and master futures methods.

Methods such as Delphi surveys and futures workshops have been tested with various designs for gathering data for scenarios.

The projects on the futures of cities, neighbourhoods and metropolitan regions have approached planning from different angles and paradigms: There have been projects that utilise futures studies methods as part of strategic planning exercises like the GHV2050. There have also been pure research projects that have sketched global, comprehensive (yet alternative) images of future societies and cities and provided possible pathways towards these futures, as was done in the SPREAD scenarios. Other scenario exercises have had a place-based approach (while still taking into account global/exogenic drivers), depicting alternative pathways of change on the level of a single neighbourhood or a city. Scenarios have been tested as a way to illustrate the interaction between spatial planning, social innovations, behaviour and lifestyles, and global, macro-level drivers like digital technologies, climate change and the global economy.

Over the course of 20 years, the relevance of these topics, methods and approaches for society, politics and business have surged. Climate change has become mainstream in political agendas, the amount and variety of infrastructure solutions, consumer products and services that aim to significantly reduce our climate impact have exploded, and most of the major cities in western countries have an official climate neutrality target. Cities of the 2040s in many regards have to function very differently than cities in 2020. Also, people have to change many things in their behaviour and daily routines. The future will be different than what we thought it would be a moment (perhaps a decade) ago. In other words, planning for the future requires (intentional, conscious) re-focusing on the future, not merely letting the future happen as a consequence of solutions to past challenges.

In this PhD thesis, I demonstrate that the horizon in the planning of cities is changing as a result of the abovementioned developments. That change requires tools and processes that support different kinds of learning and un-learning of people from various backgrounds, representing different interests and viewpoints. I have seen this happen on a smaller scale numerous times. This preface has provided a historical overview of that practice and its evolution. The following chapters of the thesis provide a systematic account of this finding and both empirical and theoretical arguments corroborating it.

ACKNOWLEDGEMENTS

I would like to thank my esteemed supervisors – Professor Peter Ache at Radboud University Nijmegen and professor Panu Lehtovuori at Tampere University for their invaluable advice, continuous support, and patience over the course of my PhD degree. I knew both of them well by the time I started my PhD studies. During this process, I've been fortunate to spend a lot of time with both profs. Ache and Lehtovuori, having had numerous warm and inspiring conversations on my thesis but also on an array of other topics. Building such friendships in parallel with working on the PhD thesis is something I value highly and feel great gratitude to both of them for.

My gratitude extends to the Faculty of Built Environment for the opportunity to undertake my studies at the Doctoral Programme in Built Environment at Tampere University, as well as to the Nijmegen School of Management at Radboud University for a position first as an external PhD student and eventually as a full PhD student.

I would also like to thank Fortum Foundation (currently called Fortum and Neste Foundation) for the grants I received to initiate my PhD studies in 2014 and 2015.

Additionally, I would like to express gratitude to Adjunct Professor Osmo Kuusi for his treasured support regarding methods of futures studies and ways of argumenting on their validity. Numerous discussions with him over the years on the scientific foundations of futures studies proved their value when writing the synthesis part of my thesis.

My dear, valued colleague and friend Dr. Kaisa Schmidt-Thomé was the first to read the manuscript of my synthesis chapter. I am very grateful for all the comments and positive feedback she gave to me on that early version.

The manuscript committee appointed by Radboud University - Professor Arnoud Lagendijk, Professor Vincent Marchau and Professor Mark Tewdwr-Jones - did a meticulous job in reviewing my manuscript and providing me with comments and suggestions that resulted in a significantly improved final version. I express my gratitude to the committee members, as well as to professor Niki Frantzeskaki for her pre-examination work at Tampere University.

The thesis is a compilation of four articles, all of them co-authored with other researchers. I co-authored an article with each of my supervisors, I wish to thank

both Prof. Ache and Prof. Lehtovuori for collaboration and mentorship on how to build an academic journal article.

I am grateful to Mr Joe Ravetz, Research Fellow at Manchester University, and Professor Raine Mäntysalo, for the opportunity to collaborate with them in writing the article published in Regional Studies. I learned a lot about their respective methods and approaches during the process.

The first part written in this thesis was "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach", an article on the scenarios of the SPREAD Sustainable Lifestyles 2050 project. That article, the SPREAD project and its scenario approach significantly shaped the rest of the PhD process. That all was a tour de force of Demos Helsinki, the primary context of my professional life for the past 17 years. Like practically all projects at Demos Helsinki, this was also a triumph of collaboration and co-creation between a group of highly committed people from our own team and our partners. Overall, Demos Helsinki and its people have been the sine qua non for the development of thinking behind this thesis. Demos Helsinki has by now managed to attract hundreds of extremely talented value-driven people. Working with them has been an exceptional bicycle for my mind. Additionally, my career at Demos Helsinki has allowed me to work on a continuous basis with cities searching for their future and developing tools and methods for doing so.

It gives me a unique joy that there is a piece written by my incredible Demos Helsinki colleagues included in this thesis! The eventual journal article was co-authored by a team of six; Satu Lähteenoja was the one who initiated the project during the proposal phase and gave it its agenda. Juha Leppänen started his Demos career (that has so far led to the chief executive position in the organization) by making a literature review on backcasting scenarios and then participating in writing the scenarios. Maria Ritola joined Juha and me writing the scenarios while also coordinating the SPREAD project at Demos Helsinki. Tuuli Kaskinen and Roope Mokka had significant roles in planning the scenario process. Needless to say, I am extremely grateful to all these dear colleagues and the whole Demos Helsinki team!

Two other long-time colleagues at Demos Helsinki, Outi Kuittinen and Simo Vassinen, also made significant contributions to the landmark project of SPREAD Sustainable Lifestyles 2050 and enabled the gathering of material for my study. My great appreciation goes to both of them for all their collaboration and friendship over the years, I have learnt a lot in our shared adventures on essential things like co-creation and mindful action.

Kirmo Kivelä had a pivotal role in creating the visual format for the SPREAD scenarios. I would like to thank my dear friend and close ally for all the shared thinking and wonderful collaboration over the years across numerous projects, including honing several tables and figures for this PhD thesis.

I am also grateful to Mikko Annala, who as one of his first Demos Helsinki duties helped in the re-submission of that very same article, and has ever since become one of the most trusted colleagues.

During the SPREAD scenario process I had the honour to collaborate with John Manoochehri in ideating the thematic logic of the scenarios, and with Dr. Michael Lettenmeier in modelling the material footprint composition that each scenario resulted in. I wish to express my deep gratitude to both of them for sharing their great expertise, as well as to the numerous other people that I collaborated with in the SPREAD project and eventually became longtime friends and allies with, like Nik Baerten.

I have been also very fortunate in being surrounded by numerous well-educated and sharp younger colleagues who have been capable of taking on the challenging task of editing the language of an academic manuscript despite having spent only a few years within academic culture. I would like to express my sincere gratitude to Kalle Mattila, Katariina Rantanen and Nour Attalla, all of who not only honed the language but also demanded I clarify my arguments in my articles and the synthesis section, eventually making them academically sound.

The case on Greater Helsinki Vision 2050 was a result of a competition entry called "City 2.0 – Towards a Social Silicon Valley" that won the second prize in the GHV2050 ideas competition. I will be always thankful for my dear and talented teammates in that contest, Roope Mokka, Hans Park and Tuomas Toivonen.

During my journey toward my PhD, I've had several influential mentors who have taught me something valuable about research work and the topics of my study.

Professor emeritus, Dr. Antti Hautamäki was the one who uttered the idea that came to be Demos Helsinki and also helped get it started. Over the years he has guided me to numerous new discourses and also led by example on how to utilize once gained education in philosophy in building relevant viewpoints on emerging complex societal issues. My maximum respect to Antti for his long-standing support and comradeship!

I had the great honour to be a friend and an ally of Tuija Talvitie for nearly 15 years, until her death in early 2020. Tuija provided tremendous support for Demos Helsinki from its early phase, offered invaluable encouragement and led me to numerous exciting events and places in her roles at the British council and Crisis

Management Initiative CMI (currently CMI - Martti Ahtisaari Peace Foundation). I miss her dearly and feel gratitude for all she gave to me and Demos Helsinki.

I was honoured to work in 2007-2010 for an explorative and forward-looking research project called KULTA, initiated and led by Professors Timo Honkela (RIP), Raimo Lovio and Mika Pantzar. Following their work in exploring and analyzing the nascent themes of the project taught me a lot and encouraged me to take on research on topics that are still emerging. I am deeply grateful for being given an opportunity to work with them. Through the very same project, I met Dr. Sari Stenfors, who has later become somewhat of a role model to me as a futurist driven by a strong societal mission and desire to collaborate with people from all walks of life.

I would like to thank Leo Kosonen for his willingness to share his vast experiences in the practice of urban planning, as well as his latest developments in translating that experience into a generalized theory on the planning of sustainable cities. The conversations and excursions I've had with him have played a great role in my education towards a planning scholar.

A great part of my thinking has grown as a result of conversations with my friends. I genuinely believe that the best ideas are co-created, emerging through intellectual exchange between people. Hence, I am very thankful for a great number of people who have inspired and pushed me forward.

I spent much of my early adulthood at the environmental NGO Dodo that I was part of founding in 1995. I have a conviction that all genuinely novel things originate from civic activism, a domain outside the market pressure of business or the political pressures of public organizations. Many of the ideas we were toying with at Dodo in the late 1990s and early 2000s have since become mainstream, starting from the idea that cities are the primary venues for solutions for the global environmental crisis. Dodo was also the cradle for many of the things that have been present in Demos Helsinki and this PhD thesis. I tend to say that my university education had a great influence on my development but so did my peers in Dodo. To name a few of those friends (in order of appearance in my life): Tuukka Taskinen, Jarno P Vastamäki, Jepa Pihlainen, Dr. Simo Kyllönen, Johanna Taskinen, Harri Lammi, Jarre Parkatti, Janne Tompuri, Johanna Sinkkonen, Kirmo Kivelä, Johanna Helmivirta, Tommi Laitio, Markus Nevalainen, Tea Tönnov, Sami Keto, Ella Vihelmaa, Matti Järvinen, Inari Penttilä and Pauliina Jalonen.

In Dodo I also met Pauli Saloranta, with whom I have had many great conversations related to the topics of my PhD. We share an aligned passion for understanding cities and developing methods for long-term planning. My deepest appreciation for all those moments and ideas we've created together.

Dr. Mikko Rask has had a great influence on my career as a researcher, first mentoring my internship as a research assistant at VTT, then sharing his experiences on building a career as a researcher and eventually convincing me that I have both the experience and materials that could take me several steps towards obtaining a PhD degree. My warm thanks for all your nudging, as well as for your long friendship.

My great appreciation goes to also a number of other friends for their exceptional capacity to be in my company and share valuable thoughts and ideas with me: Assistant professor Aleksi Aaltonen, Ferdi van Heerden, Kaisa Kosonen, Jenna Lähdemäki-Pekkinen, Antti J. Peltonen, Paul Miller, Dr. Björn Müller, Ismo Räävi, Anni Sinnemäki, Charlie Tims and Tim Wessman.

I co-founded think tank Demos Helsinki with Roope Mokka 17 years ago. Discussing, writing, working, partying and simply spending time together is always a special delight. One of the great miracles in my life has been that we managed to turn that joy into a profession and build a growing organization around it - and still it felt good! One has to feel great gratitude for your company, as well as the opportunity to have your dear family - Liisa Karttunen and your two daughters - in my life.

From the bottom of my heart, I would like to say a big thank you to my parents Ulla and Veikko Neuvonen, as well as my sister Aura Kaarivuo. Primarily for their love and care throughout my life. Secondly, for nurturing my curiosity and their willingness to have conversations on serious topics with me from very early on. Thirdly, for all the material and psychological support you've given to me over the years. I am very pleased that I can give my parents one additional reason to be proud of their adult son!

Finally, I would not have endured such a lengthy process without a partner like Tuuli Kaskinen by my side. We co-authored one of the articles of my thesis and have worked together throughout these years leading to my PhD degree. Since the onset of our collaboration in volunteering at Dodo, much before there was any romantic aspect involved, you have been a unique source of inspiration to me. Much of what I've achieved I owe to you. I am extremely proud and grateful for all we've done together! You have encouraged me to work towards the PhD degree, helped me in creating space and time for it and reminded me time and time again what a remarkable and exceptional achievement it will be. I am very pleased that I can say that my love for you has grown ever stronger during this process.

Of course, a great factor here is that we now have Sirri Neuvonen in our life, as a source of totally new dimensions of love. My greatest gratitude to both of you for

introducing me to all that - something that I could not properly imagine nor anticipate in my life when the journey towards the PhD degree began. Because of you, I've re-focused on the future!

ABSTRACT

The dissertation deals with the effects of carbon neutrality goals of cities on spatial planning. The special focus is on the utilization of backcasting future scenarios in this new context.

Hundreds of cities around the world have set goals for carbon neutrality to be achieved over the coming decades. These politically defined strategic goals provide a new kind of framework for urban planning. They provide normative, numerical indicators on what society and cities of the future should look like in the coming decades. Simultaneously, the desired carbon-neutral future will act as a vantage point for planning, replacing a present resulting from historical trends. The title of the dissertation, Re-focusing on the future, refers to this change.

Within futures studies this type of normative scenario approach is called backcasting, referring to imagined, logical pathways extending from a distant future to the present. The study contributes to planning theory by suggesting ways in which backcasting scenarios are being embedded in urban planning and by explaining how normative goals on carbon neutrality change goals, contents and process of urban planning.

These topics are being elaborated using three case studies and a literature review, all written as individual academic journal articles.

The literature review (presented in Article 1 "Planning Meets Futures Studies. Systemic societal change and the possibility of transformational planning) explores how the relationship between planning and futures studies has been described in previous academic literature. It provides context to the inquiries on backcasting and its potential role in spatial planning.

The first case study (presented in Article 2 "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach") depicts and explains the logic behind the backcasting scenarios created in the SPREAD Sustainable Lifestyles 2050 project. The case explores the function and purpose of backcasting scenarios in transitions towards a carbon-neutral society.

The second case study (presented in Article 3 "Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures") presents a description and analysis of the Greater Helsinki Vision 2050 process. This

process intended to create a long-term transformative vision for a territory that previously lacked formal governance structures.

The third case study (presented in Article 4 "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions") explores the emerging role of carbon neutrality targets as 'the new normative' in urban and regional planning. The context of the new normative is being illustrated through a review of the Greater Manchester process on developing climate mitigation, low-carbon and carbon neutrality policies since the 1990s.

The main results of the dissertation are related to explaining how backcasting generates higher-order, strategic and collective learning that can increase agency, change problem framings and enable new forms of collaboration and co-production. Additionally, the role of un-learning as an outcome of backcasting is highlighted, referring to an idea that different actors can see the future as dependent on choices made in the present day, instead of as something determined by external forces.

The main practical relevance of this thesis arises from explanations on why backcasting scenarios are an indispensable tool in planning toward carbon neutrality and how their benefits appear. For urban planning, these scenarios expand the view on decarbonisation and help discover a more detailed and wider scope of solutions than what planning has previously provided. Examples include traditional density, public transit and walkability-related frameworks on climate mitigation. This is bound to become increasingly important as the decarbonisation of primary energy production and urban mobility are accelerated and the priorities in emission reductions move to other domains of consumption and urban lifestyles.

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CONTRIBUTIONS OF THE AUTHOR

Article 1: Aleksi Neuvonen was the lead author of the article and took responsibility for conducting the literature review and its analysis, as well as writing the theoretical background on futures studies. The introduction part framing the question, the discussion, and summary sections of the article were created in collaboration with the co-author.

Article 2: Aleksi Neuvonen was the lead author of the article and was in charge of gathering the theoretical framework and describing the methodology used, positioning the paper and its research questions in the introduction and synthesizing the conclusion of the article.

Article 3: Aleksi Neuvonen was the lead author and had the main responsibility of writing the parts on backcasting methodology and the case description, while the introductory parts and the analysis sections were written in equal collaboration with the co-author.

Article 4: Aleksi Neuvonen was the initiator of the article. The data for the case review was collected by Joe Ravetz, who was the lead author of the article. Neuvonen was responsible for writing the parts on backcasting scenarios as a component of the methodological framework presented and defining the conceptual frame of the new normative. Additionally, the introduction and discussion sections were created in equal collaboration among the three authors.

1 INTRODUCTION: RE-FOCUSING ON THE FUTURE

Our cities of today are facing a historically unprecedented situation, as the threat of climate change challenges them to alter numerous previous developments and practices. Meanwhile, the global trend of urbanization continues. Cities are also the places where the prosperity of people grows and accumulates. Over the history of the industrial era, this development has entailed growth in climate emissions and other forms of environmental stress. Now the link between these phenomena is bound to be broken as a result of human intentions: hundreds of cities throughout the world have set time-bound targets on reaching climate neutrality over the next 10-30 years (cf. Reckien et al 2018) as a response to the climate crisis.

The ambition to reverse the historical trend is remarkable, and so is the commitment to control the catastrophic threat caused by climate change. However, this ambition also creates a remarkable step in the history of cities: long-term climate targets set a clear, well-defined goal that will guide and constrain what cities of the future will be like. Climate emissions cut across our contemporary society and its practices. Therefore, climate-neutrality targets are setting principles on the development of nearly all domains and sectors of society and the economy, including urban planning.

These targets create a new normative framework for planning, aiming at a radical transition. In other words, planning should be guided by something residing in the future, and not be merely based on current needs, existing physical structures and past continuities.

In a way, urban planning has always reached further towards the future, searching for ways of organizing available resources so that they elevate society's capacities to increase wellbeing and transcend its past limits and related problems. This is something embedded in the practice of planning. It is also a mission that planning should communicate to society, as it is and should be the 'mobilisation of hope' (Healey & Hillier 2008), and planners certainly have a 'bias for hope' (Friedmann 2002).

Yet, despite the future orientation of urban planning, the material artefacts and social spaces of cities inextricably tie them to their past as well. Today, the influential historical legacy dates from the industrial era that markedly increased city sizes and expanded the scale of urban infrastructures. Most of the technical innovations behind industry-driven urban growth were based on energy from fossil fuels.

Now, due to many cities' commitment to transition to carbon neutrality, urban planning is facing a situation in which its future orientation has to be re-gained and re-focused. For a while, climate mitigation was thought of as a technocratic challenge, mainly requiring tweaks in technological systems and perhaps economic incentives and financial tools enabling and accelerating technological change. This approach requires mastering quantitative metrics related to greenhouse gas (GHG) emissions, costs of emissions reduction measures and their anticipated value in the future. Yet, when the problem of climate change is interpreted as the imperative of transition to carbon neutrality, it emerges as an issue of non-linear co-evolution of a large array of solutions, social innovations and new institutional configurations (Luque-Ayala et al 2018).

Our climate challenge calls for tools for both planning and thinking about the future. The era full of uncertainties and emergence cannot be managed by planning transformative change linearly. Nor can we passively explore how various new drivers, megatrends and other surprising phenomena appear and then navigate through these uncertainties, trying to adapt as successfully as possible.

These options are not possible because of the existential nature of the threat. In the case of climate change, trying merely to adapt to the changes it eventually brings would be morally wrong because of its devastating consequences on future generations. Yet these types of futures are precisely where business-as-usual development will lead if we fail to make significant changes. Therefore, decision-making and planning cannot solely rely on these types of images of the future or future scenarios. Instead, a greater focus on desirable futures in societies beyond climate emergencies and ways of achieving them is needed.

Societies and their members have to assume that significant changes (for the better) are possible despite the historical trend of rising GHG emissions pointing in the opposite direction. Organizations and societies must be able to build capabilities for transitions that differ significantly from the usual incremental ways of altering and renewing reality around us. This entails seeing people as capable of thinking of the future as something that they can affect and of targets as relevant tools in shaping reality. In other words, human intentions and plans, not only the macro-level

accumulating, predominantly deterministic causal processes of nature and society, are significant drivers of change in the perspective of long-term futures.

Urban planning can be the domain of collective imagination of futures beyond the transition and discover (by borrowing or inventing) tools that can connect images of the future with commitment from stakeholders and co-evolution of solutions. Hence the title of this thesis 'Re-focusing on the future' means two things: 1. To strengthen the relationship of spatial planning to the long-term future, and 2. to transform how the future is being thought of: not merely as a continuity of the past but also as the goals and targets defining transformative future change.

Historian Jenny Andersson has described the dual role of the future in our contemporary culture as follows: The future appears to us both as (1) images of a coming tangible reality, resulting from regular, path-dependent developments, and as (2) a fundamental social construct, emanating only from the human mind as a result of imagination (Andersson 2018). 'Carbon neutral city', as a political, imaginary response to climate change is an example of the future as a fundamental social construct. We have plenty of prediction tools for creating representations of the future as forecasted from past facts. To strengthen the power of social constructs on imagined futures, we have to also have tools for creating representations of transformative futures.

This thesis focuses largely on the use of the backcasting scenario approach as a tool with the potential of re-focusing on the future. In essence, backcasting scenarios work backwards from an envisioned future image (e.g. a future within the 1.5. degrees global warming target) to the present day, depicting alternative pathways within the boundaries of desirability or acceptability. Constructing and reading backcasting scenarios is supposed to help in expanding the domain of solutions and conditions that could accelerate system-level transitions.

This thesis analyzes cases that exemplify and depict changes in spatial planning's relationship to long-term futures, and introduces ways of using backcasting as a tool that can help in re-focusing planning to the future.

The three cases presented in the four articles of this thesis, written between 2012-2020, provide different perspectives on carbon-neutral transitions in cities, spatial planning as a system to manage and govern those transitions, and the backcasting scenario approach as a new tool that could help spatial planning in the emerging mission of urban decarbonization. These issues, domains and cases form the fundamental elements of this thesis' research framework and are introduced in the chapter on objectives of the research (chapter 3). Furthermore, the synthesis section of this thesis contextualises research presented in the articles into wider theoretical

frameworks (chapter 4) that provide ingredients for the conceptual model of the research (chapter 5). This eventually enables the construction of the overarching research strategy and methodology of this thesis (chapter 6). Chapter 7 and 8 gather the results of the PhD of the study and identify the contributions to previous academic discourses and practical work.

2 THE RESEARCH OF THE THESIS AND ITS CONTEXT

This thesis was initiated by curiosity towards backcasting scenarios and their potential in planning and managing the transition to a carbon-neutral society. The author's master thesis in theoretical philosophy in 2005 compared the scenario method with notions on scientific predictions within (traditions of) philosophy of science. Soon after that, reading about the distinction between forecasting scenarios and backcasting scenarios, elaborated mainly by Karl Henrik Dreborg in his seminal article 'Essence of Backcasting' (1996), crystalised the understanding of scenarios as a tool for depicting alternative futures as results of human action.

Several projects on the future of cities and spatial planning enabled experimenting with backcasting scenarios and eventually provided valuable lessons on how backcasting could be applied and what kinds of benefits it would bring. Three of the four articles in this PhD thesis were results of work done in these projects taking place between 2007-2019.

The author participated in the Greater Helsinki Vision 2050 ideas competition and its follow-up work in various roles between 2007-2008; first as a member of an eventually successful competition entry, then as a member of a team analysing the competitions' results and designing a participatory stakeholder process towards the 2050 vision. The process allowed several experiments to be developed around the backcasting approach.

In 2011-2012, the author was part of the European commission-funded FP7 project Sustainable lifestyles 2050 (SPREAD) and was in charge of designing a backcasting scenario process, resulting in a scenario report on the future of sustainable lifestyles in Europe.

In 2016-2019, the author was part of a research project called BEMINE – Beyond MALPE-coordination: Integrative Envisioning, funded by the Strategic Research Council of Finland. The project focused thematically on the integrative capacities of urban planning in steering city-regional development towards a more sustainable future. Among the themes studied in the project was the role of different scenario techniques in urban planning.

These experiences, and questions arising from them, prompted the writing of the articles of this thesis and their compilation into a PhD dissertation.

Article 1

The first article of the thesis, "Planning Meets Futures Studies. Systemic societal change and the possibility of transformational planning" (in process), co-authored with professor Panu Lehtovuori, is a literature review that intends to build a view on how the interaction between futures studies and urban planning has been described, and how the backcasting scenario approach should be contextualised in this wider picture.

The author of this thesis was the lead author of the article and took responsibility for conducting the literature review and its analysis, as well as writing the theoretical background on futures studies. The introduction part framing the question, and the discussion and summary sections of the article were created in collaboration with the co-author.

The article explores how the relationship between planning and futures studies has been described in previous academic literature, providing context to the inquiries on backcasting and its potential role in spatial planning. This question related to the relationship between the two disciplines is being framed by a wider contextual research problem on how previous rational and communicative approaches to planning could be updated to face the current systemic societal transition, necessitated by the climate crisis and the horizon of carbon-neutral cities and society. The initial hypothesis is that planning and planning theory would benefit and be better equipped to take on this new challenge if it could learn from epistemes, practices, methods and tools of futures research.

The literature review is based on a bibliometric study that intended to identify previous academic papers that elaborate the relationship between planning and futures studies. This study managed to identify 27 such articles, published between 1976 and 2018. The articles are being analyzed through the following questions: 1. What are the major or disruptive challenges that influence the ability of urban planning in providing for better cities and societies in the future? 2. What could urban planning learn from the episteme and practices of futures studies to improve its impact and relevance? 3. What are the relevant institutional forms or good practices that combine future studies and urban planning? 4. What are the tools and

methods that planning should adopt from futures studies, especially in the context of unfolding environmental crises?

The articles explored in the review do not form a clear discourse. There is no coherent discipline nor theory on how foresight should be used in planning, and this foresight is only exhibited in individual local practices by enthusiastic planners.

In the article's summary, the authors Neuvonen and Lehtovuori suggest that there would be a clear need for a new planning paradigm, calling it transformational planning. This new approach would respond to the need to imagine and plan cities within the constraints of carbon neutrality, combining both procedural and substantive aspects of planning. This new process should learn and take elements from backcasting scenario approach and transition studies, thus refocusing planning on clear societal goals and transformational missions.

Article 2

The second article of the thesis provides a case study on backcasting scenarios used in the context of low-carbon transitions. It depicts and explains the logic behind the backcasting scenarios created in the SPREAD Sustainable Lifestyles 2050 project, in which the author was the work-package lead of the scenario study. The article "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach", published in Futures 2014, was co-authored with Tuuli Kaskinen, Juha Leppänen, Satu Lähteenoja, Roope Mokka and Maria Ritola, all of whom were involved in designing and implementing the preceding scenario process.

The author of this thesis was the lead author of the article and was in charge of gathering the theoretical framework and describing the methodology used, positioning the paper and its research questions in the introduction and synthesizing the conclusion of the article.

The article demonstrates how backcasting scenarios can depict alternative futures of low-carbon societies and sustainable lifestyles in those alternative futures and societies. Based on a participatory scenario process of the SPREAD project the article intends to expand the discourse on sustainable consumption patterns into a wider approach on sustainable lifestyles (that could now be termed 'sustainable social practices'). It also elaborates the function and purpose of backcasting scenarios in transitions towards a low-carbon society by introducing the idea of emancipatory backcasting, a variant of backcasting scenarios that aims to identify and empower actors to understand their role in the formation of sustainable futures. In this case,

'backcasting' appears as a wider methodology of a study, yet it is also used as an interaction method amongst participating stakeholders (cf. Quist & Vergragt 2006).

The theoretical framework for the article is based on studies regarding sustainable lifestyles and consumption patterns, the tradition of transition studies and thinking behind backcasting scenarios. Research on the environmental impacts of consumption patterns has over the past 20 years provided a detailed understanding on hotspots of environmental stress of lifestyles and variances in levels of ecological/climate/material footprints between different lifestyle trends, social groups and geographical regions. Transition studies have focused on how sustainable practices can spread through co-evolution between niche level innovations, their user groups, regulation, spatial structures and landscape-level changes in other fields of society. Backcasting scenarios have emerged as a tool that can help in sense-making on how transitions to a future society within planetary boundaries can come about.

As a combination of these theories we formed presumptions that a) there are alternative futures that lead to a low-carbon society with sustainable lifestyles and that within those alternative futures is diversity in (sustainable) lifestyles, b) the average material footprint of a European living in a low-carbon society in 2050 could be estimated to be 8000 kg/annum. Based on these principles a scenario process consisting of desk studies, Delphi surveys, a large stakeholder workshop and several citizen workshops, four scenarios on sustainable lifestyles in low-carbon societies were formed. Promising practices on sustainable lifestyles and emerging niche level lifestyle bits identified in different locations during the SPREAD project functioned as the building blocks of the four scenarios created.

Two of the scenarios ("Singular super champions" and "Governing the commons") were depicted as processes of gradual change, driven and enabled by emerging technological opportunities and continuing the long trend of a globalizing economy, culture and technological regimes. The other two scenarios ("Local loops" and "Empathetic communities") were narratives that included a disruptive crisis that tweaked societies towards increasingly local practices. Another distinction between scenarios was the primary role of individuals, whether it was focused on professional performance or on being an active citizen.

Article 3

The third article is a case study on the use of the backcasting scenario approach in a strategic spatial planning process. "Metropolitan vision making – using backcasting

as a strategic learning process to shape metropolitan futures", published in Futures in 2017, presents a description of the Greater Helsinki Vision 2050 process that both authors (Aleksi Neuvonen and Peter Ache) participated in as experts working with municipal and regional planning authorities. In writing the article the author of this thesis acted as the lead author and had the main responsibility of writing the parts on backcasting methodology and the case description. The introductory parts and the analysis sections were written in equal collaboration with the co-author.

The Greater Helsinki Vision 2050 process intended to create a vision for a territory that lacked previously formal structures of governance. The article suggests that a visioning process can be seen as an attempt to bring 'unmanageable' metropolitan regions within the scope of the manageable by imagining alternative futures that have longer-than-usual time horizons.

The role of metropolitan regions in the process of urbanization has grown over the past decades. This has challenged the traditional methods and institutions of planning. Meanwhile, several other drivers are challenging planning, from the imperative of carbon neutrality to the challenge of how to plan within spatial structures that have already once been planned and built. Creating new types of 'soft spaces' by initiating discussions on long-term futures with various stakeholders is a way of stretching the horizon of possibilities in planning. The incrementalism with the perspective approach, introduced in the International Building Exhibition Emscherpark in Germany during the 1990s, is an example of how to expand the scope of planning in a large, challenging context by sketching long term possible futures and experimenting with ways to incrementally move towards them.

The extensive vision process included an ideas competition and a follow-up aimed at gathering diverse elements from the awarded competition entries and refining them through a participative stakeholder process into a regional vision. This was hoped to accelerate and deepen collaboration between the 14 municipalities of the Helsinki region and their planners.

The article explains how the backcasting approach was used in various stages of the GHV2050 process and how it helped participants of the project to think of distant futures and challenge their existing practices and problem definitions, eventually bringing about strategic learning that helped in identifying trajectories of change. Backcasting appears mainly as an interaction process among stakeholders. Still, it is also introduced as a method that helps in operationalising the 'incrementalism with perspective' approach by connecting elements of a vision with steps that can be planned and implemented to take place in a more immediate future

(following the alternative definitions on backcasting presented in Quist and Vergragt 2006).

Article 4

The fourth article, "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions", published in Regional Studies in 2021 and co-authored by Joe Ravetz, Aleksi Neuvonen and Raine Mäntysalo, is a case study that explores the emerging role of carbon neutrality targets as 'the new normative' in urban and regional planning. The context of the new normative is being illustrated through a review of the Greater Manchester process on developing climate mitigation, low-carbon and carbon neutrality policies since the 1990s.

The data for the case review was collected by Joe Ravetz, who acted as the lead author of the article. The author of this thesis created the concept and framed the article that combined and elaborated elements that each co-author had previously developed elsewhere. Aleksi Neuvonen was responsible for writing the parts on backcasting scenarios in the methodological framework section and defined the conceptual frame of the new normative. Additionally, the introduction and discussion section were created in equal collaboration among the three co-authors.

Cities and regions have developed policies and measures on climate change mitigation for over 25 years. Yet, in most cases, the imperative to radically reduce greenhouse gas emissions has been dealt with predominantly through linear, functional solutions, and not as a systemic transformation that will require entirely new types of collaboration and co-production. Therefore, many established city- and region-level programs aiming at carbon neutrality are now struggling with implementing the ambitious targets. This has contributed to the power relations between stakeholders being challenged.

The case example on the Greater Manchester process on climate, low-carbon and carbon neutrality policies demonstrates how various political, economic and social drivers cause unexpected changes that make long-term planning difficult. It also underlines the need for identifying boundary objects and trading zones in various contexts that can serve in aligning stakeholders towards system transformation. This will, however, require a well-designed process that can unlock new forms of collaboration, co-learning and co-production essential to linking the 'new normative' aspirations to policy realities in turbulent times.

The new planning approach that is being named in the article is "synergistic scenario planning". It is a process tool for developing synergies and alignment

between stakeholders in strategic planning processes in the context of a system-wide transformation.

Firstly, linking future goals with present-day actions requires the use of scenarios. However, scenarios are not only useful as a functional way of estimating alternative pathways for sectoral emissions reductions. Backcasting scenarios also help in grasping uncertainties and alternative pathways while bridging the gap between the 'new normative' goals and current actions.

Second, in addition to new temporal horizons with the help of scenarios, the framework suggests new tools for stakeholder alignment. The concept of 'boundary objects' is useful when thinking about how material entities could bring people together and focus their attention. A carbon neutrality target itself is a boundary object that gathers stakeholders with differing views around it. However, it turns out to be rather weak alone without other, more tangible boundary objects related to decarbonization actions. Together, they can expand 'trading zones' and build capacity for co-producing new systemic solutions. Backcasting scenarios can also aid in building a 'cognitive chain of boundary objects' by interconnecting different agendas, narratives and discourses on climate mitigation actions.

Thirdly, moving from functional problem solving to system transformation requires new tools of thinking and collaborative action. 'Synergistic thinking', its methods and tools provide a blueprint on a broader co-creational process that combines sensemaking on regional resources, global and local trends, backcasting scenario work, forming of synergistic visions and programming policy steps towards these visions.

Nomenclature

This study is transdisciplinary by nature, operating with the help of various disciplines and their concepts. That can potentially lead to a situation in which a reader might feel unsure about what different concepts mean and to which tradition they refer. In order to avoid confusion, this short listing on the nomenclature should help in enhancing coherence in the use of concepts in this study, and improve the reading experience,

Backcasting scenario approach is an application of scenario methods used widely in futures studies. In backcasting scenarios, pathways are constructed from images of the future to the present day (instead of constructing them from the present to images of the future). (Dreborg 1996; Höjer & Mattsson 2000; Börjeson et al 2006.)

Boundary object, a concept adopted from science and technology studies, refers to boundary-crossing capacities of coordinated activities, such as plans on built strategies or programs behind such plans. This is typically in a context with various actors with significantly differing interests and viewpoints. This approach has also been applied in studies on strategic spatial planning (Ravetz et al 2020; Mäntysalo et al 2019).

Carbon neutrality target refers to a formally approved policy goal by an organization (mainly cities and regions in the context of this thesis) that aims to reach the level of net-zero or less greenhouse gas emissions, which are 'associated' with that territory (Praskin and Cleveland 2019).

Communicative planning is a paradigm of planning theory that has largely dominated the academic discourse on processes of spatial planning since the 1980s. Communicative planning is motivated by participatory and democratic ideals of planning, deriving extensively from Jürgen Habermas' ideas on ideal communication in which people can comprehend things being discussed and aim at sincerely understanding each other (Taylor 1998; Allmendinger 2009).

Futures research is the sub-domain of futures studies that has been conducted with scientific rigour, meaning that systematic methods have been used transparently. Futures studies is a broader field of inquiry that aims at exploring possible, probable and preferable futures, using methods and previous research from various disciplines.

Incrementalism with perspective is a mode of spatial planning. It combines two basic principles: 1) sketching a wider framework for possible future developments, 2) experimenting with new solutions and practices that enable incremental change towards identified (preferable) futures. The approach has been developed for planning contexts of post-industrial societies with an extensive legacy of an ageing built environment in need of repurposing. (Hutter 2006; Neuvonen & Ache 2017.)

The multi-level perspective (MLP) on socio-technical transitions is a framework used in transition studies and transition management. The framework depicts co-evolution processes in the development and adoption of new technologies (i.e. technological transitions), happening between different levels and sectors of society (Rip & Kemp 1998; Geels 2004). Transition management is a governance approach that focuses on sustainability transitions in complex systems cross-cutting technological, social and economic domains such as energy, transportation and food (Rotmans et al 2001.)

New normative refers specifically to carbon neutrality targets that cities, regions and national governments have assumed, and implications that these targets have on planning and other fields of policymaking. These targets and goals suggest (at least implicitly) value frameworks for preferable futures, thus introducing a normative element into planning that should comply with those targets (cf. Wolfram et al 2019).

Planning theory, or planning thought, is a discipline exploring questions about urban/spatial/town/regional planning, mostly related to depicting and analysing practices, goals and societal impacts of planning (e.g. Taylor 1998).

Rational planning is a paradigm of planning theory emphasizing the expert process of spatial planning, leading from goals to decisions and implementation through a systematic procedure. The approach intends to apply the ('rational') ideals of science in iteratively developing planning procedures. (e.g. Taylor 1998.)

Scenarios are the most prominent tool of futures studies, used in depicting alternative images of the future and pathways leading to them. Scenarios help to identify potential decision points for influencing various developments and causal processes. (e.g. Kahn & Wiener 1967; Schwarz 1991.)

Social practice is an approach to individual behaviour, explaining it mainly as a social phenomenon, or entity, that includes socially shared meanings, skills, material objects and infrastructures. This view is being contrasted with the idea that behaviour would be merely an expression of the values and attitudes of the individual. (Spurling et al 2013; Vihalemm et al 2016.)

Strategic spatial planning is a complementary approach and set of tools to statutory land-use planning systems (Mäntysalo et al 2015). The 'strategic' approach appears through focusing on a limited number of issues and

defining an attainable goal within a specific geographical context and timeframe. This requires the design of a strategic planning process to always be adjusted to local, contextual conditions (Van den Broeck 2013).

Sustainable lifestyles are practices of people, including consumption patterns and decisions regarding such routine or long-lasting, permanent elements of everyday life as housing and mobility, that enable societies to stay within planetary boundaries (Rockström et al 2009). Sustainable lifestyles are largely dependent on the material and social structures of society, especially on prevailing infrastructure and the level of default environmental impact it leads to.

Vision is an expression of a preferable future, or of boundary conditions defining alternative preferable futures, typically formed collectively, either within an organization or network of different stakeholders, to serve a planning process (McPhearson et al 2016).

3 OBJECTIVES OF THE RESEARCH AND RESEARCH QUESTIONS

The context of this research is the planning and governance systems in contemporary cities that are coping with a number of long-term, transformational challenges. Despite the challenges posed by climate change and the need to transform cities to carbon neutrality within the next decades, the theories and practices of spatial planning have remained remarkably unchanged till date.

Still, a great number of cities have by now assumed official, time-bound carbon neutrality targets. These targets, as normative future goals, set principles guiding the direction of urban planning. What this means is that planning would in principle be guided by a reality residing in the future, not merely by existing needs, physical structures and past continuities. Within futures studies this type of normative 'future-back' approach is called backcasting, referring to imagined, logical pathways extending from a distant future to present.

The theoretical framework supporting the research perspective of this study derives from previous research on (a) theories on urban planning and its future orientation, (b) on theories regarding transitions to a carbon neutral society, and (c) on theories on (building and depicting) alternative futures. The following theories provide ingredients for the conceptual model that is being combined with the research objects (see figure 1 below): Academic literature on planning and futures studies, scenarios on sustainable lifestyles, Greater Helsinki 2050 vision process, and Greater Manchester carbon neutrality goals. The resultant research framework can be seen in figure 1:

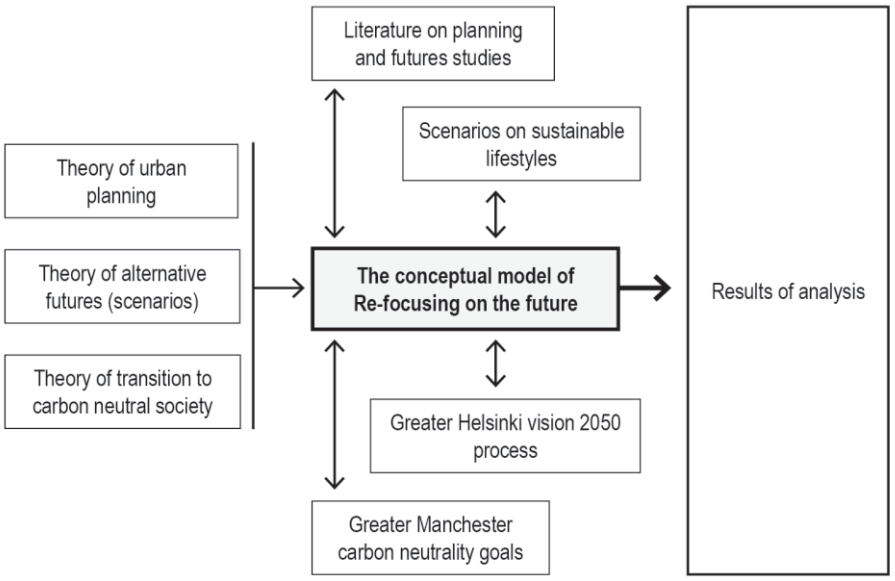

Figure 1. The research framework of the thesis

The research framework helps in formulating the main research question of this thesis:

- **How can backcasting scenarios re-focus urban and regional planning in regard to the implementation of normative goals on carbon neutrality?**

This study aims to provide descriptions and explanations on this re-focusing on the future/emerging relationship with a normative future, and thereby develop answers to the following sub-questions:

- It analyses (based on a literature review) connections, parallel developments and differences between futures studies and urban planning. Based on this analysis it aims to answer **research question 2: How do futures studies, its epistemes and practices affect urban planning?**
- It develops the conceptual framework of the backcasting scenarios, through which re-focusing on the future and its normative goals on carbon neutrality in planning could potentially happen. This is done by presenting 1.) a methodological example on backcasting scenarios and how they depict alternative pathways from futures actualizing desirable

outcomes, 2.) the application of backcasting in two real-life spatial planning related processes. Based on this analysis it aims to answer **research question 3: How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?**

- It showcases how current planning and its governance systems cope with long-term futures and how domains, processes, contents, and objectives of planning are being re-conceptualised due to the emergence of new external drivers in society, especially due to the imperative of carbon neutrality. This happens mainly with the help of two case studies on real-life exercises on metropolitan region vision processes. Based on this analysis it aims to answer **research question 4: How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?**

Main research question	Sub-questions	Key concepts	Methods	Data	Article(s) addressing the question
(1) How can backcasting scenarios re-focus urban and regional planning in regard to the implementation of normative goals on carbon neutrality?	(2) How do futures studies, its episteme and practices affect urban planning?	Future-orientation of planning; futures studies; alternative futures; strategic planning, incrementalism with perspective	Literature review	Journal articles	1 (3, 4)
	(3) How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?	Socio-technical transitions; Emancipatory backcasting; Agency	Case study based on participatory action research	Scenarios, scenario process materials. Participatory observations, official documents, GHV2050 ideas competition materials	2 (3, 4)

	(4) How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?	Normative goals; Synergistic scenario planning; boundary objects; trading zone	Case studies based on participatory action research	Journal articles, Participatory observations, official documents, GHV2050 ideas competition materials	3,4

Table 1. Research questions in relation to key concepts, methods, and data

Theories of urban planning and theories on alternative futures combined aid in answering question (2); theories on alternative futures and theories on transitions to carbon-neutral society help in building answers to question (3); theories of transition to carbon-neutral society and theories of urban planning are relevant when addressing research question (4). Each part of the theoretical framework is being elaborated in chapter 4 of this synthesis section.

By elaborating these topics with the help of case studies and the literature review, the study contributes to planning theory by suggesting ways through which backcasting scenarios are being embedded in urban planning and by explaining how normative goals on carbon neutrality change goals, contents and process of urban planning. Also within futures studies backcasting scenarios is a still-emerging approach. Hence this research contributes to elaborating the theory of backcasting particularly by elaborating its use in urban planning.

Furthermore, the research has practical relevance by providing cities, regional planning authorities, private developers and planning consultants with frameworks, concepts and examples that help them in renewing planning practices to transform cities towards carbon neutrality. This is being done by building a better understanding on how insights regarding (possible, probable and desirable) future(s) are currently being used and incorporated in planning, and by suggesting new tools and approaches that could make planning better equipped and more relevant in our time.

4 THEORETICAL BACKGROUND

4.1 Future orientation of urban planning

This part of the theoretical discussion deepens the view on how the relationship to long-term futures has appeared in planning and planning thought. Exploring this topic will primarily provide ingredients to respond to research question two; "How do futures studies, its episteme and practices affect urban planning?" This will be done by describing the notions and approaches of planning that futures studies have and potentially can shape. The literature will also provide some foundations towards answering research question four; "How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?".

The subchapter first gathers definitions and arguments on how and why spatial planning is a future-oriented practice. It then explains how different theories in planning have approached the future through different frames.

Two of the utilised case studies depict how planning systems are being adjusted to and shaped by long-term goals, visions and scenarios. Hence, the latter part of this chapter reviews how visioning and different related approaches of strategic planning have been adopted in strategic spatial planning, and how that has shaped the future orientation of those practices.

The description of the interaction between planning and futures studies is aligned with the literature review in Article 1 of this thesis. There are also links to articles 3 and 4 that concentrate on processes in strategic spatial planning and how the episteme and practices of futures studies are being integrated into such approaches.

4.1.1 Future as the most important characteristic of planning

Planning is a field that has a special tendency, or even commitment to the future. This idea has been echoed in numerous publications characterising spatial planning as an activity. For instance, Faludi (1970) claims that "nearly all definitions recognize that planning is directed toward the future. This is perhaps the most important

characteristic of planning, introducing the elements of prediction and uncertainty and conditioning all aspects, problems, and features of planning" (p. 331). Freestone (2012) suggests that "Planning is inherently about looking ahead". Myers and Kitsuse (2000) explain that urban planning has the deepest 'future mortgage' of all activities in the form of planned and built structures possessing long time horizons.

However, in the past decades numerous authors have observed declining long-term thinking in planning practices (e.g. Khakee 1985; Isserman 1985; Myers & Kitsuse 2000; Freestone 2012; Fernández Güell & González López 2016). Suggested explanations for this increasing short-sightedness include changes both inside the planning realm and in wider society. For instance, Khakee (1985) and Isserman (1985) mention planners' hectic pace of working due to shrinking public budgets, while Myers & Kitsuse (2000) and (Avin & Dembner 2002) talk about political pressures to produce overly realistic proposals and fear of being blamed for idealism and courageous visions of the future. Constant failures to accurately predict medium and long-range development in a complex and uncertain global economy have also eroded confidence in attempts at long-termism (Marshall 1997; Freestone 2012). Isserman (1985) claims that planners have attempted to integrate methods of quantitative social science into their practice, and consequently focused extensively on historical data without properly acknowledging limitations of such trend-based, linear approaches.

On the other hand, Freestone (2012) suggests the degree of future orientation within planning practice and education has varied across decades: Rapid urbanization and large public investments combined with the emergence of planning systems created a strong forward-looking atmosphere in the first half of the 20th century. This was followed by a period in the 1950s where a more down-to-business attitude and focus on immediate delivery of solutions prevailed. The emergence of new planning methods, supported by the introduction of the new computer models in the 1960s, sparked a resurgence of interest towards the future. The economic downturns, ideological fragmentation of planning and overall incremental, ameliorative approach to societal development in the 1970s and 1980s resulted in planning to lose interest in the future again. Freestone suggests that eventually, in the 1990s, longer time horizons were re-introduced in planning as a result of spreading awareness about the urgent need for sustainable development. The emergence of strategic spatial planning was also a response to increased complexity and uncertainty regarding these challenges.

4.1.2 Future orientation in planning styles

This broad interpretation of a changing future orientation in planning can be compared with commonly used descriptions on the historical development and phases of planning thought categorising different styles and conceptions of planning (cf. Sager 2006; Taylor 1998). The variation in amount or degree of future orientation in different historical periods and their respective prevailing theories in planning (cf. Faludi 1973) are difficult to precisely estimate and prove. However, it is still possible to discern differences in styles, methods and attitudes related to stances to the future.

Minkkinen with his co-authors, in their recent review on the literature on foresight typologies, suggest that foresight systems and their futures mindsets can be categorised into six distinct foresight frames according to perceived unpredictability and pursued change (Minkkinen et al 2019). Frames reflect the demands of differing surrounding contexts of planning and policy-making and thus make explicit that in different operational environments different approaches to the future are being emphasised.

Planning, visionary and transformative frames are connected to systems in which there is a clear normative intention of influencing the future. Comparatively, predictive, scenaric and critical frames are characteristic to foresight and planning contexts in which there is a need to explore the future and build resilience towards emerging events and phenomena. Planning and predictive frames are suitable for operational environments of more closed systems with modest levels of uncertainty, while the transformative frame (and critical frame, which primarily remains confined to academic research, thus not being relevant in the context of this research) serve in contexts characterised by more open systems and high degrees of deep uncertainty. Scenaric and visionary frames fall in the middle of these contexts. The frames are meant to be complementary to each other, providing an understanding of different aspects of the future. (Minkkinen et al 2019).

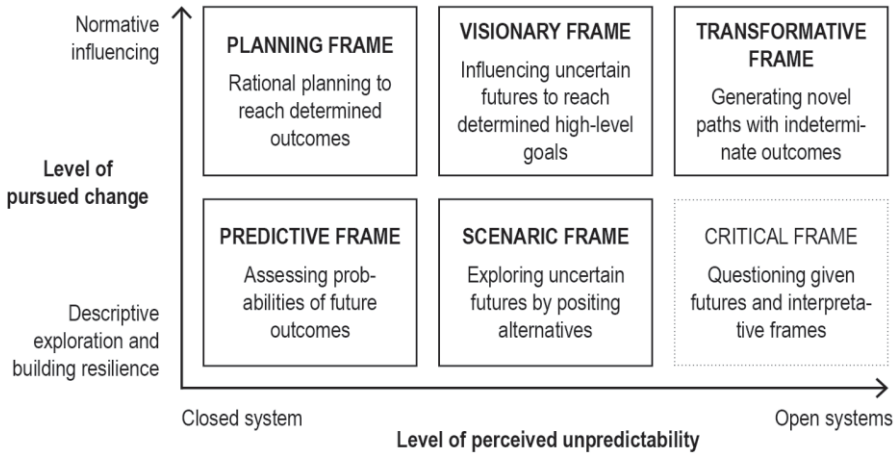

Figure 2. The alternative future frames of urban planning, adjusted from six of foresight by Minkkinen et al (2019).
'Critical frame' on grey background, indicating that it is a frame appearing in primarily within academic futures studies, thus not relevant for characterising urban planning and its future orientation.

The six frames of foresight can be applied in characterising differing future orientations of various styles of urban planning. As elaborated above, urban planning is directed towards the future and hence always presumes a certain type of mindset or approach to the future. These mindsets vary regarding the surrounding context and degree of openness of the system. Urban planning differs from foresight by always having an explicit intention of influencing the future, not merely exploring and describing alternatives. The planning frame is always present, as urban planning should result in plans capable of being implemented as physical structures that change practices and behaviours within their context (Fainstein & Campbell 2012). However, different styles of planning have differing approaches to the degrees of change they assume should and could be reached: should planning have a proactive stance for creating change, or mainly maintain the status quo while providing resilience and protection from external influences (cf. Minkkinen et al 2019)?

The six frames model is being used here as a tool for characterizing future orientations of different planning styles and approaches.

'Utopian comprehensiveness' is a normative theory that characterised planning and its outcomes influenced by the modernist movement in the early and mid-20th century. This theory perceived the future (of society) as something that can and must

be designed and invented anew, based on ideals laid out by the planner in his plans, and implemented as a comprehensive whole (Taylor 1998). Utopian comprehensiveness was based on an idea of 'physicalism' or 'physical determinism', according to which the physical form of the city can in an evolutionary manner steer cities, inhabitants' behaviour and therethrough affect wider society (Batty & Marshall 2009).

In other words, planners had a great responsibility - and a privilege - to design and steer future society towards a desirable direction, by putting in place an ordered form in a city. This all entailed an implicit assumption on consensus regarding societal values and desirable outcomes of planning. Planners as generalist experts could synthesise and give it a technical, applicable interpretation, mainly through visualizations on spatial structures of future cities, towns and villages (Taylor 1998). Consequently there was no need to explore the future in a systemic manner, containing emergent characteristics and different types of unintended consequences, nor to make a distinction between probable and desirable futures. Instead planners (or at least the most successful visionaries, e.g. Howard, Geddes, Wright, Le Corbusier, who managed to build movements around their thinking) focused on how to produce a new kind of city that fixed the numerous societal problems resulting from industrialisation and urbanisation (Fainstein & Campbell 2012; Hall 2002).

Based on this it is fair to characterise utopian comprehensiveness as operating under a visionary frame: The goals planners aimed to advance and implement were ambitious and linked to high-level societal targets. These goals were also pre-determined and explicit, overlooking considerations of various uncertainties and their implications. Due to the commitment to high-level goals, the visioned future would be unprecedented in many aspects, and hence predictions based on historical data would not be fit-for-purpose.

This systemic or rational approach to urban planning signified a shift in the focus of planning theory from outcomes (designs) of planning to planning processes, following the distinction attributed to Faludi (1973) (Taylor 1998; Fainstein 1998). Taylor (1998, 60) claims that rational views on planning assumed that a commitment to a scientific worldview and methodological discipline could be translated into managerial politics. This ideal was to be achieved by structuring planning into a rational process with a clear separation of tasks and division of labour between planners and politicians (Allmendinger 2009). Therefore, in rational theories of planning the relationship with the future is meant to be explicit and included in the ideal structure of a planning process.

For instance, Faludi (1970, 21), in defining characteristics of rational planning in terms of its relationship with the future, suggests that the future in planning is approached in two distinct yet equally important ways, one related to values and another related to facts. A planner should take as the starting point a goal that is based on values defined by the client (typically a politically elected body). The goal guides the preparation of alternative proposals for a plan. The planner then collects relevant facts that help to formulate predictions on consequences of different alternatives. These predictions enable the client to perceive what is possible to achieve (for instance within a limited range of costs) and where a choice of prioritizing between different values is needed.

All in all, the rational approach to planning makes a separation between probable, possible and desirable futures. However, these categories are formal and abstract: defining what substantial problems planning should aim to solve is a contextual question, presumed to be left to be decided through a political process. Planning should not provide any predictions nor images of the future (i.e. plans) before decision makers have set the goals for a planning process. Otherwise, planners end up biasing the process and jeopardise its rationality (Faludi 1970). Hence, rational planning exemplifies the predictive frame and the planning frame: It tends to presume that the level of uncertainty in the operational environment is rather modest, or at least manageable with the help of rational planning process and the methods it deploys, therefore planning can lean heavily on model-based calculations of probabilities on relevant aspects of society, and the desired outcomes of planning can be determined beforehand in a rather precise manner.

Yet the rational approach to planning received criticism for suppressing the future orientation of planning. For instance, Isserman (1985) criticised planners (without explicitly mentioning rational theories) for their naive tendency to accept (population) forecasts as given truths on the future (due to their limited understanding on social science methods), without considering different assumptions and uncertainties included in models behind the forecasts. Hence, planners end up implicitly choosing a future, or at least prioritizing certain factors as key drivers shaping the future (Isserman 1985; Dalton 2001). Meanwhile, focusing on simplistic predictions hides (growing) uncertainties of the future that diminish the capacity to produce accurate forecasts (Ratcliffe & Krawczyk 2011; Zapata & Kaza 2015). As a consequence, planning sacrificed the capacity to think and dream of possible and desirable futures (Isserman 1985).

Communicative planning arose from this very same critique on the rational, expert-driven ideal of planning: By giving science and expert knowledge a special

role, planning ends up neglecting a great variety of views and simultaneously supporting the dominant role of the capitalist, technocratic system over and in subcultures and lifeworlds of people. If we admit plurality of views and values in society, we also have to open the discussion on societal goals, not assuming an implicit agreement on them, nor that they can be separate from means of achieving them. (Allmendinger 2009.)

Hence, the communicative theory of planning sees planners' work within its social interactions and the planners' role as "experiential learners" that translate people's stories into commensurable arguments that could then be forged into a consensus (Fainstein 1998). Planners as institutionalised experts should not pretend that their views alone would provide sufficient and legitimate ingredients for a plan. Thus, Friedmann (1993, 482) suggests that planning should not put too much emphasis on casting imaginative futures, but focus on the present and create dialogue around everyday events that different stakeholders encounter and that can be changed by planners.

In this regard the future mindset of communicative planning can be characterised through the transformative frame that Minkkinen et al (2019) use. This frame describes a context in which the future is approached by analysing present assumptions and opportunities instead of necessarily creating any clear representations on particular images of the future. In other words, the relationship with the long-term future in communicative planning is emergent by nature, dependent on context and concerns of the participating stakeholders.

The communicative notion on planning does not abandon the future altogether: forecasts and simulations on the future can and should be used, but their role is always secondary to experiential knowledge provided by stakeholders (Friedmann 1993). Also, desirable futures can have a role in a communicative planning process, such as in the form of a participatory visioning process. Still, the intention of operating through a transformative frame often fails: Localised visions often end up being either technical and incremental, or detached from political realities, eventually failing to challenge current mainstream developments (Myers & Kitsuse 2000). Moreover, a distinction between desirable and probable futures can become unclear in a context characterised by diverse stakeholders, goals and ideas presented, eventually raising false expectations (Avin & Dembner 2001).

During the past 30-40 years, planning has been increasingly seen as a communicative practice. Consequently, the attempts to strengthen the future orientation of planning have taken form in participatory processes, engaging stakeholders into co-production of images of the future and co-learning of the

multitude of views and factors that shape the future, eventually resembling visionary frames or scenaric frames of foresight. There have been attempts to define elaborate participatory futures processes that could serve in advocacy for marginalised groups, to help in making technical, data-driven aspects of planning more transparent and inclusive, or to provide planners with a more realistic understanding of the complexity and uncertainties characterising contemporary cities (Chakrobarty 2011; Zapata & Kaza 2015; Chakrobarty & McMillan 2015; Fernández Güell & González López 2016).

4.1.3 Future orientation as visions and strategic plans

Strategic spatial planning has emerged over the past decades as a complementary approach and set of tools to statutory land use planning systems (Van den Broeck 2013; Mäntysalo et al 2015). The demand for expanding the scope of planning is depicted to arise from the tension between the narrow, juridical status of formal instruments and the need to provide iterative, less detailed solutions as spatial responses to new, gradually emerging issues (Van den Broeck 2013). Incremental amendments to existing built structures of cities cannot produce sufficient change vis-a-vis contemporary challenges, such as intensified competition in global markets, demographic changes, emergence of new technologies and also climate change (Mäntysalo et al 2015). Whereas traditional spatial planning has been missioned to maintain the existing social order (Albrechts 2015, 510), strategic planning aims at "sustainable transformation and innovation of space" (Van den Broeck 2013).

Thinking again of the six frames of foresight (cf. Minkkinen et al 2019) as being applied in styles of urban planning, strategic spatial planning takes a stance in which it clearly departs from planning and predictive frames: it presumes the operational environment of planning to be a rather open system with a high level of unpredictability. In the contemporary context of planning, there is a constant and growing need for tools and approaches to manage complex institutional settings and issues with deep uncertainty. These issues have previously often escaped the existing forms and methods of governance and planning, and new innovations make the previously unmanageable manageable (Ache 2011). These new tools and approaches also build new regional potential by creating and strengthening shared cultures between stakeholders (Lehtovuori & Maijala 2007).

As a response to these demands, the future is seen to evolve as a result of systemic development, requiring an understanding of key external drivers but also building

strategic goals and interventions controlled by the involved stakeholders (Albrechts 2015). In order to cope with uncertainties related to these complex forces and differing intentions, the future should be approached through scenarios defining alternative possible future developments (Fernández Güell 2009). Hence, the scenaric frame on the future aiming to explore and make visible different options and build greater resilience is strongly present in strategic spatial planning.

Yet, even more important are visions of the "possible becoming" of an [geographic] area that can give direction to strategic initiatives implementing goals set by the vision over a defined time period (Van den Broeck 2013, 45). A vision enables focusing on a limited number of issues. Still, defining an attainable goal within a specific geographical context and timeframe requires a design of a strategic planning process to always be adjusted to local, contextual conditions (Van den Broeck 2013). Such a 'visionary frame' on the future, containing a clear intention of influencing uncertainty by having high-level goals, is bound to include tensions between motivational, even transformational aspirations and assumptions on the plausibility of envisioned futures (Minkkinen et al 2019).

However, besides strong scenaric and visionary frames that focus on representing various futures, strategic spatial planning can be claimed to also use a transformative frame on the future. Many interpretations on strategic spatial planning emphasise co-production as a defining character of the approach (cf. Albrechts 2015). This type of epistemic stance, stressing understanding the multitude of values, attitudes and views on the future, is also widely endorsed in foresight approaches, often based on the collaborative creation of future-oriented insights, decisions and action (Dufva 2016). However, the ideal of co-production goes beyond an epistemic pursuit of combining various types of knowledge, information and insights: Co-production processes are also exercises of deliberative governance through which citizens are engaged with issues and perspectives outside their normal personal realm and scope of experiences, thus building potential for empathy towards others (Albrechts 2015).

Deliberative governance entails making better sense of current underlying assumptions and expanding the scope of possibilities, but also producing novel forms of agency and collaboration (Minkkinen et al 2019). In strategic planning, this kind of co-production of transformative and critical frames on the future is implemented through various types of action arenas (Albrechts 2015; cf. Ache 2011). They serve as platforms for new types of open, equitable discourses on the future and assist in addressing power relations that reflect the existing social order and its priorities (Albrechts 2015).

There are different ways of conceptualizing various aspects of such transformative frames within the discourse on strategic spatial planning. Referring to a concept developed by Ganser and his colleagues (1993) in their study on planning in the IBA Emscher Park in Germany, Ache (2011), proposes an Incrementalism with perspective approach. in this approach, collaborative imaging on a long-term desirable future ('horizon') is a valuable tool for initiating, accelerating and steering experiments and other forms of present-day action (following the tradition of incrementalism in planning, cf. Lindblom 1959). Incrementalism with perspective aims to suggest how planning can direct disruptive transformation while still appreciating the uncertainty and complexity that have disarmed traditional rational control (Ache 2011).

So-called 'trading zones' (Mäntysalo et al 2013, referring to Galison 1997), aim to capture the idea of the future as "anticipation-of-emergence" (Minkkinen et al 2019, referring to Miller 2018), resulting from various, partly conflicting values, intentions and interpretations on both present context and the future. Trading zones, depicting certain types of planning and policy processes, are hybrid platforms where information and services are "traded" among different actors, with differing problem framings or value systems. Yet, trading zones can emerge as spaces of collaboration: once interaction and exchange (even if based on radically differing objectives, interpretations and benefits) have commenced, actors may gradually align to local actions and eventually even change their respective interpretations (Balducci & Mäntysalo 2013).

But what does a transformative frame of the future actually mean in the context of strategic spatial planning? The term 'transformative frame' implies that the future is fundamentally unpredictable and that we have limited control over it, despite us fleshing out high-level goals within a visionary frame that we presume are capable of influencing the future (Minkkinen et al 2019). Yet strategic spatial planning, like other styles of urban planning, is supposed to provide representations of the future that can guide the implementation of spatial structures (cf. (Cole 2001; Fainstein & Campbell 2010).

Perhaps the transformative frame in the context of strategic spatial planning could be interpreted as referring to planning as a process in which changes in spatial relations are the result of social interactions between people in different organisations, institutions and groups (Albrechts 2015). Such planning operates around different kinds of narrative scenarios and storytelling that help in articulating some determinants of desirable futures and underlying values and assumptions. Yet those representations would not necessarily have to focus on spatial aspects of the

future but instead outline issues on the future that spatial solutions would potentially provide conditions for. 'Visionary fields' and different types of 'trading zones' serve as platforms for testing and exchanging such possible futures without the burden of immediately providing all feasible steps for their implementation.

4.1.4 Key findings of the theoretical discussion in regard to the research questions

Many authors have defined spatial planning as an inherently and even exceptionally future-oriented practice. Nevertheless, there are claims that planning has been pushed to short-termism as a result of high pressures on planners to produce actionable plans and design, without wasting too much time on exploring long-term futures. Growing uncertainties regarding the future that have caused future predictions to constantly fail have also factored into this short-termism.

However, future orientation can also mean other things beyond distinguishing between short-termism and long-termism. Urban planning and foresight approaches operate through different kinds of frames and mindsets on the future (Minkkinen et al 2019). These frames are characterised by their differing assumptions on the level of prevailing uncertainty of the operational environment and the level of pursued change.

Different paradigms and styles of planning approach the future differently, and these different perspectives can be described through different frames on the future. Utopian comprehensiveness approached the future through planning's presumed capacity to shape and alter the future through design. Under such a 'visionary frame', the focus was on the desirable future, yet there was little discussion on values defining the desirable, as many (social and cultural) aspects of the future were assumed to remain unchanged. The rational style of planning intended to make a clear distinction between desirable futures ('planning frame') and predictions ('prediction frame'), and how responsibilities on each of these perspectives should be divided between actors of planning. Making this distinction turned out to be an ambiguous task and it was claimed to constrain discussions on opportunities of the future and on what really is desirable. Lastly, communicative planning prioritises experiences arising from everyday contexts over speculative visions on desirable futures or model-based predictions. The aim here is to convey the plurality of values and interests to the planning process. This can be interpreted as a 'transformative frame' on the future, although both scenaric and visionary frames are occasionally

also present, despite being in secondary roles. Overall, the future orientation of communicative planning can be characterised as an emergent, contingent result of a communicative process.

Over recent decades strategic spatial planning has expanded the traditional scope of planning as an attempt to respond to the growing complexity of the context of planning. This approach and its various applications assume that regional and urban planning operate in very open systems and consequently, high levels of uncertainty. Therefore, the prevailing frames on the future are scenaric, visionary and transformative. Visions, as expressions of long-term direction, are a tool for extending the scope and domains of planning to issues that have previously been beyond its reach. Their focus is not necessarily nor primarily on fleshing out representations of spatial structures but to help in articulating values and assumptions that different stakeholders hold and to co-produce new kinds of future possibilities that would allow rather experimental, early steps of implementation, in the spirit of 'Incrementalism with perspective'.

4.2 Backcasting scenarios as a way of building alternative futures

This subchapter is targeted at providing a theoretical background for elaborating answers primarily to research question 3; "How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?" It also has some relevance to research question 2 "How do futures studies, its episteme and practices affect urban planning?

The subchapter first depicts how theories and methods for constructing alternative futures, as part of the broader field of futures studies, have evolved over the past 80 years. That background allows us to explain what backcasting scenarios are, what purposes they are supposed to serve and what kinds of benefits the approach creates.

Furthermore, the subchapter contextualises backcasting scenarios to carbon-neutral transitions and details their purpose and position under this particular domain, especially when compared to other approaches utilising scenarios and other forms of constructing and presenting alternative futures. This will help us when formulating an answer to the main research question 1 "How can normative futures studies methods such as backcasting scenarios help urban and regional planning to be relevant in implementation of normative goals on carbon neutrality?"

Alternative futures as the dominant idea of futures studies

World War II provided the impetus for a totally new scale of planning practices, mostly within the military industry. Later, these innovations were transferred to other sectors of society, first being utilised in public organizations (from transport to education, regional planning to industrial policies and social issues) and eventually in multinational private corporations. The expansion of planning created demand for the discipline supporting the development of long-term plans and gave rise to various tools for (quantitative) modelling that enabled the construction of alternative futures and estimation of their probabilities. (Rescher 1998; Bell 2010).[1]

According to historian Jenny Andersson (2018), post-WWII years created a new notion of the future in which the (long-term) future was seen as a direct consequence of present decisions and actions, not merely as an imagined, distant temporal island (Andersson 2018). However, the radical openness and uncertainty of the future, resulting from human will and action, also posed significant threats. These had been experienced in the two world wars and the invention and use of atomic bombs. Therefore, a need for political technology that could manage both good and bad futures was evident (Andersson 2018.).

Both Bell (1997) and Andersson (2018) identify two separate origins and traditions in futures studies: 1.) Futurism, the tradition (attributed mainly to Robert Jungk and Ossip Flechtheim) of developing knowledge and tools that would help humankind to take responsibility for the future and jointly channel it in desirable directions, and 2.) futurology (attributed to people working in RAND corporation or its proximity), the attempt to develop methods for scientific long-term forecasts, a general theory of predictions.

By the mid-1960s, constantly failing forecasts had eroded the credibility of scientific futurology and the scientific general theory of predictions had failed to emerge (Rescher 1998; Andersson 2012). A sequence of major surprise events (such

[1] There are various periodizations (i.e. analytical attempts to cluster historical events and trends related to a phenomenon in order to understand reasons behind them (cf. Son 2015)) on the development of futures studies as a discipline in its historical context: Wendell Bell (1997) and Nicholas Rescher (1998), both of who were involved in development of the discipline since 1950s, have depicted historical evolution of futures studies as part of books that elaborate theoretical foundations of futures studies. Jenny Andersson (2012, 2018) has written proper historical research on futures studies as a phenomenon within a broader intellectual, cultural and political context. Hyeonju Son (2015) provides a three-phase periodization on futures studies that extends to 2010s while narratives of the other three authors reach to 1990s.

as the oil crisis, collapse of socialist regimes and the 9/11 terrorist attacks) eventually shook or even broke down the previous idea of the future as something that can be predicted and planned. The conception of uncertainty became the defining attribute of our relationship with the future and increasingly started shaping conditions for planning and decision-making.

Uncertainty means that there is a gap between available knowledge and the level of knowledge a decision-maker would prefer to use as the basis for a decision (Marchau et al 2019a). Different systems vary in regards to their level of uncertainty. There are systems (e.g. controlled engineering systems) that are predictable based on historical data and deterministic models of the system that allow us to estimate the future outcome as one extrapolation of past trends. However, on many occasions (e.g. in business, finance and epidemiology) models have to be described probabilistically. Predicting future outcomes requires imagining several alternative outcomes and then estimating the probability of each scenario (Marchau et al 2019; Malekpour 2019).

Many approaches in planning and decision-making, the aforementioned Futurology among them, attempted to develop methods that would enable treating complex societal processes as so-called Level 1 and Level 2 uncertainties by developing more elaborate, complementary system models and gathering more detailed, accurate data (Malekpour 2019). Nonetheless, the types of phenomena and challenges societies and their planning systems faced appeared to result in a higher level of uncertainty. Under such Level 3 uncertainty the number of possible futures is wider and it is impossible to assign probabilities to those future outcomes. In this context, mitigation of uncertainty focuses on comparing favourable consequences of each scenario and evaluating policies resulting in such outcomes (Marchau et al 2019a).

As a result, the focus of future studies shifted from predicting probable futures towards more diverse and eclectic notions of the future. Typologies on these alternative frames of foresight - i.e. the planning, predictive, scenaric, visionary, transformative, critical frames (presented in chapter 4.1) - can be introduced, each of them having differing quality criteria and selection of methods (Minkkinen et al 2019).

4.2.1 Varieties of scenarios

However, strategic planning in many companies and public organizations has been strongly focused on probable futures and scenarios (Son 2015). They serve as the primary tool of futures studies, performing the task of political technology aiming to manage and control the radical openness and uncertainty of the future (Andersson 2018; cf. Amara 1981). Scenario studies serve both attempts to govern and rationalise uncertainties, as well as in making explicit the potential consequences of present-day decisions.

The most commonly used definition for scenarios is given by Herman Kahn and Anthony J. Wiener in their book *The Year 2000. A Framework for Speculation on the Next Thirty-Three Years* from 1967:

> Scenarios are hypothetical sequences of events constructed to focus attention on causal processes and decision points. They answer two kinds of questions: (1) precisely how might some hypothetical situation develop, step by step and (2) what alternatives exist, for each actor, at each step, for preventing, diverting, or facilitating the process. (Kahn & Wiener 1967, 6.)

Beyond this formal definition on the ontological and epistemic status of scenarios, there are also typologies on what practical purpose or interest scenarios serve. Börjeson et al (2006) suggest a typology of three main scenario types, with each type corresponding to one of the categories of possible, probable and desirable futures that often (e.g. Amara 1981) define the alternative missions of futures studies. These three types are predictive, explorative and normative.

Predictive scenarios intend to answer the question of 'What will happen?', explorative ones 'What can happen?' and normative scenarios 'How can a specific target be reached?'. These three questions are assumed to represent our principal interests in shaping the future (Börjeson et al 2006).

Typically, predictive scenarios and on some occasions explorative scenarios, are based on quantified models. Normative scenarios are very rarely based on quantitative models. For instance, within the context of planning, quantitative model-based scenarios are typically used as stress tests, assessing how existing and planned spatial solutions can accommodate future demand for functions such as housing and mobility (cf. Malekpour et al 2020).

However, quantitative models entail that there is a clearly defined system with system boundaries and a detailed understanding of the system structure (Börjeson et al 2006). In many topics relevant to the future, the context of planning and decision-making is characterised by deep uncertainty (Marchau et al 2019a, referring to

Lempert et al 2003). Uncertainty can arise in many parts of the context. There is often limited information on what external factors and developments affect the system in the long term, as well as on their level of impact, as there can be structural uncertainty regarding how the system reacts to those external developments. Furthermore, it is very likely that stakeholders value these future outcomes differently, prioritise different problems and also evaluate the acceptability of potential solutions differently (Marchau et al 2019a). In these cases, the models that form the basis for scenarios have to be imprecise, often qualitative and include factors on which there is rather limited knowledge.

Another quite common way of using the term 'scenario' is to refer to different alternatives for a plan or a strategy. This type of scenario consists of decisions, policies and activities that an organization can control, and the potential consequences of these strategic steps when they face varying external contexts. For instance, in urban planning, there are different options for zoning or decisions to build major infrastructure. On the other hand, some scenarios depict alternative futures as resulting from external factors, without assuming any perspective of actors with interests and capacities to shape the future. According to the typology by Börjeson et al (2006), predictive scenarios and external explorative scenarios focus on external factors, whereas explorative strategic scenarios and normative scenarios take into account internal factors.

In cases where the time horizon of scenarios is long, the distinction between external and internal factors often becomes unclear or even unimportant (Börjeson et al 2006, referring to Höjer 2000): different actors can potentially gain power over various factors in the long run.

Agency and human intentions are difficult factors to include when modelling the future. The human capacity to both destroy and fulfil predictions by adjusting behaviour as a reaction to predictions limits the capacity to predict human behaviour and societal futures (Rescher 1998; Kuusi 1999). Robinson (1988) suggests that predictions, or images of the future overall, often causally affect present decisions because people treat them as something real. While the future does not exist in the present, the future is represented by, or takes the form of, anticipations that are part of the behaviour of people. Anticipations are guided by various types of anticipatory assumptions that are being shaped by different anticipatory systems in society. These components form the practices of 'using-the-future' in the present (Miller 2018.).

Following this definition, predictions and predictive models can be interpreted as one type of anticipatory system that shapes the anticipatory assumptions of people.

Robinson (1988) claims that people often cannot recognise the normative components included in predictive models. This normativity originates from institutional, disciplinary and individual factors that are always involved when crafting a model. Instead, people often assume models to be results of science, although seldomly individual models are replicated, and eventually falsified or corroborated, following the ideals of the scientific process. Still, predictions based on these models are commonly used in justifying policies as something value-neutral: They tend to imply the assumption that a future deemed as likely is in fact a necessity.

Moreover, model-based forecasts are over-represented in the range of images of the future easily accessible to people because of the established methods used to produce them, and the credible organizations spreading their results (Robinson 1988). This obscures the role and scope of human choice in shaping the future. Therefore, human behaviour of the present day is being shaped by these predictions that also restrict human capacity for imagination and social innovation, or any form of emergence (Höjer & Mattsson 2000).

4.2.2 The backcasting approach

This over-representation of prediction in anticipatory systems creates the need for backcasting scenarios and other normative transformative scenarios. The purpose of backcasting is to arm people with ideas regarding new paths, plans and solutions in a context where conventional paths and solutions are no longer feasible (Höjer & Mattsson 2000). Backcasting operates in the 'context of discovery' instead of the 'context of justification': successful backcasting is capable of providing new and productive hypotheses on future action (Dreborg 1996). As backcasting scenarios work from a desired future (vision), they are explicitly value-laden and prioritise specific issues and targets (Robinson 1988).

Yet, on most occasions, the term 'desired future' is somewhat misleading when defining starting points of backcasting scenarios. A vision of a backcasting scenario exercise defines a (wide) group of normative futures that meet the criteria of acceptableness. The images of the future that do not meet these boundary conditions should be avoided and are not sensible outcomes for any planned activity. While this seemingly limits the scope of futures worth pursuing, the number of acceptable alternatives can still be relatively large.

The term backcasting, due to its broadness, can refer to various types of applications on different levels of abstraction. It can be:

- An analytical tool for evaluating the feasibility and consequences of different policy options (e.g. in energy futures)
- A heuristic tool for a policy and innovation process (e.g. in mainstreaming corporate sustainability initiatives).
- An overarching methodology for curiosity-driven futures studies exercises.
- A tool for a stakeholder interaction process (e.g. in processes aiming at advancing sustainable transitions.(Quist & Vergragt 2006; Dreborg 1996; Robinson 1988).

In this thesis, backcasting is interpreted as an approach that supports imagining and preparing transformative solutions for some of the most important long-term problems our contemporary societies face. The three different case studies presented in this thesis develop different aspects and uses of backcasting in different contexts and domains partly different aspects and uses of backcasting.

4.2.3 The contexts of backcasting

Backcasting was originally developed into a formal method in the context of energy futures and gradually spread to different types of sustainability studies (Robinson 1988; Dreborg 1996). These fields are by default framed by an imperative of transition in central technical, economic and social systems: current energy systems face several contradictory policy goals, such as growing demand, balanced production mix, and the need to reduce negative environmental impact. Sustainability sets a requirement to find an alternative balance between economic performance, social development and the level of environmental stress caused by human activity. The awareness that business-as-usual development and incremental advances will create unacceptable results makes backcasting an attractive tool to alter this course (Dreborg 1996; Vergragt & Quist 2011).

Dreborg (1996) elaborates under what types of conditions backcasting (instead of other ways of building images of the future) should be used. These characteristics are:

- The problem is complex and affects many sectors of society

- There is a high need for major change, with marginal changes creating insufficient feasible results.
- The dominant trend is part of the problem
- The problem is largely a result of market externalities, and can hence not be solved by markets alone
- The time horizon for scenarios and planning is long enough.

In this type of transformational context, most other approaches to the future provide infeasible projections. There are short- and medium-term studies that can depict a few steps in the right direction, but these steps are not tantamount to the scale of the change required. On the other hand, there are long-term forecasts that in transformative contexts inevitably indicate that the needed change will not happen and the prioritised (sustainability-related) goal cannot be achieved. The reason is that the model behind the forecast does not include factors that would bring about the necessary level of change. The omitted factor is typically innovation; something unprecedented that has not been among the presuppositions of a (business-as-usual) model. (Dreborg 1996.)

Like other types of scenarios, backcasting intends to support planning and decision-making in dealing with deep uncertainty. In such a context no single model would capture all relevant aspects of the system that includes both historical trends, prioritised targets and actions required in implementing them (Marchau et al 2019a). Attempts to advance transitions towards normative goals with the help of different types of interventions add an extra layer of complexity: they introduce new interplay between diverse political, technological, social and economic drivers, and steer development away from tested business-as-usual plans (Malekpour 2020). Hence, the number of plausible scenarios and their outcomes is vast, and stakeholders value these outcomes differently, partly as a result of limited information and capacity to imagine their consequences. (Marchau et al 2019a).

Some authors (e.g. Höjer & Mattsson 2000) suggest that often backcasting should be used alongside different types of modelling and forecasting (i.e. predictive, or in some cases explorative, scenarios). A forecast that indicates that the current development leads to undesired consequences motivates the search for alternative solutions and thereby sets a starting point for backcasting. In that regard, backcasting can be said to always be contrasted to one or several forecast scenarios, either implicit (when the unwanted consequences are thought to be common knowledge) or explicit. Höjer & Mattsson (2000) and Malekpour et al (2020) also suggest that transition pathways constructed through backcasting scenarios should be stress-

tested with the help of exploratory, modelling based scenarios that could reveal vulnerabilities of required policy options and make trade-offs explicit. This combination of scenarios, policy analysis and transition methods are needed in providing feasible action plans and policy packages for strategic planning in the context of socio-technical transitions (Malekpour et al 2020).

For instance, building strategies and programs that outline the pathway to carbon neutrality for a city or region require using different types of scenarios. A standard method is to first calculate the so-called reference scenario reflecting baseline assumptions on the future of the economy, patterns of energy production and consumption, development of international and national regulation and the level of GHG emissions within city boundaries, presuming that no significant measures are taken by the city. The reference (i.e. predictive forecasting) scenario shows the transformative potential of more aggressive policies and emissions reductions. This assessment then leads to alternative scenarios for more ambitious emissions reduction targets, demonstrating what types of urban action is needed to attain certain levels of emissions by a target year (including carbon neutrality (Erickson & Tempest 2014).

When an official carbon neutrality target is in place and provides the main operating principle for emissions reduction policies, more detailed backcasting scenarios are needed. They demonstrate alternative pathways for reaching the target that can vary both in terms of the size of contributions they assume each major emissions category to produce and what type of temporal trajectory towards the target there will be (early or sustained action). These scenarios aren't necessarily confined only to the city's policies and activities (i.e. internal factors) but can also include variation regarding assumptions on external factors, such as the pace of development of different key technologies and their prices (Erickson & Tempest 2014).

Wangel (2011a) distinguishes between three levels of backcasting scenarios: target-oriented ('what can change'), pathway-oriented ('how change can take place') and eventually action-oriented ('who could make change happen'). Target-oriented backcasting focuses on factors that can directly contribute to goal-fulfilling, i.e. the objects of change are quite typically technical and material, and especially so in the case of decarbonization context. Pathway-oriented backcasting is concerned with bridging the gap between the goal and the present-day situation, focusing on dynamically moving the process forward and depicting policies, incentives and behavioural change. Action-oriented backcasting intends to augment these views by

forming a comprehensive plan of a systemic transition that also includes discussions on social learning, changes in governance and expanding agency (Wangel 2011a).

Different modes of backcasting (alongside other types of scenarios) are needed when designing policies and building new coalitions around carbon-neutral transitions. When decarbonization is being approached with the help of target- or pathway-oriented backcasting, human agency, governance and social structures are often neglected and omitted. Still, in reality, it is evident that these factors are always involved, even when implicitly (Wangel 2011a).

The capacity of backcasting exercises to create changes on the level of actors, agency and social configurations has been elaborated and conceptualised by various authors. Robinson (1988) considers the desired outcome of backcasting activities the un-learning of seeing model-based forecasts as legitimated views of the future. In other words, backcasting should expand our capabilities to discover and seriously consider alternative (transformational) futures.

Quist & Vergragt (2006) suggest a wider framework of higher-order learning that can bring about shared vision(s) on desirable futures and enhanced systems perspective on the transition process. They also emphasise the change happening on the level of values, attitudes and underlying convictions. Higher-order learning can be further divided into policy-oriented learning (re-framing of policy goals, problem definitions and strategies), and organisational learning (changes in norms, goals and principles governing decision-making processes) (Quist & Vergragt 2006). Robinson et al (2001) summarise the benefits brought about by participatory backcasting as social learning, referring to increased buy-in towards shared goals and broadening the scope of solutions from discrete goals to systemic paths of operations and events.

4.2.4 Key findings of the theoretical discussion in regard to the research questions

Returning to the research question relevant to this theoretical discussion (3), "How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?", we can draw the following conclusions.

The idea of exploring possible, alternative futures as a means for navigating amid uncertainties has characterised futures studies for decades. In parallel, enabling discussion on desirable futures and helping humankind take responsibility for building a better future has defined the mission of a large part of futures studies (Andersson 2018). Different types of scenarios, predictive, explorative and

normative, have served as the foremost tools for coping with uncertain futures and identifying what types of outcomes could be acceptable or desirable (Börjeson et al 2006).

In the current context of the climate crisis and other global sustainability challenges, normative scenarios depicting transformative change are gaining relevance. However, these normative scenarios should still accommodate a wide variety of external drivers and forms of deep uncertainty that affect how prioritised, normative goals can be attained. Often, this is done by combining backcasting with other scenarios, policies, and transition approaches, in order to provide feasible support to planning.

Backcasting scenarios serve as heuristic tools in search of alternative societal paths indicating how a prevailing trend can be broken and how a strategic, prioritised goal can be reached (Dreborg 1996; Höjer & Mattsson 2000; Börjeson et al 2006). All projections on the future shape so-called anticipatory assumptions that people hold, and eventually affect their behaviour and choices in the present. The purpose of backcasting scenarios is to help people to expand the scope of feasible futures and solutions they include, especially in the context of system-level transitions in which business-as-usual forecasts inevitably lead to unacceptable outcomes. Yet, on many occasions scenarios focus on depicting what is needed in order to attain a target and how feasible activities to create such pathways can be initiated. However, questions on agency and governance structures behind scenarios are often being omitted (Wangel 2011a). Therefore, it is important to make a distinction between various modes of backcasting and what types of benefits they are supposed to bring about. If we assume that decarbonisation to carbon neutrality is to entail significant changes in various social practices and forms of agency, backcasting is a tool to support social and higher-order learning and build shared ownership on long-term, transformative goals.

4.3 Normative goals and carbon neutrality transitions

The primary intent of this subchapter is to provide theoretical background for elaborating answers mainly to research question (4) "How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?". It will also address some aspects of research question (3) "How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?"

To respond to these research questions, it is relevant to understand how carbon neutrality in cities has been conceptualised and what the position of urban planning is in advancing decarbonization. Hence, the first part of the chapter elaborates briefly on what carbon neutrality targets are, how they are being defined and how they establish the new normative framework (mentioned in the title of article 4). It then explains what is currently known regarding the capacity of urban planning to contribute to decarbonization. Finally, the chapter builds a view on what kind of process a carbon-neutral transition in the context of cities is as an interplay between spatial structures, technological solutions, policies and social practices.

4.3.1 Carbon neutrality targets in the context of decarbonizing policies

The role of cities in mitigating climate change has gained increased attention over the past two decades, among other fora in IPCC reports on climate change (IPCC 2014; Kona et al 2018). Due to their high levels of energy consumption, over 70% of global carbon emissions can be attributed to cities (IEA 2008). At present, numerous cities have official, time-bound targets for becoming carbon neutral, with target years ranging from 2025 to 2050 (e.g. Carbon Neutral Cities Alliance 2020).

Kenis & Lievens (2017) suggest that visible city-level initiatives on climate change are asymptotic to three key trends of contemporary climate policies: 1. failures in international climate negotiations, 2. attempts to reframe the climate challenge in economic terms (i.e. as an opportunity for green growth), and 3. tendency to frame climate change in managerial and technocratic terms. This has boosted a 'storyline' on sustainable societies built on virally spreading networks of forerunner cities, embodied by transnational coalitions of cities, such as the International Council for Local Environmental Initiatives (ICLEI), Energy Cities, the C40 Cities Climate Leadership Group, and the Global Covenant of Mayors for Climate and Energy and Carbon Neutral Cities Alliance (Tozer & Klenk 2018; Kenis & Lievens 2017; Luque-Ayala et al 2018). Hodson & Marvin (2013) call this development 'new self-reliant urbanism', in which major urban agglomerations are developing common systems for measuring GHG emissions, exchanging best practices in low-carbon solutions and collectively building systems of cleaner transport, energy efficiency and renewable energy.

Transnational city networks have also had a significant role in spreading carbon neutrality targets and in setting methodologies and standards supporting them. For instance, the Carbon Neutral Cities Alliance has defined carbon neutrality as a city

or region where the net greenhouse gas emissions 'associated' with that territory are zero or less (Praskin and Cleveland 2019). However, existing targets vary largely in terms of their time horizons and metrics (e.g., absolute vs per capita targets) (Barnsard et al 2017), or even regarding definitions and use of key terms. Nevertheless, this process has resulted in a transnational 'storyline of carbon neutrality'. (Tozer & Klenk 2018). This storyline has also been recently adopted by the EU Commission, which has launched the '100 climate neutral cities by 2030' initiative as one of its Mission Board activities (European Commission 2020).

The storyline on carbon-neutral cities, together with carbon neutrality goals in numerous cities, has established an additional framework of a 'new normative' (cf. Wolfram et al 2019), a concept used in this study. New normative refers to carbon neutrality targets that cities, regions and national governments have assumed, and implications that these targets have on planning and other fields of policymaking. These targets and goals suggest (at least implicitly) a valuing framework for preferable futures, thus introducing a normative element into planning that should comply with those targets. Tozer and Klenk (2018) define this phenomenon epitomised by carbon neutrality targets as a 'transnational sociotechnical imaginary', suggesting that such imaginaries shape infrastructure, objects and institutions and link to both policies and politics.

4.3.2 How to define a carbon neutral city?

The Greenhouse Gas Reporting Protocol (2016) makes the distinction between Scope 1, 2 and 3 emissions of cities: Scope 1 refers to emissions from sources within the city boundary, Scope 2 emissions from consumption of grid-supplied energy generated outside the boundary, and Scope 3 emissions are embedded in traded goods and services, produced elsewhere but consumed inside the boundary, reflecting the full emissions lifecycle of goods and services.

To date, most cities measure only scope 1 and 2 emissions (and those from waste generated in the city, formally belonging to scope 3). Therefore, their carbon neutrality targets do not include consumption-based emissions (CNCA 2015; C40 2019; Laine et al 2020). While the decision to focus on production-based emissions is often justified by the lack of appropriate and reliable methodologies to quantify scope 3 emissions, such decisions are highly political by nature and have typically been preceded by fierce political debate (c.f. Kenis & Lievens 2017; Prestwood et al 2018). Including consumption-based emissions in the official carbon neutrality goals

would set the level of ambition much higher. For instance, the cumulative carbon footprint of Helsinki residents was estimated to represent 220% of emissions included in the official carbon neutrality target of the city (i.e. scopes 1 and 2) (City of Helsinki 2015).

Many recent studies suggest that in the case of cities in wealthy Western countries, calculating emissions based on consumption would better reflect the structures of the contemporary global economy compared to the territorial approach: This method would take into account both the global value chains of goods and services consumed by inhabitants, and the materials used in expanding and updating urban infrastructures that accommodate the growth of cities. This vantage point reframes how we look at economic activity, seeing economic activities within the global economy as existing to serve individuals and households that eventually get to enjoy the goods and services extracted and produced in hinterlands and cities of developing countries with lower production costs. (Jones et al 2018; Heinonen & Jóhannesson 2019.)

Furthermore, consumption-based approaches on emissions would enable tackling so-called rebound effects; a surge of emissions resulting from growing consumer demand induced by efficiency gains and resulting in decreasing costs (Ottelin et al 2018). Part of the rebound effects happen through channelling saved costs from e.g. efficiency gains in electricity or fuel consumption into other categories of consumption, such as consumer goods or travelling that have their emission hotspots outside the remits of a city.

Several studies (e.g. Hagen 2016; Jones et al 2018; Ottelin et al 2018) indicate that without such a complete view on carbon footprints it is difficult to understand how urban emissions develop and how people behave as a result of a multitude of drivers, spatial planning among them. Thus, many planning interventions fall short of bringing about reductions in overall emissions.

It is reasonable to assume that eventually, while the decarbonization of societies advances further, this approach incorporating scope 3 emissions will be adopted gradually by cities striving towards carbon neutrality. It will pose a remarkable challenge to policy-making, inevitably leading to significant transitions in the ways in which cities, institutions, communities and socio-technical dimensions of technologies and infrastructure are conceptualised and valued (Luque-Ayala et al 2018). This new approach raises numerous new questions, such as how to influence consumption patterns and lifestyles, what are the available options for a city to change existing realities of the political economy, such as global trade rules or production processes? It is apparent that eventually, affecting Scope 3 emissions will

require new levels of regulation and other interventions to decisions by private companies and individuals that authorities in cities have not usually engaged with. In other words, it will entail re-drawing and re-imagining the boundaries of a city regarding decarbonization, both geographically and related to relevant social groups (Kenis & Lievens 2017).

4.3.3 What can urban planning do in decarbonizing cities?

Overall, the impacts of urban planning are difficult to discern precisely from various other factors such as technological change, development of household incomes, macro-economic cycles or other climate policy measures like taxation on energy, fuel and vehicles (Ottelin et al 2018; Heinonen & Jóhannesson 2019). The impacts of planning strategies and decisions materialise only after a significant delay (Hagen 2016; Jones et al 2018) when they enable the emergence and adoption of more sustainable social practices and economically efficient innovations. The potential impacts of spatial planning and different strategies also vary significantly between different geographical and temporal cultural contexts (Romero-Lankao 2012; Jones et al 2018; Ottelin et al 2018).

Guidelines and studies on urban planning and climate change have concentrated on Scope 1 and 2 emission through affecting three issues: 1., improving the energy efficiency of new and existing buildings (by designing the urban form and grouping of buildings, building codes and zoning of parks and other forms of urban greenery that affect heating and cooling), 2., enabling the building and installation of renewable and distributed energy production capacity (through zoning and building permits allowing installation of solar, wind and geothermal production in optimal locations) and 3., supporting transit, pedestrian and cycling-oriented mobility patterns and overall shorter commuting distances (by planning compact urban forms with a mix of different land uses and creating urban design improving the attractiveness of transit use, walking and cycling) (Crane & Landis 2010; Hagen 2016; Jones et al 2018; Newman 2020).

Furthermore, recent studies have started emphasizing the role of carbon sinks inside cities (i.e. maintenance of parks and other types of urban vegetation) (Ottelin et al 2018) and designs of neighbourhoods to support collaborative consumption and circular solutions that could reduce consumption of material goods, thus affecting Scope 3 emissions (Ottelin et al 2018; Newman 2020).

These factors of climate mitigation are being steered on different levels and scales of planning: Regional design and strategic metropolitan planning are needed in shaping the urban form such that it reduces travel, enables efficient transport infrastructure and supports the integration of new renewable energy sources into existing, often layered urban structures. Yet, more detailed urban design is needed to improve energy efficiency, facilitate the installation of renewable energy production in new and retrofitted buildings, and secure walkability and access to transit within neighbourhoods. (Hagen 2016; Gedikli 2018; Kempenaar et al 2020.)

The evidence on how different intended, planning-related emissions reduction strategies are realised in terms of actual carbon footprint is still somewhat incomplete and in many topics contradictory (e.g. Crane & Landis 2010; Hagen 2016; Ottelin et al 2018). There seems to be rather coherent evidence that strict energy standards on buildings, dense urban form, appropriate groupings of buildings and multi-family housing decrease the need for heating and cooling, and eventually GHG emissions (Hagen 2016). However, the energy mix used in the production of cooling, heating and power production significantly affect the level of housing-based GHG emissions, (Jones et al 2018; Ottelin et al 2018).

Probably the most studied field of planning and its potential for decarbonization is the impact of the urban form on mobility-related GHG emissions (an early example of this being Hall 2000). Both Hagen (2016) and Otteling and her co-authors (2018) claim that evidence on how much policies favouring dense urban form and compact neighbourhoods can actually shape travel behaviour remains incomplete and dependent on other factors: fuel taxation and the fuel efficiency in vehicle fleets much more directly affect consumption-based emissions.

Eventually, the most coherent driver of personal carbon footprint is income level (Ottelin et al 2018). Cities and their densest areas in prime locations have the highest economic productivity and consequently high-income levels (Ottelin et al 2019). Moreover, household sizes are smaller in densely populated areas with high housing costs, which further increases the level of personal carbon footprint. Consequently, carbon footprints in densely populated central areas are the highest of all urban zones: low levels of private car usage are being offset by more extensive use of public transport, long-haul travel and other forms of consumption (Ottelin et al 2018; Heinonen & Jóhannesson 2019). However, when removing the effect of income and household size, the correlation between urban density and per capita GHG emissions is negative (Ottelin et al 2018).

Looking at the development in the coming decades, it is quite likely that both energy production and personal transport will be decarbonised due to ongoing

transitions to renewable energy, mainstreaming of electric vehicles and diversification of mobility services, partly also due to the emergence of autonomous vehicles (Newman 2000). This is a remarkable step toward carbon neutrality in cities, as mobility and housing are typically the two biggest (Scope 1 and 2) emissions sectors (cf. Jones et al 2018).

However, the growth of emissions in other sectors of consumption will continue and eventually offset achievements in housing and transport, presuming that wealth generation in the most successful cities will continue and no measures are taken to transform consumption patterns and lifestyles (cf. Jones et al 2018; Heinonen & Jóhannesson 2019). In other words, without changes in behavioural patterns and urban structures that support the formation of new social practices, there will be an eventual rebound effect that offsets previous contributions of technological advances (Hagen 2016).

Both transitions to carbon neutrality in energy and mobility technologies, and unchecked growth of consumption-related GHG emissions elsewhere demand new planning solutions over the coming decades. As these solutions are being developed vis-á-vis historically novel technological, economic and social phenomena, there are no tested instruments around which to build policies. Nor can simple, static planning ideals on sustainable cities like New Urbanism, Smart Growth, Transit-Oriented Development or walkability provide sufficient guidelines for decarbonising cities and shrinking carbon footprints.

4.3.4 The three layers of the carbon neutral transition of cities

'Carbon-neutral' can be seen as an overarching storyline that can accommodate several, diverging sociotechnical imaginaries of urban futures. Conventional imaginaries, widely present in official decarbonization strategies of cities, assume technological determinism and a linear vision of energy transition. They encourage and engage different stakeholders with promises of business opportunities in the new, green economy, on a position among the technological forerunners and early adopters, and modernisation and technological updates in urban infrastructure. (Tozer & Klenk 2018.)

This kind of storyline focuses the attention of climate policies on measures that can affect critical emissions sources and their underlying technology and infrastructure. The storyline could be called Type E transition (E standing for emissions). This type of transition would not change planning, its domain, or

objectives significantly as it assumes decarbonization to happen primarily via the substitution of technologies without significant changes in social practices or institutional structures.

However, there are also competing imaginaries and storylines on urban carbon neutrality. Many authors (e.g. Bulkeley et al 2013; Kenis & Lievens 2017, Luque-Ayala et al 2018) claim that fast and deep decarbonization should be thought of as a process primarily transforming social and economic practices in which emissions are embedded. This would consequently affect the ways different stakeholders have agency on the decarbonization of different stakeholders, as well as modes of governing the city. This interpretation of carbon-neutral transitions could be called Type A transition (A standing for agency), and it would entail dramatic changes in urban planning as well.

Also, the definition of the target matters: if we are talking about carbon neutrality of a city defined by territorial, or Scope 1 and 2 emissions, a storyline of Type E transition might sound appropriate, especially in cities of the global North where the transition towards post-fossil fuels and electric vehicles in urban transport is accelerating. However, when thinking of carbon neutrality based on consumption-based emissions, including also Scope 3, a storyline on Type A transition and greater focus on social and economic practices, becomes more appealing.

However, technology, infrastructure, policies, markets and behaviour of people are strongly intertwined. Over the past two decades, multi-level perspectives (Rip & Kemp 1998) and transition management (Rotmans et al 2001; Geels 2002) have formed a widely spread framework for analysing and governing different kinds of sustainability transitions. This governance approach focuses on sustainability transitions in complex technological, social and economic domains such as energy, transportation and food. The framework presumes that the regime level of established institutions, markets, rules, policies, companies and technological systems is primarily oriented towards optimising efficiency. Eventually, co-evolution and co-learning between niche level radical novelties, typically evolved in protected and insulated special conditions outside direct competition, can lead to challenging and replacing established regime solutions (Geels 2004).

Some critics have doubted whether transition studies and its multilevel perspective is capable of properly taking into account the place aspect of transition (Hodson & Marvin 2013) and whether the approach overlooks the political aspect of transitions (Shove & Walker 2009). The political aspect, as well as the aspect of place, are strongly present in urban infrastructure and in the path-dependencies it creates (Bulkeley et al 2013). Despite these shortcomings, multi-level perspectives

and transition management provide a valuable analytical framework for explaining how pieces of urban infrastructure, not only as socio-technical but also socio-material systems, can be steered to far-reaching changes and long-term transitions (cf. Bulkeley et al 2013).

Transitions in networked urban infrastructures such as energy, water and transport systems are shaped by configurations of existing, layered spatial structures of cities and regions (Monstadt 2009). For instance, it is not only a matter of simply changing the mode of energy production, as there are good scales of place-specific factors shaping this transition: local technological specialization, previous market formation, local institutional variation and current actor strategies are all such factors.

There is also plenty of evidence on how changes in institutions, cultural values and rules and regulations affect transformation trajectories of urban infrastructure and the built environment: privatization of previously publicly owned infrastructure, changes in accounting practices of utilities and international environmental regulation are examples of landscape-level changes that shape regimes and eventually cities, introducing new actors in urban contexts and shaping meanings attributed to different practices in cities. (Monstadt 2009.)

This kind of inertia and obduracy of spatial structures and existing infrastructure, caused both by its institutional and material characteristics, oppose and slow down wide applications of the latest innovations in urban contexts (Juwet & Ryckewaert 2018). Therefore, there is no certain blueprint for implementation that could serve as-of-yet unknown technological solutions and user needs, nor is there any warranty on how long-lasting a design envisioned today will be.

As indicated earlier, transitions in the biggest sources of emissions and urban infrastructure will not be enough to ensure carbon neutrality if consumption-based emissions in other (Scope 3) categories continue to grow (cf. Ottelin et al 2018). Therefore, it seems unavoidable that urban carbon neutrality transitions would have to eventually address the layer of behavioural patterns.

Following the theory on social practices, the behaviour of individuals is only an observable layer of practices, made of different elements, that can be categorised into three types: material, competence and meaning (Spurling et al 2013 referring to Shove et al 2012). This notion of social practices as entities (as opposed to performance, i.e. observable behaviour) challenges the pervasive discourse of behavioural change that is widely spread in various fields of policy (Vihalemm et al 2016).

Social practices often appear self-evident to people in everyday life, and there is no reason to look for alternatives. Even on occasions where people make conscious choices regarding their behaviour, their degree of autonomy is limited: they have limited resources (time, money), and picking an option might require knowledge and skills they lack. Their surrounding infrastructure and other material conditions do not necessarily enable their desired choice. Alternatively, an option can be outside the scope of their social tastes, possessing too narrow, or wrong kinds of, meanings. (Spurling et al 2013).

Technologies and urban infrastructure are substantial components of social practices. Still, technologies are often being developed to serve the needs and behavioural patterns of urban lifestyles. Larger socio-cultural, technical and economic transitions shape notions of normality and eventually change meanings that give interpretations to social practices. Changes in policies, often resulting in re-designs and visible changes in our material reality can introduce a 'new normal' that people soon stop questioning and instead start aligning their own behaviour with (Spurling et al 2013). These shifts in meanings of practices have no universal mechanism to follow, and instead, they obey historical, cultural and social specifics (Vihalemm et al 2016).

The previous paragraphs have provided arguments on why decarbonization of cities should be interpreted as a systemwide transition, instead of having a more linear approach and focus on transforming the most significant emission sources. Technologies, infrastructure and social practices are intertwined and carbon neutrality cannot be achieved without changes in all of them. In the best case, a co-evolutionary transition, harnessing momentum created by emerging technologies and behavioural patterns, can evolve into new, wider systems architecture around carbon neutrality (Wheeler 2017; Ravetz 2020). However, such a systemic innovation (Schot & Steinmueller, 2018) might require the intentional, sustained and inclusive building of a transition and visioning process that supports collective or higher-order learning and creation of shared reference points for further negotiations (Hodson & Marvin 2013; Vihalemm et al 2016; Kenis & Lievens 2017)

However, Luque-Ayala and her co-authors (2018) claim that system innovation will not happen unless social and political dimensions of infrastructure, as well as multiple agencies behind it, are being recognised in urban governance. They suggest that this expansion of the political domain is happening through the rise of urban experimentation (Luque-Ayala et al 2018), operating mostly outside the scope of traditional policies and planning instruments.

4.3.5 Key findings of the theoretical discussion in regard to the research questions

Cities have taken a more visible role in climate policy over the past decade. As the most visible sign of that, numerous cities throughout the world have set time-bound targets for carbon neutrality. Under such carbon-neutral storylines, there are various ways of defining what carbon neutrality means, as well as several storylines on what the transition entails.

Despite most cities defining their carbon neutrality targets through territorial emissions, consumption-based emissions better reflect the current structures of the global economy. Furthermore, whilst emissions from housing and mobility seem to be in decline, emissions from other forms of consumption continue to rise. Hence, re-defining the carbon neutrality goals through a more adequate methodology would gradually reframe the underlying problem that cities and urban planning are supposed to address in decarbonization.

There is no evidence that any simple planning principle (e.g. compact neighbourhoods, walkability etc) would alone be sufficient in targeting infrastructure and behaviours to a radical, sustained trajectory of declining emissions. Nor is it enough to merely focus on the largest sources of emissions and to choose the most rational policies for reducing these emissions. Decarbonization involves various socio-technical aspects that involve co-evolution between technologies and various kinds of material and social structures, happening between different levels and sectors of society (Rip & Kemp 1998; Geels 2004).

Under a dominant storyline, the decarbonization process is being interpreted as a Type E transition, as something that can be governed and planned by focusing on point-source emissions. Yet, it is reasonable to believe that the level of decarbonization required and also targeted by many cities will lead to transitions in agency, structures and practices in which carbon is embedded, as a Type A transition. Urban infrastructures and social practices, the two critical areas in carbon-neutral transitions, are difficult to change with the help of traditional urban policies alone. New domains of governance and planning, focusing on co-evolution between different layers of transition, can engage different stakeholders in a transition process that supports collective learning and establishes shared visions that provide common reference points.

5 CONCEPTUAL MODEL

The core concepts of this research are:

1. Normative goals on carbon neutrality
2. Future orientation of spatial planning
3. Backcasting scenarios

These concepts help in defining the main research question of this thesis: "How can backcasting scenarios re-focus urban and regional planning in regard to implementation of normative goals on carbon neutrality?" This proposition suggests that "normative goals on carbon neutrality" will change planning's focus and future orientation following the intentions of those long-term targets. Furthermore, it suggests that "backcasting scenarios" can shape the creation of this relationship. In the image illustrating the conceptual model (see figure 3 below), these two relationships are expressed by arrows with full lines.

In addition to these two relationships, the conceptual model contains two other relationships between the core concepts that remain implicit in the formulation of the research hypothesis: There is an implicit assumption that spatial planning when having a suitable future orientation, can have a significant contribution in transitioning to carbon-neutral cities (i.e. attaining the corresponding normative goals). Furthermore, there is an assumption that the growing political commitment to goals on carbon neutrality is making backcasting scenarios (and probably various other approaches and methods of futures studies) increasingly relevant tools and ways of conducting systematic studies about the future. These two (more implicit) relationships are expressed in figure 3 by arrows with dotted lines.

Additionally, there are different sub-categories under each key concept, also affecting the phenomena to which the concepts are linked. These categories have been elaborated on in chapter four. There are five main frames on the future orientation of urban planning: planning, predictive, scenaric, visionary and transformative (see 4.1). The normative goals on carbon neutrality can refer to two types of transitions, Type E transitions and Type A transitions (See 4.3). Backcasting

scenarios can be labelled into Target-oriented, Pathway-oriented and Action-oriented backcasting (See 4.2).

The core concepts, variables elaborating the nature of their interaction, and relationships between the concepts are being explained below (in Figure 3).

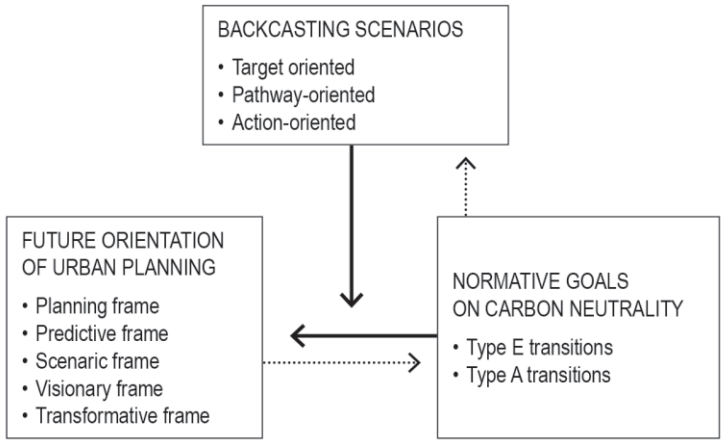

Figure 3. The Conceptual model of the research

6 RESEARCH STRATEGY AND METHODOLOGY

The research and the articles of this thesis are being built around practical explorations with the backcasting approach that have led to an understanding of the value of backcasting in long-term transitions towards societally relevant goals like climate neutrality. The general research approach follows the constructivist idea: it focuses more on an understanding of the topic than on providing explanations. Thus, interpretations of the case studies are presented, which have been shaped by previous foreknowledge and attitudes, based on the literature and research read, earlier experiences related to backcasting and spatial planning, and social environments and the meanings and experiences are derived from them.

Since the beginning of the process (i.e. the first case presented in article 3), there has been an initial hypothesis that backcasting scenarios could be a valuable approach when planning for transitions to carbon neutrality (as explained in chapter 2). Ever since, this hypothesis has been iterated and elaborated numerous times by mixing experiences with backcasting with ideas based on theories and concepts presented in the relevant literature. In other words, the hypothesis and experiences have gradually been placed into wider contexts, thus expanding our understanding on backcasting, planning and the carbon-neutral transition through a hermeneutic circle. Simultaneously, the research and practical projects from which the case studies were drawn exist within the same reality that has been studied, and have directly influenced the world and the objects of the research. (Moses & Knutsen 2007.)

In other words, the research depicts the topic and the case from the perspective that the researcher has obtained from interactions with the environment, providing them with interpretations that could aid other people in understanding similar issues better. Considering the complexity and deeply social characteristics of the object of research; cities and urban planning happening in the context of a transition to carbon neutrality, it would not be possible to obtain objective knowledge on it, not at least on the aspects this study has focused on, related to backcasting and its potential impact on the future orientation of planning. There are no universal or formalised practices on the use of backcasting scenarios in the context of the decarbonisation of cities. Therefore, there were no pre-existing criteria for case selection, nor a focus

on certain aspects of the topic. Thus, creating an understanding of holistic, real-life cases appeared to be the most useful approach for the research.

6.1 Ontological and epistemological considerations

The conceptual model of this research elaborates an assumption that there are relationships between a) planning and its future orientation and b) the normative goals that frame carbon neutrality transitions. The existence of policy goals indicating a large-scale transformative change such as decarbonization of society alters the context of planning. Meanwhile, spatial planning and the styles it deploys can (positively or negatively) affect carbon-neutral transitions. Additionally, there is an assumption that backcasting, if integrated successfully into planning, can help in re-focusing planning toward long-term transitions and the future.

The methodological questions should explain 'how we know' or 'what are the methods of knowing'. In this context, what are the methods of reaching valid information on the aforementioned phenomena and their relationships? We are dealing with two issues, (1) normative goals for carbon-neutral transitions and (2) the future orientation of urban planning. These issues are extensive, complex and socially constructed: they exist inter-subjectively through words and symbols, and as results of interactions between people.

As constituents, these issues have various ingredients that are mainly socially constructed. The 'future orientation of planning' consists of interpretations by different actors (mainly academic researchers). These interpretations refer to large amounts of previous research in different academic fields and real-life examples of planning practices. Some of these interpretations intend to be descriptive, i.e. depicting and explaining existing practices with no explicit intention to suggest how similar practices should take place in the future. Others are normative, i.e. intending to suggest how such practices should happen to fulfil certain ideals.

Urban planning practices themselves consist of various types of social processes, different types of actors (professional groups, stakeholders of certain institutions etc), these actors' beliefs and attitudes and formal documents and social institutions. These processes have spatial, geographically constrained structures as their objects of action and they produce imaginary descriptions of how those structures should be changed. These practices are being defined and bordered by formal legal and institutional structures and by other, less formal societal structures.

'Normative goals' refer to politically agreed targets that are typically defined and documented in policy and planning documents. They result from negotiations between groups of people, performed in formal institutions and following the rules of those institutions. In other words, these targets and goals are agreements or promises made between people. Following the theory on speech acts and social ontology by John Searle (2010), promises are declarations and social entities that combine descriptions on how the physical world is with human intentions to change the world. These declarations attach numerous status functions to other entities that entail rights, obligations and norms. In the case of carbon neutrality and decarbonization targets, this means that certain activities, organizations, machines or pieces of land have a defined contribution to climate emissions and an obligation to reduce this amount to a certain target within the agreed time frame.

According to Searle, status function declarations are essentially speech acts: they are being created in social interactions that involve language. In order for these declarations to have any causal power on reality, they have to be embodied in the beliefs and attitudes of people and shared and publicly articulated (Little 2017). This is what politically approved goals on carbon neutrality intend to do: constitute social norms by articulating shared views on desirable states of the future that then change the world by introducing new status functions.

'Carbon neutral transitions' refer to the processes happening in parallel in various sectors and levels of society over long time periods, stretching several decades. 'Carbon neutrality', a concept adopted from environmental economics, has several definitions (see chapter 4.3). These definitions are dependent on various theoretical concepts used in different fields of science that construct our contemporary understanding on climate change and its causes. These concepts refer to physical entities and states of affairs (from 'rain', 'air temperature', 'soil' or 'photosynthesis' used in natural sciences to various human-made artefacts that contribute to climate emissions and are being defined by different fields of engineering). These concepts and scientific (and hence tentative) knowledge constitute a basis for politically agreed targets related to mitigation of climate change, such as climate neutrality of a nation-state, region or city. In other words, these targets and goals are agreements or promises made between people.

However, how successful such agreements turn out to be in shaping the world is a question that can be answered only in retrospect, based on historical development. Different societies and institutions differ in their capabilities to implement political decisions and specifically long-term targets. These capabilities are also dependent on the topic or field. In the case of carbon neutrality and climate change there are

various difficulties to evaluate this: 1. Policies aiming at radical decarbonization are still relatively new phenomena. The quest also changes over time due to the parallel development of technology and social practices elsewhere. Therefore, it is difficult to assess the credibility of different societies, cities and institutions with their decarbonization intentions. 2. Carbon neutrality requires parallel action in various fields and sectors of society, as public organizations and political decisions possess limited capacities to bring about the action needed without significant changes in dominant structures of political and economic power.

The third component of the conceptual model of this research is backcasting. As indicated above, the assumption in this study is that backcasting scenarios could contribute to attaining normative goals on carbon neutrality by (for instance) changing planning and its future orientation. In other words, backcasting scenarios (both as outputs of scenario studies, and as processes of creating such outputs) could serve in reinforcing status function declarations related to carbon neutrality targets by creating awareness and commitment toward different activities advancing the target. Eventually, they could even affect the levels of credibility of those politically approved targets, making people believe that such goals possess significant causal powers on the behaviour of people and organizations, thus shaping the way people also perceive normative statements on distant futures.

Backcasting scenarios, or scenarios overall, are abstract products of human action and describe future events that do not exist. Hence, there are no facts on future events. Fuller and Loogma (2009), interpreting and summarizing definitions and descriptions on the ontological status of 'futures knowledge'[2] from seminal publications of futures studies, suggest that 'futures knowledge' can be defined as generated through social action, meaning in discourse and negotiations with language (Fuller & Loogma 2009). Scenarios consist of theoretical concepts that are linked to operational concepts depicting the present reality. They are also linked to operational concepts depicting phenomena yet to be realised (Sneck 2002). Kuusi et al (2015) claim that their external validity (i.e. relevance to their users) depends on how well scenarios are in line with current future relevant facts and/or how well the scenario is being understood by its users.

[2] I am personally reluctant to use concept 'knowledge' in the context of future events. According to the classical definition of knowledge (often attributed to Plato) it is a statement that is justified, true and believed (by someone). As there are no truths about the future, it would be confusing to talk about 'future knowledge. However, many futures researchers, being aware of the classical definition of knowledge, use the term. Therefore I am referring to it here as a technical term and therefore inside quotation marks.

From a methodological perspective, the process of producing futures knowledge is more significant than the accuracy of the knowledge it produces. Oft-used methodologies include different forms of participation that aim at generating both knowledge and action about the future. (Fuller & Loogma 2009.) 'Dufva (2016) suggests that 'futures knowledge' is created in interaction between humans in a gradual manner that manifests itself in shaping networks of concepts.

All in all, backcasting scenarios can be seen as a method of changing people's awareness about the future and the opportunities for action and decisions. As defined in chapter 4.2, results of backcasting are often defined in terms of the different forms of learning that backcasting can bring about.

To summarise, we can know about backcasting scenarios through a) understanding the meaning and relevance of their content, b) understanding the process and methods through which they have been constructed, c) understanding their use, practical benefits and the impact they have on people, society, and its various institutions and processes.

The aforementioned research problem connects the three core concepts and suggests several relationships between them. Now, after defining what types of entities and relations these concepts refer to (and what they ontologically are), the remaining question is how to gain knowledge on the research problem: What are valid methods for studying it?

6.2 The case study approach as a research strategy

As indicated above, the challenge contextualising the research, transitioning to carbon neutrality, is a still-emerging process, and a primary concern is how it could be shaped in the future. This constrains what can be known about it and what type of knowledge is relevant from the point of view of this research's objectives. Therefore, the research strategy of this thesis has been explorative: future-oriented practices are first described in their context. Then, it is explained how they relate to societal challenges, previous practices. Eventually, the issues that would enhance the capacity of these practices to make more significant contributions to planning and carbon-neutral transitions are identified.

One central characteristic of a good case study is that it aims at building a general, holistic idea of the object in its context, as one whole (Verschuren & Doorewaard 2010). A hypothesis-generating case study can provide elements for a gradually evolving theory. Later case studies on the same topic can then add further elements

to a theoretical construct (cf. Moses & Knutsen 2007). A paradigmatic case highlights a great number of general characteristics of the phenomenon, eventually creating a metaphor or prototype that structures learning around it (Flyvbjerg 2006). This type of hypothesis and theory-generating case research is often labelled as inductive (as opposed to deductive case research, aimed at testing hypotheses) (e.g. Johansson 2003; Dubois & Gadde 2002).

However, quite often, generalisations are made by comparing and matching the empiria provided by a case with a framework provided by existing theories and previous, known cases. This abductive approach acknowledges that in case-study research, different modes and elements are intertwined and integrated: A research process consists of going back and forth between an analytical framework (existing concepts and theories) and empirical observations, gradually adding new elements and evolving the framework. Instead of generating a theory, abductive case research develops existing theories. (Dubois & Gadde 2002.)

Urban planning is often a complex and contextual phenomenon, defined by local economic, political, social and legal conditions. A case study with an intensive approach is often the most appropriate type of research for studying such a broad, social phenomenon: in order to properly understand the phenomenon, there is a need to collect information on its properties from various sources over a longer period of time (Swanborn 2010). Case studies provide contextual understanding of a phenomenon. Such contextual, detailed information is the basis for learning for all people, regardless of their level of expertise. This is what makes case studies a valuable method in social sciences. (Flyvbjerg 2006.) Considering the (practical) objective of this research to enhance the capacity of planning to positively contribute to carbon-neutral transitions, it is specifically important to provide easily identifiable and transferable information to readers.

The two case studies on policy processes in metropolitan regions (depicted in Articles 3 and 4) use the thick description method, in which reported research provides a detailed account of context and field experiences that can help to explore and interpret explicit patterns of cultural and social relationships (Lincoln & Cuba 1985; Geertz 1973; Holloway 1997). Providing such detailed information enables other researchers to evaluate the conclusions' external validity(Lincoln & Cuba 1985). The use of theories and theoretical concepts serve to make a description thicker, eventually making it easier for the reader to transfer the conclusions of the study to a familiar context.

All three case studies in my research are being built around backcasting scenarios, illustrating different ways of understanding the approach and its benefits. The

intention has not been to produce strictly comparative cases. Rather, the goal has been to create complementary views on how backcasting scenarios are being used in planning long-term transitions and to generate hypotheses on their role in spatial planning for carbon-neutral transitions. The analysis on the cases has been theory-guided: the gathered empirical material has been compared with the existing conceptual and theoretical framework on backcasting. This framework has been elaborated throughout the process, meaning that building foreknowledge, planning and implementing the cases, gathering material, analysing and interpreting them have happened simultaneously, through an ongoing hermeneutical cycle (Moses & Knutsen 2007). This kind of abductive approach has enabled the further development of existing theories on backcasting. Integrating other relevant concepts and theories (e.g. incrementalism with perspective, trading zone) and adjusting backcasting to the chosen empirical cases allows this framework to evolve further (cf. Dubois & Gadde 2002).

As explained in chapter two of this study, this research is largely based on practice undertaken over a 17-year period. The empirical data of each case study had been created and collected prior to our plans to write an academic article. The articles have been created by combining and matching the collected empirical materials with suitable theoretical frameworks, and by enriching descriptions on the contexts of the cases.

In other words, the theoretical frameworks did not guide the original collection of data, and the process was characterised by going back and forth between the theoretical framework and the previously produced empirical material. The research framework, the objectives of the PhD study and the main research question have been defined while writing this synthesis chapter of the PhD process, after completing the articles that introduce the case studies. Therefore, this synthesis adds yet another vantage point and layer of interpretation and critical reflection on the original empiria and practices used. This was based on theories and concepts introduced mainly in the theoretical background, and in Article 1 based on the literature review. This combining of several cases and partly differing theoretical frameworks has enabled further synthesis of the learnings and generalisations on backcasting scenarios and their relationship to spatial planning.

It is worth considering what methods an alternative research strategy could include. There could have been a comparative study on the use of backcasting approaches in a wider number of cases and contexts in urban planning. This would have enabled identifying and analysing different general characteristics of the method, its outcomes, contexts of usage and perhaps even benefits to planning.

These results could have been implemented through various alternative methods, either by comparing public documents, conducting a survey or interviewing people involved in the exercises. Alternatively, there could have been a comparison between a planning exercise using a backcasting approach and another one deploying another method. However, the focus of this research has been to understand how backcasting can help in introducing goals, domains and contents in urban planning in new, transformative contexts. Hence, the primary interest was to understand and explain the processes of learning, un-learning and co-production that backcasting scenarios can bring to urban planning. Therefore, it was more appropriate to provide a deeper view on the use and learning-related benefits of backcasting approaches in the context of explorative and paradigmatic cases.

6.3 Utilised research questions, cases and methodologies

The research hypothesis has been operationalised into three research questions. Question two 'How do futures studies, its episteme and practices affect urban planning?' sets a mission to understand how the two core domains of this research, urban planning and futures studies, have previously been connected and how this relationship might evolve in the context of this research. The research object here consists of the academic literature identified with the help of the Scopus database. This literature review focused on journal articles on urban planning and futures studies, with an assumption that academic publications would also reflect and describe (at least partially) how this relationship with futures studies has appeared in planning practice. The methods and materials used in conducting the literature review have been described thoroughly in article 1.

The literature review, reported in article 1 of this thesis, explored how futures studies has been used in planning, how futures studies relate to the discourses in planning theory, and how previous research depicts the ways futures studies could help in updating planning to be better equipped for emerging societal challenges. This article helps in contextualising the remaining parts of the research in the existing literature and identifying what the contributions of my research are to the academic discourse.

Research question three, 'How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?' sets the mission of understanding what backcasting scenarios are like in the societal context this study is particularly interested in: How do they link present-day relevant facts,

societal structures, trends and actors with the future developments? How are normative goals and targets interpreted as (various differing) desirable futures? What is the backcasting approach assumed to do in different types of settings? A case study on a backcasting scenario exercise, presented in article 2, builds an understanding that intends to answer the question, while articles 3 and 4 provide additional insight on the functions of backcasting.

The analyses on the backcasting exercise focus on the qualities of the scenario pathways and principles through which they were formed. The exercise depicted in article 2 was done as part of a relatively large research project in which the research design was entirely built by the research group, with very little need to integrate external or practical considerations (i.e. the project had no client whose interests to serve). The scenarios were built following established methods of futures research, such as the Global Business Network/Shell scenario technique (Schwarz 1991) and the Delphi survey. The process and materials used were documented in a transparent manner in the public research report (Leppänen et al 2012) in order to secure the internal validity of the scenarios (cf. Kuusi et al 2015).

In addition, the scenario process engaged a large number of experts and ordinary citizens through several workshops and the Delphi survey, with an intention to build scenarios based on broad expertise and diverse perceptions and viewpoints on the future and sustainable lifestyles. This can be seen as a way of contributing to the external validity of scenarios, which Kuusi et al (2015) define through the amount of possible, relevant futures, coherence with future relevant facts and intelligibility to the relevant audience.

On this occasion, the goal of the scenario exercise was to design a paradigmatic example of backcasting scenarios in the context of transformative change toward a sustainable, carbon-neutral society. Engaging participatory action research (McIntyre 2008) the case resulted in a future-oriented benchmark (due to the special nature of the scenario exercise and due to special access of research to the case) that can serve as a reference point for forthcoming similar exercises.[3]

Research question four, 'How are the domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?' is being answered with the help of two distinct case studies depicted in articles 3 and 4. Once again, there are still relatively few examples and evidence on carbon neutrality targets and the ways they have shaped planning, especially when the intention is to understand broader, longer-term changes in the field.

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[3] There are actually several scenario studies that have copied aspects of it, for instance scenarios of EU Innovate project by Forum for the future (Adams et al 2016; Angheloiuet al 2017)

These two case studies; "Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures" and "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions" provide examples on what long-term visions, targets and transition processes exist in real-life contexts of urban planning. They depict drivers that create demand for long-term thinking, tensions that limit the use of long-term visions in everyday planning and eventually social and institutional processes through which visions and long-term targets influence planning and governance systems.

"Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures" (Article 3) focuses on one, in many ways unique policy process: an international ideas competition and a regional vision process implemented as a follow up on the competition. It depicts in detail the most intense one-year period of this process.

The material for the cases was collected using a participatory action research approach (McIntyre 2008): both co-authors (Aleksi Neuvonen and Peter Ache) were involved as participants in the process and the context that the case study describes. In other words, the researchers have contributed to the knowledge production and problem-solving with people whose activities are being researched. In this case, the author of this thesis had several roles in the process depicted: as a member of an awarded vision competition team whose ideas fed into the metropolitan vision process, as a member of a research team that analysed the competition results and eventually facilitated a communicative planning process with citizens, planners and experts, and as a researcher who eventually co-authored a paper based on experiences and materials from the process. (Applying and testing) backcasting was largely the author's contribution to the practical process.

The materials and methods used in this case study have been depicted more in depth in the article while the public research report (WSP Finland 2008) and chapter 2 of this thesis provide complementary information.

As the authors claim in the article, the need for regional visioning processes has been growing. Therefore, this description could be seen as a future-oriented, paradigmatic case-study, depicting practices that are likely to spread elsewhere. The novelty element and the special access the authors had to the case made this exercise a relevant object for a case study: it exemplified many characteristics of future orientation in planning that would have growing relevance. Thus, analysing them could enable acquiring new, relevant knowledge relevant to the research question.

In contrast, "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions" (Article 4) tells a story of a longer, often meandering

and less clearly defined process. It illustrates how low carbon/carbon neutrality targets, i.e. the new normative framework of urban planning, are being operationalised and how other policy sectors and parallel processes influence and shape their implementation. In that regard, this case study and its detailed description of the context help in understanding what is needed from urban planning that aims to follow normative goals and build capacities for implementing them. In other words, it also challenges some preconceived notions regarding the phenomenon, as a relevant case study should do (cf. Flyvjberg 2006).

The materials of this article were collected by the co-author Joe Ravetz who has taken part in the policy and planning processes in the Greater Manchester metropolitan region in various expert roles. The author of this PhD study and the third co-author Raine Mäntysalo completed secondary research in which the framework with theories they had previously worked with was elaborated (in the case of the author of this thesis, mainly backcasting scenarios) reflecting it on this new research object. The methods and materials used are being further elaborated on in the article.

The literature review (article 1) indicated that there are no paradigmatic cases on the use of scenarios and visions in transformative planning contexts. The two case studies on policy processes in metropolitan regions, articles 3 and 4, intend to reveal cases depicting something that has not been properly understood (for relevant comparisons, see Khanee 1985 and Dixon et al 2018).

The four articles build a journey through a research problem and context of research that are still largely emerging. The objective of the research guides us toward exploring what can be learnt from what has happened so far. Therefore, the research strategy includes a literature survey and three case studies that help in answering the relevant research questions. They provide understanding on future relevant, paradigmatic practices in a context that both motivates and constrains them. This understanding denotes the future and offers ingredients for practical objectives in this study.

6.4 Relevance, reliability and validity of the research

The main body of this thesis consists of articles that report qualitative case studies. Two of the case studies, those with an intensive approach on policy processes in metropolitan regions, use thick description as their method. This method intends to achieve validity by providing sufficient appropriate information on the context

where a study has taken place so that a reader can evaluate whether the conclusions drawn from the case can be generalised and transferred to another context (Lincoln & Cuba 1985). This implies that the scope of transferability is also dependent on those intending to transfer conclusions: how well they know the receiving context and what type of access they have to different data sources.

Both of these cases are based on processes of participatory research and hence researchers have had a significant amount of tacit knowledge available that they have tried to interpret and make explicit through research. Judging the validity of such a process is always challenging: there is plenty of subjective and contextual knowledge involved, there are also plenty of dynamic elements involved, signifying that the level of temporal stability is low. Often the only way would be to ask people involved in the case whether they would recognise the description and conclusions as credible, or perhaps find the conclusions relevant in the context of their practice (Lincoln & Cuba 1985).

The validity of scenario exercises (such as the one detailed in the case on SPREAD 2050 scenarios) can be evaluated from both internal and external perspectives. Kuusi et al (2015) suggest that high internal validity of futures research means that the process is well-organised, deploying consistent reasoning and appropriate methodology, and that outcomes are supported by well-founded argumentation. Based on these criteria it is fair to say that the scenario exercise included in this thesis meets these criteria of internal validity: The research behind the study on the scenarios on sustainable lifestyles in the SPREAD 2050 project was conducted using established methods with a process that was exceptionally well documented with materials published in an openly available report (Leppänen et al 2012). The process included a stakeholder workshop and two rounds of Delphi study during which the argumentation used in the scenarios was fine-tuned.

Further on, Kuusi et al (2015) define the external validity criteria for futures maps, i.e. scenarios. These criteria aim to ensure that futures research has possible practical value. For a scenario study, this means that an exercise can suggest a wide scope of possible futures that are relevant from the point of view of acceptability and aid in identifying the most relevant futures. (Kuusi et al 2015.) The scenarios created in the case study on the SPREAD Sustainable Lifestyles 2050 project have been widely discussed and also used and modified for various contexts, both by the authors and by other experts. This indicates that the scenarios have been well understood and they have provided relevant futures maps.

There are clear limitations on how the results of case studies on broad, complex societal issues can be applied and transferred to other contexts. When the cases are

about geographically defined regions there are always specific factors involved. Both of these case studies describe processes in major European metropolitan regions with globally established higher education and research institutions. Hence, the results cannot be generalised globally to all metropolitan regions. The cases are also specific to certain historical periods defined by their economic, social, political and technological contexts.

The practices depicted in these case studies presume the existence of an established, well-resourced planning system (with 5 characteristics). Firstly, it is assumed to operate as a function supervised by a representative, democratic system that reflects the commitment of people to a target. The second presupposition is that science can influence and provide advice for policies and decision-makers, and that such evidence-based targets are properly understood and accepted by the majority of citizens. Thirdly, it is assumed that there is enough transparent and reliable data available on which to base policies and plans, and fourthly, that there are capable experts who can contribute to a rational process with ever more detailed analysis on things like emissions reduction measures. The final assumption is that there is a relevant planning practice in place as part of the public sector. These criteria are only met in cities of industrialised countries of the global North. In most parts of the world and their growing cities, transitions towards carbon neutrality will require a number of other types of reforms and improvements in planning.

Yet, some aspects are present in numerous places. The societal challenges through which the cases (especially climate change) are being defined are universal. Also, governance structures and socio-technical configurations presented have significant similarities across national borders and continents.

Regarding the scenario exercise of the SPREAD project, it is relevant to note that it was created explicitly for a European context, to explore future European lifestyles. This implies certain limitations concerning how scenarios would be relevant and transferable to other contexts.

Still, the relevance of this research is evident: The main research problem has been built around climate change and the quest for carbon-neutral cities and societies - likely the biggest challenge of humanity in our time. The three case studies are based on practical projects with outcomes targeted for practical use and non-academic audiences. The processes depicted have included large participation of stakeholders to ensure their relevance.

The academic contributions intend to deepen our understanding on this topic and attach the cases to the wider academic context, enabling relevant concepts and approaches to spread to practices, academic research and different forms of applied

or action research. It remains to be seen how useful the research will be, as this is also partly dependent on the academic quality of these studies.

7 RESULTS

Below, the results of the thesis are outlined for each of the four research questions presented in chapter 3. The research questions have been investigated mainly through the three case studies presented in the articles included in this thesis.

The conducted literature review provides insights that help to address research question 2; "How do futures studies, its episteme, and practices affect urban planning?" The two case studies on the regional planning process provide additional contributions to our answer.

All three of the utilised case studies discuss the use of backcasting scenarios as a tool for steering long-term transitions. The case 'backcasting scenarios on the future of sustainable lifestyles' analyses the content and structure of such scenarios. Together, the cases provide answers to research question 3; "How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon-neutral cities and societies?"

Two of the cases depict the context of a (strategic) regional planning process in which a backcasting approach is being applied. The Greater Manchester climate policies case focuses more specifically on carbon targets, whereas the Greater Helsinki Vision 2050 case analyses a process centred around more generic long-term goals. Together, they respond to research question 4; "How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality?"

The answer to the main research question "How can backcasting scenarios re-focus urban and regional planning in regard to implementation of normative goals on carbon neutrality?" is outlined through a summary of key elements from sub-questions 2-4.

7.1 How do futures studies, its episteme(s) and practices affect urban planning? (RQ2)

Both the episteme and practices of contemporary futures studies are organised through questions regarding what is probable, possible and desirable in the future

(Amara 1981). Across paradigms and methods, the assumptions on the openness of the operational environment and effective agency in shaping future events differ. This means that the focus on the created probable and desirable futures varies in different futures exercises. However, in contemporary futures studies, the main emphasis is on exploring possible futures instead of predicting or assigning probabilities to particular outcomes.

The primary answer to research question 2 is that urban planning can adopt from the episteme and practices of futures studies a more transparent and clear distinction between what is assumed to be probable, possible or desirable in the future.

Various authors suggest that urban plans are developed based on a narrow range of demographic, traffic, and economic forecasts and scenarios. These scenarios rely on the technical modelling of data reflecting past developments (Chakraborty et al., 2011). In other words, the dominant frame in urban planning is predictive, emphasising what kind of future is probable based on past trends. However, the operational environments of planning have become increasingly open and complex over the past half-century (e.g. Ratcliffe & Krawczyk 2011), reducing the reliability of historical trends and the predictions relying on them. This is relevant because using a future frame that doesn't match a chosen case's context can lead to misleading assumptions and plans (Minkkinen et al 2019;).

Urban planning can learn from futures studies on how to operate in uncertain contexts by approaching the future through 'scenaric' and 'visionary' frames. Both of these frames address the unpredictability of the context by mapping a wide number of alternative futures.

Scenarios are the most widely used and the best known methodological approach of futures studies. Model-based, quantitative scenario studies are frequently utilised in planning, and especially in topics related to various urban sub-systems (water, transport, ecosystems etc). Paradigms, such as decision-making under deep uncertainty have created specific tools and techniques to deploy model-based scenarios supporting planning in these contexts (Marchau et al 2019a). In strategic spatial planning, narrative scenarios are used in synthesising an understanding on the key external drivers that challenges existing planning solutions (Fernández Güell 2009). Participatory scenario planning has used future scenarios as a tool for communicative and advocacy planning, providing marginalised groups with better access to discourses on the long-term goals of planning (Chakraborty 2011).

Additionally, the use of different types of visioning exercises has gained momentum in planning. These exercises have often been used with the intent of

increasing community participation (McPhearson et al 2016) and to build greater strategic alignment in implementing long-term goals.

The two case studies on strategic spatial planning processes provide ingredients for deeper analyses on how futures studies approaches help in defining and deploying a suitable frame on the future in the context of urban planning.

The case study on the Greater Helsinki Vision 2050 process elaborates how collective imagining and scenario exercises support urban planning in influencing topics and developments that have previously been largely out of its reach. This allows the field of planning to move towards 'visionary' and 'transformative' frames. The vision process brought together a group of planning professionals from the municipalities of the Helsinki region to discuss themes that went significantly beyond the usual scope of planning and into an exceptionally long future horizon. In retrospect, the visioning and scenario process has resulted in several new collaboration processes that both define long-term targets on issues such as housing and transport, but also aid coordination between municipalities.

Over the past decades, goals on sustainable development and decarbonization have reintroduced a transformative frame on the future in urban planning. The case study on the decarbonization planning process in Greater Manchester develops a framework of synergistic scenario planning. This framework can be utilised as a tool to support urban planning in focusing on long-term, society-wide transformation. In Greater Manchester, as in various other regions and cities, alternative pathways to carbon neutrality have been created. These pathways deploy so-called functional scenario-planning in which decarbonization is seen as a partially bounded problem of innovation and markets. In that context, the backcasting scenario approach has been applied linearly, focusing on what kinds of material solutions (technology, infrastructure, vehicles) are needed when moving from a business-as-usual trajectory towards carbon targets.

In this case, the functional scenario approach to decarbonization is being contrasted with synergistic scenario planning. Synergistic scenario planning considers decarbonization through a broader spectrum of socio-political implications. A systemwide transformation happens in an evolutionary manner, as it is contingent on actions by and collaboration between a wider scale of actors.

This exemplifies the emergent characteristics of a 'transformative frame' on the future: It is not possible to create precise representations of the future under highly uncertain conditions. Still, conversations on long-term transformative goals between diverse stakeholders can make current values and assumptions explicit. This can

enable the emergence of new possibilities and narratives as a result of the collective learning and co-production of stakeholders.

7.2 How do backcasting scenarios systematically and co-creatively define alternative pathways to carbon neutral cities and societies? (RQ3)

The case studies of this thesis provide evidence on how the backcasting scenario approach holistically brings together ideas on society-wide transformation, the emergence of novel human practices and changes in stakeholder agency. At the same time, building such scenarios helps in accommodating and adjusting diverse views solutions in planning processes supporting decarbonization. By doing so, backcasting scenarios link present-day emerging social and technological innovations to form larger potential pathways towards carbon neutrality. Imagining and defining alternatives (instead of merely presenting one plan or vision) is necessary in historical contexts where undesirable business-as-usual pathways necessitate transformative development.

The case study in the SPREAD 2050 sustainable lifestyles project demonstrates a way to connect promising niche practices to wider future stages of the decarbonization process. A sample of emerging lifestyle patterns and social innovations were first identified as practised by various groups across Europe. The co-created scenarios take these practices and demonstrate how their co-evolution with spatial structures, technologies and institutions could potentially enable mainstreaming "bits of lifestyles" that enable future carbon-neutral societies. By doing so, the backcasting process aimed to improve the external validity of the futures research process by connecting images of the future with a large number of future-relevant present-day phenomena and trends (cf. Kuusi et al 2015).

One critical aspect of backcasting scenarios is the definition of a 'vision', 'goal' or framework of acceptable futures that set the scenario's end-point. In the case of backcasting scenarios on sustainable lifestyles, a scenario goal was defined through an iterative process of literature review and interviews. The first iteration was built around previously defined, global boundary conditions such as planetary boundaries (Rockström et al 2009) or UNDP human development indices (Hughes et al 2011). Then, they were operationalised to the eight-tonne material footprint of annual lifestyle-related consumption.

The presented scenarios also demonstrate that a low-carbon society with sustainable lifestyles can be attained under several societal models, each of which would still allow for a great diversity of lifestyles. In other words, despite the normative goal of backcasting scenarios, it does not imply that there would be no alternatives or one uniform model for future sustainable lifestyles. The four scenarios of the project don't exhaust all such possible futures. The number of potential transformation pathways to sustainable societies, sustainable lifestyles and everyday practices is of course much larger than the scope of the project. However, constructing these four coherent and logical scenarios, each depicting an alternative societal model and governance structure provides solid proof of the diversity of societal models and sustainable lifestyles capable of operating within planetary boundaries.

The SPREAD 2050 scenarios case exemplifies action-oriented backcasting (Wangel 2011a) that focuses on human agency, governance and social structures. It intends to respond to the question 'who could make the change happen', and advance it towards 'emancipatory backcasting'. Consequently, the communicational quality of scenarios and their focus on lifestyles brings attention to empowering key actors to build their role in decarbonization.

The example on the backcasting approach from the Greater Helsinki Vision 2050 case provides complementary evidence on emancipatory backcasting. In the case described, 250 future ideas from an ideas competition were evaluated with the help of a backcasting approach by workshop participants consisting mainly of land-use planning experts. The workshop participants were asked to reflect on how the ideas depicting desirable future practices and spatial structures could provide elements for solutions to different societal challenges - one of the key challenges being the transition to a low-carbon society. They were then asked to place these potential solutions on future timelines forming transition trajectories.

Overall, the case studies of this thesis approach the question of decarbonization of cities and societies as a systemic and complex transition process that cannot be achieved by focusing merely on technical, sector-specific solutions that provide emission reductions. Instead, the context of decarbonization is characterised by deep uncertainty (cf. Malekpour 2019; Marchau 2019a). Therefore, a scenario approach that can expand the scope of potential solutions advancing the transition is needed. Target-oriented or functional backcasting scenarios simplify the complexity of a transition process to linear, bounded solutions. Therefore, their capacity to catalyze new solutions and agency is limited. Backcasting scenarios that focus on human agency, collaboration, and divergent perceptions across different levels and sectors

of society, serve that purpose better. This also justifies the relevance of backcasting scenarios that depict future sustainable lifestyles in the context of land-use planning.

7.3 How are domains, processes, content and objectives of planning being re-conceptualised due to the imperative of carbon neutrality? (RQ4)

Time-bound carbon neutrality targets, adopted by hundreds of cities and regions all over the world, have initiated new policy initiatives and introduced new principles and conditions to planning. These targets define future objectives regarding many aspects other than technologies and practices responsible for direct GHG emissions. They also give rise to numerous new planning processes and constellations of stakeholders. Carbon neutrality targets will additionally create demand for inventing processes that can shape new content, such as everyday practices related to material consumption.

The case study on the Greater Manchester (GM) decarbonization process approaches carbon neutrality targets as 'boundary objects' that gather together multiple actors with differing worldviews and ways of perceiving and interpreting the challenge. However, the shortcomings and setbacks in implementing GM climate policies indicate that a carbon neutrality target alone is a rather weak boundary object, vulnerable to the changing realities of non-territorial political contexts and institutional tensions between different sectors of planning.

The analysis of the GM case suggests that carbon neutrality goals should be linked to a multitude of present-day actions advancing decarbonization. The key is to connect multiple initiatives from different sectors and various stakeholders. These act as interconnected boundary objects, to form a 'cognitive chain' between the carbon target and tangible issues that different stakeholders experience from their own perspective.

A chain of boundary objects, connecting present-day actions with a long-term view, have the capacity to build and expand a 'trading zone' around carbon-neutral transitions, thus shaping the domain of urban planning. Different stakeholders participate in a trading zone from the perspective of their own priorities and sectoral views on the decarbonization process. Therefore, it is not realistic to assume that all stakeholders would eventually agree on all things. The success of a trading zone is conditional on its capacity for co-learning and co-producing. This allows stakeholders to frame decarbonization differently: from fixing linear and functional

problem-solving to collaborating on system transformation, and from a sector-specific approach to 'collective carbon intelligence'. As a result, the focus of the carbon discourse would shift from known barriers and existing conflicts towards imaginaries, emerging narratives and synergistic, mutually beneficial solutions between different sectors and actors.

The case on Greater Helsinki Metropolitan Vision 2050 process provides complementary evidence on the similar expansion of a trading zone and hence in the domains, processes and contents of urban planning. The vision process, gathering experts from different organizations and deploying various futures exercises, acted as an event of collective learning in which participants expanded their views and scope of new solutions, transcending functional, sector-specific views and priorities defined by their position. The vision process led to the formation of new networks operating around the agenda defined by the 2050 vision and its exceptionally long time horizon. Eventually, new forms of collaboration between municipalities of the Helsinki region on several strategic goals on land-use and housing were institutionalised.

On a conceptual level, the initial vision process can form a 'visionary field' that later transforms into 'action arenas'. This can also exemplify how a trading zone transforms and re-organises itself around different boundary objects.

Previous paragraphs have provided arguments on the change of objectives, domains and processes of urban planning. The following paragraphs will focus on how the content of urban planning is changing as a result of carbon neutrality targets.

Until now, cities have defined their carbon neutrality targets in terms of territorial (Scope 1 and 2) emissions. At the same time, both research and organizations like the Carbon Neutral Cities Alliance (CNCA 2015) suggest that cities should define their targets through consumption-based emissions. That would provide a more adequate representation of the current structures and division of labour of the global economy in which many (Western) cities are dependent on goods and services produced in the periphery or in developing countries. This changes the problem definition, making the challenge of carbon neutrality more complex and in the case of wealthy cities of the global North, greater in quantitative terms. This would also mean that attempts to advance decarbonization through urban planning should eventually shift their focus to new content domains, primarily on the evolution of lifestyle practices.

The backcasting scenarios of the case on SPREAD Sustainable Lifestyles 2050 connect the evolution of various lifestyle practices and behavioural patterns with different urban and spatial forms of future societies. The scenarios, testing

assumptions on key societal uncertainties (such as technological development, or the future of work), demonstrate that decarbonization can happen through various alternative pathways. Distinct pathways, and the social models they exemplify, have specific co-evolution processes between urban infrastructure, lifestyle practices and landscape-level technological and economic changes. For instance, a society organised around digital sharing, abundance, and peer groups might evolve towards very different urban structures than a society oriented around the scarcity of resources, localism and strict professional roles. In other words, the domains, content and objectives of urban planning would be partly different in each of those alternative futures.

Earlier research on urban planning and its capacity to support climate mitigation has indicated that there is no unanimous proof that any single urban form or other spatial solution would result in significant reductions in our consumption-based carbon footprint. Overall, steering consumption-based emissions turns out to be challenging because in a growing economy, efficient solutions saving both money and emissions lead are replaced by other forms of consumption that eventually accumulate into greater levels of emissions. (Hagen 2016; Jones et al 2017; Ottelin et al 2018; Heinonen & Jóhannesson 2019.)

Based on those findings it is reasonable to suggest that strategic level urban planning policies should not focus solely on a single punctuated emissions source or a blueprint solution on spatial forms. Instead, they should have a broader focus on social and economic practices in which the emissions sources are embedded. This would mean that the storyline beyond 'carbon neutral' that urban policies should adopt would be 'Transition Type A', entailing changes in governance structures and in the agency of different stakeholders instead of Transition type E, which sees the transition as a process of switching direct sources of emissions (c.f. Luque-Ayala et al 2018).

7.4 How can backcasting scenarios re-focus urban and regional planning in regard to implementation of normative goals on carbon neutrality? (RQ1, the main research question)

The need for re-focusing urban and regional planning stems from several characteristics of carbon neutrality targets. These goals (1) extend the time-horizon of planning and provide a quantitatively defined, normative framework for it, (2) create a demand for approaching the future through a transformative frame, thus

augmenting the traditional mindset of urban planning, and (3) require transcending the sector-specific and functional way of managing decarbonization processes and instead perceiving them as a system-wide transformation.

In this thesis, backcasting scenarios are presented as an approach that supports imagining and preparing transformative solutions in a context in which a need for major change is high and legacy solutions are incapable of achieving feasible results. Furthermore, the case studies of this thesis focus on explaining how backcasting results in higher-order, strategic and collective learning that can generate agency, change problem framings and enable new forms of collaboration and co-production. Additionally, the role of un-learning as an outcome of backcasting is highlighted, referring to an idea that different actors can see the future as dependent on choices made in the present day, instead of as something determined by external forces. As an outcome of this, stakeholders are more apt to experiment with new issues and in new coalitions, as cases on both Greater Helsinki 2050 and Greater Manchester indicate.

These learning- and collaboration-related characteristics of backcasting help in strengthening the transformative frame on the future in urban planning.

A carbon neutrality target itself provides a boundary object that enables different stakeholders to focus around a long time horizon. However, sectorally focused, functional scenarios on decarbonization are incapable of linking the target with actions that stakeholders could implement at present and in the near future. Backcasting scenarios help in building a 'cognitive chain of boundary objects', consisting of various decisions, events and innovations that stakeholders could advance and collaborate on. This addresses the need to make the new time horizon relevant and meaningful.

Scenarios on sustainable lifestyles demonstrate how backcasting helps in interpreting decarbonization as a system-wide transformation. The four scenarios represent alternative future societal landscapes, radically differing from each other, yet all resulting in a low carbon society with personal lifestyles within sustainable limits. Thus, they also demonstrate alternative processes of co-evolution between lifestyle patterns, built infrastructure and macro structures of the economy, politics and technology.

This kind of backcasting provides a rich, multilayered view on emergent solutions for a carbon-neutral society, and can be contrasted with target-oriented scenarios on decarbonization that are constructed around functional solutions for emissions reductions. These so-called agency-oriented and emancipatory backcasting scenarios aid in understanding wider transition trajectories in social practices and

infrastructures on which emissions and their radical reduction potentials are eventually embedded.

The results from the Greater Manchester case form a largely aligned suggestion for a synergistic scenario planning approach. It aims to expand and diversify the trading zone around carbon neutrality targets. Backcasting scenarios can serve in bringing together a diversity of perspectives on decarbonization and help in creating new synergies between different sector goals prioritised by different stakeholders.

For urban planning, these scenarios expand the view on decarbonization and help in discovering a more detailed and wider scope of solutions than what planning has provided, for instance through traditional density, public transit and walkability-related frameworks on climate mitigation. This is bound to become increasingly important as the decarbonization of primary energy production and urban mobility move forward and the priorities in emission reductions move to other domains of consumption and urban lifestyles.

To conclude, action-oriented, emancipatory and synergistic backcasting scenarios help in understanding and creating collective learning on what the process towards carbon neutrality is as a society-wide transition. It enables us to move from looking at emissions sources to deeper societal solutions and re-focusing planning on matters and issues that people can truly see as defining what desirable futures are like.

8 ACADEMIC CONTRIBUTIONS OF THIS RESEARCH

Following the structure of the research framework of this thesis, the academic contributions of the research belong mainly to the theory of urban planning and the theory of alternative futures and futures studies. Hence, the contributions of each article are categorised under these two disciplines.

Furthermore, the thesis as a whole should have practical relevance (following its external aim) to the transition to a carbon-neutral society, i.e. provide understanding and tools that can accelerate such transitions in cities. Therefore, the overall contributions of the thesis are divided into the two theoretical perspectives and the practical relevance regarding carbon-neutral transitions of cities.

Article 1: "Planning Meets Futures Studies. Systemic societal change and the possibility of transformational planning"

Contribution of the article to planning theory:

- The article provides the most comprehensive review so far of academic literature regarding the relationship between spatial planning and futures studies.
- The review indicates that there is no systematic discipline on how to combine the two fields, despite repeated pleas for this by several authors in numerous articles.
- Futures studies has been deployed within spatial planning mainly as a tool in strategic planning, with a strong communicative approach.
- Over the past decade, there has been a surge in planning processes that use a backcasting approach as a tool for preparing transitions to a carbon-neutral, sustainable city.
- The article suggests a new paradigm of transformational planning that combines both updates in processes and substantive goals of planning, learning and borrowing from futures studies, its episteme and methods.

Contribution of the article to futures studies:

- The article maps the (historical) role of futures studies within the domain of urban planning.

- It gathers evidence on how the backcasting scenario approach has seen increased use in the context of cities and urban planning over the past decade.

- Results of the article can help in arguing for the importance of futures studies in planning practice and education, eventually improving the societal relevance of the discipline.

Article 2: "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach"

Contribution of the article to planning theory:

- The article introduces the 8000 kg average material footprint as a norm for future lifestyles in low-carbon societies. This can be a relevant proxy value for the desired impacts of planning aiming at carbon neutrality.

- There are different societal models and spatial designs for low-carbon societies. The article portrays four possible alternatives as potential substantive end-states in planning. These scenarios operationalise the 8000 kg target of sustainable lifestyles to different sectors and fields, including planning.

- The co-evolution of spatial structures, technologies, institutions and lifestyle patterns is critical for planning toward carbon-neutrality. Planning should pay more attention to transitions in technologies and the niche practices they give rise to.

Contribution of the article to futures research:

- The article provides an example of how the backcasting scenario approach is a relevant tool for exploring alternative futures on the level of lifestyles and social practices.

- The article demonstrates how contemporary promising practices can be used as ingredients for scenarios and made relevant to the future.

- The article also explains how boundary conditions for the normative goal of backcasting scenarios can be formed through an iterative process.

- The results of the article suggest that a backcasting approach can be used in emancipating, mobilizing and motivating various actors, including individuals, towards transformative goals of society and planning.

Article 3: "Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures"

Contribution of the article to planning theory:

- The article provides a paradigmatic case on how a process aimed at forming a long-term vision happens in the context of a city region.
- The article describes how a vision process and extended time horizons serve as tools for bringing previously unmanageable metropolitan spaces within the scope of the manageable.
- Incrementalism with perspective, a planning approach used in complex contexts undergoing remarkable transformations, is being applied in the governance of metropolitan regions.
- The backcasting scenario approach, used as a tool for analysing different types of emerging solutions and policies, as well as an interaction tool supporting the vision process, is suggested as a way of building a visionary field that brings about strategic and higher-order learning among stakeholders. Eventually, this is perceived to lead to network formation around the topics of the vision.

Contribution of the article to futures research:

- A process on how visions and backcasting can extend the strategic horizon and domain of available solutions is being elaborated.
- The use of the backcasting approach as an analysis tool in a foresight process is being depicted and explained.

Article 4: "The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions"

Contribution of the article to planning theory:

- The article provides an exemplary case of a metropolitan region planning and policy process aiming at carbon neutrality targets.
- The article introduces the concept of the 'new normative' as a tool for depicting this ongoing shift in planning (to planning guided by carbon neutrality targets) and suggests that the current communicative paradigm of planning theory has to be updated to match the era of the new normative.
- The article explains how the backcasting scenarios approach is being integrated into synergistic thinking (Ravetz 2015, Ravetz 2020). It devises how synergistic scenario planning can be integrated into regional planning and help in adjusting

current planning practices to the emerging context defined by long-term carbon neutrality targets.

- It also links widely discussed concepts, such as trading zones and boundary objects to discussions on carbon neutrality targets and the role of scenarios in planning.

Contribution of the article to futures research:

- The article contextualises the use of scenarios in the wider process around planning and stakeholder alignment. By doing so it also intends to identify potential outcomes and contributions that scenarios, visions, trend analysis and other futures research tools can bring about when advancing system-level transformation.

- The article suggests that those outcomes appear in the form of new collaborations, collaborative capabilities and (co-)learning.

- In addition, the article discusses how narrativity of scenarios - the function that often makes them a unique sense-making tool when explaining distant events - can be combined with functional scenarios used more commonly in planning aimed at carbon emission reductions

The overall contributions of the thesis

The study suggests that a backcasting scenario approach can help urban planning in gaining its position in the decarbonization of cities; a challenge that is bound to characterise the context of urban planning over the coming decades. The thesis and its case studies propose both conceptual and practical tools for using backcasting scenarios as a way of operationalizing carbon neutrality targets in the context of spatial planning. The thesis also provides new understandings on what backcasting scenarios are in the context(s) of decarbonization and in the planning of long-term futures of cities and regions.

This is being presented through paradigmatic and future-oriented cases that help in making conceptualizations on how backcasting scenarios can be used in urban planning, especially as part of processes of strategic spatial planning. The study also explains how backcasting scenarios, when embedded in urban planning, can help in identifying structures and social practices through which long-term emissions levels can be affected, instead of focusing more narrowly on current sources of emissions. Furthermore, the thesis elaborates on how backcasting supports higher-order, strategic and collective learning in urban planning, eventually altering the prevailing mindset through which the future is framed and initiating new forms of collaboration

among stakeholders. These kinds of novel processes are essential once carbon neutrality is understood as a society-wide transformation.

The most important contributions the thesis makes to futures studies relate to the positioning of the backcasting scenario approach within the field. This happens in two ways:

- The cases explain how carbon neutrality targets define the new normative framework for planning the future (as done in the case study on Greater Manchester), and how we can define (in an iterative, tentative manner) material or carbon footprints of the future sustainable lifestyles (as done in the case study on SPREAD 2050 project scenarios). These new boundary conditions will increasingly characterise the images of the (long-term) future presented in the public discourse, and subsequently, change the anticipations people have about the future.

- The study elaborates on how we should understand normative goals that define (desirable) images of the future of backcasting scenarios. A normative goal, such as a carbon neutrality target of a city, does not mean that all scenarios reaching that goal would converge into one similar future. Instead, a goal should be interpreted as a domain of acceptable futures, consisting of a wide set of alternative futures, each of which meets different criteria of desirability to different degrees. Therefore, backcasting scenarios can and should depict a plurality of different societal solutions despite the same normative goal. In the case of sustainable lifestyles, for instance, scenarios should suggest various types of lifestyles that can flourish in a sustainable, carbon-neutral society.

The articles of the thesis provide paradigmatic cases on the use of backcasting scenarios in thematic domains that have not been properly described in the previous literature. The case on SPREAD 2050 scenarios provides an example of how backcasting scenarios define alternative forms of co-evolution of lifestyles and societal structures in a process towards carbon neutrality. The case on the Greater Helsinki Vision 2050 process analyses how backcasting scenarios support and advance strategic learning in a strategic spatial planning process in a mid-sized European metropolitan region. The case on the Greater Manchester climate policy development provides another example on how low-carbon and carbon neutrality targets shape regional planning and what the role is of different types of scenarios in such a process.

Regarding the practical work of managing transitions toward carbon neutrality in cities, the main relevance of this thesis arises from explanations on why backcasting scenarios are an indispensable tool and how their benefits appear. While decarbonization in cities advances further into the future and various policy interventions have managed to close and limit the biggest individual sources of

emissions (fossil fuels in primary energy production, energy efficiency of buildings and vehicles), the emphasis will shift to expanding agency of new groups of stakeholders that can bring about new emissions reductions through assuming new habits and practices. Backcasting scenarios can help in identifying those new actors and their transformative potential, as well as serve in emancipating those actors to action.

Furthermore, recurring to the title of the thesis, Re-focusing on the future, the thesis has demonstrated that the horizon in the planning of cities is changing. Planning is always about shaping the future and starts with the intention of making a better future. Yet, in the context defined by targets on decarbonization, we interpret the desirability and acceptability of the future through new conditions and principles. This means that planning has to take the future more seriously and place a new emphasis on imagining transformative futures that meet those criteria and therefore can help us plan ambitious steps through the carbon neutrality transition.

REFERENCES

Ache, P. 2011. "'Creating futures that would otherwise not be' – Reflections on the Greater Helsinki Vision process and the making of metropolitan regions", Progress in Planning 75 (4), 155-192. https://doi.org/10.1016/j.progress.2011.05.002.

Adams, G., Angheloiu, C., Armstrong, L. 2016. D5.3 Detailed Future Scenario report. Forum for the Future and EUInnovate project. Retrivied from https://www.forumforthefuture.org/Handlers/Download.ashx?IDMF=ae302475-d1a7-441d-9c8f-b61c2d33922e on Dec 17th 2020.

Ahlroth S. & Höjer M. 2007. "Sustainable Energy Prices and Growth", Ecological Economics 63(4), 722-731. https://doi.org/10.1016/j.ecolecon.2007.05.002.

Albrechts L., & Van den Broeck, J., 2004. "From discourses to acts: the case of the ROM-project in Ghent, Belgium", Town Planning Review 75 (2), 127–150.

Albrechts, L. 2015. "Ingredients for a more radical strategic spatial planning", Environment and Planning B: Planning and Design 42, 510–525. https://doi.org/10.1068/b130104p.

Allmendinger, P., 2009. Planning Theory. 2nd edition (first published 2002). Palgrave Macmillan.

Amara, R. 1981. "The Futures Field. Searching for Definitions and Boundaries". The Futures XV, 25-29.

Andersson, J. 2012. "The Great Future Debate and the Struggle for the World", The American Historical Review 117(5). 1411-1430. https://doi.org/10.1093/ahr/117.5.1411.

Andersson, J. 2018. The Future of the World. Futurology, Futurists, and the Struggle for the Post Cold War Imagination. Oxford University Press.

Angheloiu, C., Chaudhurib, G., Sheldrick, L. 2017. "Future Tense: Alternative Futures as a Design Method for Sustainability Transitions", Design for Next 12th EAD Conference. doi: https://doi.org/10.1080/14606925.2017.1352827 .

Avin, U.P. & Dembner, J.L., 2001. "Getting scenario building right", Planning, November 2001, 22-27.

Balducci, A. & Mäntysalo, R. 2015. "Introduction" in Balducci, A. & Mäntysalo, R. (Eds.) Urban Planning as a Trading Zone. Springer, 1-6.

Balducci, A. & Mäntysalo, R. (Eds.) 2015. Urban Planning as a Trading Zone. Springer.

Balducci, A. 2013. ""Trading Zone": A Useful Concept for Some Planning Dilemmas" . in Balducci, A & Mäntysalo, R. (Eds.) Urban Planning as a Trading Zone, Springer, 23-36.

Bansard, J. S., Pattberg, P., & Widerberg, O. 2017. "Cities to the rescue? Assessing the performance of transnational municipal networks in global climate governance", International Environmental Agreements, 17(2), 229–246. https://doi.org/10.1007/s10784-016-9318-9.

Batty, M., & Marshall, S., 2009. "The evolution of cities: Geddes, Abercrombie and the new physicalism", Town Planning Review, 80(6) 2009. https://doi.org/10.3828/tpr.2009.12.

Bell, W. 1997. Foundations of Futures Studis – Human Science for a New Era. Volume 1. Transaction Publishers.

Benkler, Y. 2006. The Wealth of Networks: How Social Production Transforms Markets and Freedom. Yale University Press.

Börjeson, L., Höjer, M., Dreborg, K.-H., Ekvall, T., & Finnveden, G. 2006. "Scenario types and techniques: Towards a user's guide", Futures, 38(7), 723–739. https://doi.org/10.1016/j.futures.2005.12.002.

Bulkeley, H., Castán Broto, V., Maassen, A. 2011. Goveringing urban low carbon transitions. In Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds.). Cities and low carbon transitions. Routledge, 29-41.

Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds.). 2011. Cities and low carbon transitions. Routledge.

C40, 2019. Defining Carbon Neutrality for Cities & Managing Residual Emissions—Cities' Perspective. Retrieved from https://www.c40knowledgehub.org/s/article/Defining-carbon-neutrality-for-cities-and-managing-residual-emissions-Cities-perspective-and-guidance?language=en_US on Dec 17th 2020.

Campbell, S. 2012. "Green Cities, Growing Cities, Just Cities?" in Campbell, Scott and Fainstein, Susan S. (eds.) Readings in Planning Theory. 3rd edition. Wiley, 413-438.

Campbell, S. & Fainstein, S. (Eds.). 2012. Readings in Planning Theory. 3rd edition, Wiley.

Carbon Neutral Cities Alliance 2020.Retrieved from https://carbonneutralcities.org/about/ on Dec 17th 2020.

Chakrobarty, A. 2011. "Enhancing the role of participatory scenario planning processes: Lessons from Reality Check exercises". Futures 43, 387–399. https://doi.org/10.1016/j.futures.2011.01.004.

Chakrobarty, A. & McMillan, A. 2015. "Scenario Planning for Urban Planners", Journal of the American Planning Association 81(1), 18-29. https://doi.org/10.1080/01944363.2015.1038576.

City of Helsinki, 2015. Helsinki's Climate Roadmap. Retrieved from https://issuu.com/helsinginymparistokeskus/docs/helsinki_climate_roadmap_20150427 on Dec 17th 2020.

City of Helsinki, 2019. Carbon neutral Helsinki 2035. Summary. Retrieved from https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/esitteet/HNH2035_en_summary_14022019.pdf on Dec 17th 2020.

CNCA 2015 Carbon Neutral Cities Alliance, Framework for Long-Term Deep Carbon Reduction Planning. Retrieved from https://carbonneutralcities.org/wp-content/uploads/2018/04/CNCA-Framework-for-Long-Term-Deep-Carbon-Reduction-Planning.pdf on Dec 17th 2020.

Cooper, A. 1999. The Inmates are Running the Asylum. Macmillan Publishing

Crane, R. & Landis, J., 2010. "Introduction to the Special Issue: Planning for Climate Change: Assessing Progress and Challenges", Journal of the American Planning Association 76(4), 389-401. https://doi.org/10.1080/01944363.2010.512036.

Dalton, L.C., 2001. "Thinking about tomorrow: Bringing the future to the forefront of planning", Journal of the American Planning Association 67(4), 397-401. https://doi.org/10.1080/01944360108976248.

Dixon, T., Montgomery, J-. Horton-Baker, N., Farrelly, L., 2018. "Using urban foresight techniques in city visioning: Lessons from the Reading 2050 vision", Local economy 33(8), 777–799. https://doi.org/10.1177/0269094218800677.

Dreborg, K. H. 1996. "Essence Of Backcasting", Futures 28(9), 813-828. https://doi.org/10.1016/S0016-3287(96)00044-4.

Druckman, A. & Jackson, T., 2016, "Understanding Households as Drivers of Carbon Emissions", in Clift, R. & Druckman, A. (Eds.) Taking Stock of Industrial Ecology. Springer. 181-203.

Dubois, A. & Gadde, L-E. 2002. "Systematic combining: an abductive approach to case research", Journal of Business Research 55(7), 553 – 560. https://doi.org/10.1016/S0148-2963(00)00195-8.

Dufva, M. 2015. Knowledge creation in foresight: A practice- and systems-oriented view. VTT Technical Research Centre of Finland.

European Commission, 2020. 100 climate neutral cities by 2030 by and for the citizens. Retrieved from https://ec.europa.eu/info/publications/100-climate-neutral-cities-2030-and-citizens_en on Dec 17th 2020.

Elioth, Egis Conseil, Quattrolibri, Mana. 2017. Paris, an air of change. Towards Carbon Neutrality in 2050. Mairie de Paris. Retrieved from http://paris2050.elioth.com/pdf/170615%20-%20Paris%20Carbone%20Neutral%20-%20report_LD.pdf on Dec 17th 2020.

Erickson, P. & Tempest, K., 2014. "Advancing climate ambition: How city-scale actions can contribute to global climate goals", Stockholm Environment Institute, Working paper 2014-06. Retrieved from

https://mediamanager.sei.org/documents/Publications/Climate/SEI-WP-2014-06-C40-Cities-mitigation.pdf on Dec 17th 2020.

Fainstein, S.S. 1998. "New Direction in Planning Theory", in Campbell, Scott and

Fainstein, Susan S. (eds.) Readings in Planning Theory. 2nd edition. Wiley. 173-195

Fainstein, S., & Campbell, S. 2012. "Introduction: The structure and debates of planning theory", in Campbell, S. and Fainstein, S. (eds.) Readings in Planning Theory. 3nd edition. Wiley.

Faludi, A. 1970. A reader in planning theory. Pergamon Press.

Faludi, A. 1973. Planning Theory. Pergamon Press, Oxford.

Fernández Güell, J.M. & González López, J. 2016. Cities futures. A critical assessment of how future studies are applied to cities. Foresight 18(5), 454-468. https://doi.org/10.1108/FS-06-2015-0032.

Flyvjberg, B. 2006. "Five Misunderstandings About Case-Study Research", Qualitative Inquiry 12(2), 219-245. https://doi.org/10.1177/1077800405284363.

Frantzeskaki, N. & Loorbach, D. 2010. "Towards governing infrasystem transitions Reinforcing lock-in or facilitating change?" Technological Forecasting & Social Change 77(8), 1292–1301. https://doi.org/10.1016/j.techfore.2010.05.004.

Freestone, R. 2012. "Futures Thinking in Planning Education and Research", Journal for Education in the Built Environment, 7(1), 8-38, https://doi.org/10.11120/jebe.2012.07010008.

Friedmann, J. 1993. "Toward a Non-Euclidian Mode of Planning", Journal of the American Planning Association 59 (4), 482-485. https://doi.org/10.1080/01944369308975902.

Fuller, T. and Loogma, K. 2009. "Constructing futures: A social constructionist perspective on foresight methodology", Futures 41(2), 71–79. https://doi.org/10.1016/j.futures.2008.07.039.

Galison, P. 1997. Image and logic: A material culture of microphysics. University of Chicago Press.

Gedikli, B. 2018. "Approaches to climate change in spatial planning and design: International and Turskish experiences", METU Journal of the Faculty of Architecture 35(1), 89-109. http://dx.doi.org/10.4305/metu.jfa.2018.1.9.

Geels, F. W. 2002. "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", Research Policy 31(8-9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8.

Geels, F. W. 2004. "From sectoral systems of innovation to socio-technical systems Insights about dynamics and change from sociology and institutional theory", Research Policy 33(6-7), 897–920. https://doi.org/10.1016/j.respol.2004.01.015.

Geels, F.W., 2010. "Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective", Research Policy 39(4), 495–510. https://doi.org/10.1016/j.respol.2010.01.022.

Geels, F, W. 2011. "The Role of Cities in Technological Transitions: Analytical Clarifications and Historical Examples", in Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. Cities and Low Carbon Transitions. Routledge. 13-28.

Geertz, C. 1973. Thick description: Toward an interpretive theory of culture. The interpretation of cultures: Selected essays. Basic Books.

Giddens, A. 1983. The Constitution of Society: Outline of the Theory of Structuration. Polity Press.

Greater Helsinki vision 2050 – International ideas competition, jury protocol. 2007. SAFA. Retrieved from https://www.safa.fi/wp-content/uploads/2019/12/ghv_www_protocol_english.pdf on Dec 17th 2020.

Greenhouse Gas Protocol, 2016. FAQ | Greenhouse Gas Protocol. Retrieved from www.ghgprotocol.org on Dec 17th 2020.

Hagen, B., 2016. "The Role of Planning in Minimizing the Negative Impacts of Global Climate Change", Urban Planning 1(3), 13–24. http://dx.doi.org/10.17645/up.v1i3.671.

Hall, P. 2000. Megacities, World Cities and Global Cities. Stichting Megacities.

Hall, P. 2002. Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century. 3rd edition (originally published in 1988). Wiley.

Harvey D, 1998. "Cities or urbanization?", City 1(1-2), 38-61. https://doi.org/10.1080/13604819608900022.

Healey, P. & Hillier, J., 2008. Foundations of the Planning Enterprise. Critical Essays in Planning Theory: Volume 1. Routledge.

Heinonen, J. & Jóhannesson, S. E. 2019. "More Consumption, Less Production: The Low-Carbon Illusion of Cities" in Boucher, J.L. and Heinonen, J. (Eds.) Sustainable Consumption, Promise or Myth?, Cambridge Scholars Publishing.

Hodson, M. & Marvin, S. 2011. "Can Cities Shape Socio-Technical Transitions and How Would We Know If They Were?" in Bulkeley,H., Castán Broto, V., Hodson, M. and Marvin, S. Cities and Low Carbon Transitions. Routledge. 54-70.

Höjer, M. 2000. What is the Point of IT? Backcasting Urban Transport and Land-use Futures. Department of Infrastructure and Planning, Royal Institute of Technology, Stockholm.

Höjer, M. & Mattsson, L.-G. 2000. "Determinism and backcasting in future studies", Futures 32(7), 613–634. https://doi.org/10.1016/S0016-3287(00)00012-4.

Holloway, I. 1997. Basic concepts for qualitative research. Blackwell Science.

Hughes, T. 1987. "The Evolution of large technological systems", in Bijker, W., Hughes, T. and Pinch, T. (Eds.),The Social Construction of Technological Systems. MIT Press, Cambridge, Mass.

Hughes, B., Ifran, M., Moyer, J., Rothman, D., Solórzano, J., 2011.Forecasting the impacts of environmental constraints on human development. Human Development Research Paper 2011/08. Report. Retrieved from http://hdr.undp.org/en/content/forecasting-impacts-environmental-constraints-human-development on Nov 10th 2021.

Hutter, G., 2006. "Strategische planung. ein wiederentdeckter planungsansatz zur bestandsentwicklung von Städten", RaumPlanung 128, 210–214.

IEA, 2008. World Energy Outlook 2008. International Energy Agency. Retrieved from https://www.iea.org/reports/world-energy-outlook-2008 on Dec 17th 2020.

IPCC 2014. AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability. The Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg2/. on Dec 17th 2020.

IPCC, 2018. Special Report Global Warming of 1,5c. Retrieved from https://www.ipcc.ch/sr15/ on Dec 17th 2020.

Isserman, A., 1985. "Dare to plan: an essay on the role of the future in planning practice and education". Town Planning Review 56 (4), 483-491.

Johansson, R. 2003. Case Study Methodology. A key note speech at the International Conference "Methodologies in Housing Research" organised by the Royal Institute of Technology in cooperation with the International Association of People–Environment Studies, Stockholm, 22–24 September 2003. Retrieved from http://www.psyking.net/htmlobj-3839/case_study_methodology-_rolf_johansson_ver_2.pdf on Dec 17th 2020.

Jones, C.M., Wheeler, S.M., Kammen D.M. 2018. "Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities", Urban Planning 3(2), 35–51.http://dx.doi.org/10.17645/up.v3i2.1218.

Junnila, S., Ottelin, J., Leinikka, L., 2018. "Influence of Reduced Ownership on the Environmental Benefits of the Circular Economy", Sustainability 10(11), 4077. https://doi.org/10.3390/su10114077.

Juwet, G. & Ryckewaert, M. 2018. "Energy Transition in the Nebular City: Connecting Transition Thinking, Metabolism Studies, and Urban Design", Sustainability 10(4), 1-14. https://doi.org/10.3390/su10040955..

Kahn, H. & Wiener, A. J. 1967. The Year 2000. A Framework for Speculation on the Next Thirty-Three Years. The MacMillan Company.

Kempenaar, A., Puerari, E., Pleijte, M., van Buuren, M. 2020. "Regional design ateliers on 'energy and space': systemic transition arenas in energy transition processes", European Planning Studies. https://doi.org/10.1080/09654313.2020.1781792.

Kenis, A. & Lievens, M., 2017. "Imagining the carbon neutral city: The (post)politics of time and space", Environment and Planning A 49(8), 1762–1778. https://doi.org/10.1177/0308518X16680617.

Khakee, A., 1985. "Futures-Oriented Municipal Planning", Technological Forecasting and Social Change 28(1), 63-83. https://doi.org/10.1016/0040-1625(85)90073-3.

Kona, A., Bertoldi, P., Monforti-Ferrario, P., Rivas, S., Dallemand, J.F. 2018. "Covenant of mayors signatories leading the way towards 1.5 degree global warming pathway", Sustainable Cities and Society 41, 568-575. https://doi.org/10.1016/j.scs.2018.05.017.

Kuittinen, O., Mokka, R., Neuvonen, A., Orjasniemi, M., Ritola, M., Wikholm, M., 2012. iFuture – The diversity of sustainable lifestyles. SPREAD project Deliverable 7.1. Demos Helsinki. Retrieved from https://www.demoshelsinki.fi/wp-content/uploads/2014/08/SPREAD_D7.3_iFuture.pdf on Dec 17th 2020

Kuusi, O. 1999. Experience in the Future Use of Generic Technologies – Epistemic and Methodological Considering Delphi Studies. VATT-tutkimuksia 59. Valtion taloudellinen tutkimuskeskus.

Kuusi, O., Cuhls, K., Steinmülleri, K. 2015. "Quality Criteria for Scientific Futures Research", European Journal of Futures Research 3. https://doi.org/10.1007/s40309-015-0074-9.

Kuusi, O. 2019. "Kuinka yhdentää tulevaisuuksientutkimusta, kognitiivista psykologiaa ja tekoälyn kehittämistä?", Futura 38(2), 19-38.

Laine, J. Heinonen, J., Junnila, S. 2020. "Pathways to Carbon-Neutral Cities Prior to a National Policy", Sustainability 12(6). https://doi.org/10.3390/su12062445.

Lehtovuori, P. & Maijala, O., 2007. "Strateginen suunnittelu: Hierarkisesta kaavajärjestelmästä kohti kaupunkistrategian ja sitä konkretisoivien hankkeiden vuorovaikutusta" in Ahlava, A.i & Edelman, H. (eds) Urban design management. Opas käytäntöön, DECOMB-tutkimushanke, 38-43.

Lempert, R.J., Popper, S.W., Bankes, S.C. 2003. Shaping the Next One Hundred Years: New Methods for Quantitative, Long-Term Policy Analysis. RAND.

Leppänen, J., Neuvonen, A., Ritola, M., Ahola, I., Hirvonen, S., Hyötyläinen, M., Kaskinen, T., Kauppinen, T., Kuittinen, O., Kärki K., Lettenmeier, M., Mokka, R. 2012. From Local Loops to Global Champions: Scenarios for Sustainable Lifestyles 2050. SPREAD project Deliverable 4.1. Demos Helsinki. Retrieved from https://www.demoshelsinki.fi/julkaisut/from-local-loops-to-global-champions-scenarios-for-sustainable-lifestyles-2050-2/ on Dec 17th 2020

Lettenmeier, M. 2018. A sustainable level of material footprint — Benchmark for designing one-planet lifestyles. Aalto University publication series DOCTORAL DISSERTATIONS, 96/2018.

Lincoln, YS. & Guba, EG. 1985. Naturalistic Inquiry. Sage Publications.

Lindblom, C.E. 1959. The Science of "Muddling Through", in Public Administration Review 19, pp. 79-88.

Little, D. 2017. "Understanding Society. Searle on social ontology". Retrieved from https://understandingsociety.blogspot.com/2011/02/searle-on-social-ontology.html on Dec 17th 2020.

Luque-Ayala, A., Marvin, S., & Bulkeley, H. 2018. Introduction. In Luque-Ayala, A., Marvin, S. & Bulkeley, H. (Eds.), Rethinking urban transitions: Politics in the low carbon city. Routledge, 1–12.

Luque-Ayala, A., Marvin, S. & Bulkeley, H. (Eds.). 2018. Rethinking urban transitions: Politics in the low carbon city. Routledge.

Malekpour, S. 2019. "Models as scenario tools for developing robust transformative plans", in Moallemi, E., de Haan, F.J. (Eds.), Modelling Transitions - Virtues, Vices, Visions of the Future. Routledge.

Malekpour, S., Walker, W., de Haan, F.J., Frantzeskaki, N., Marchau, V. 2020. "Bridging Decision Making under Deep Uncertainty (DMDU) and Transition Management (TM) to improve strategic planning for sustainable development", Environmental Science & Policy 107, 158-167. https://doi.org/10.1016/j.envsci.2020.03.002

Marchau, V., Walker, W., Bloemen, P., Popper, S.W. 2019a. "Introduction" in Decision Making under Deep Uncertainty. From Theory to Practice. Springer. https://doi.org/10.1007/978-3-030-05252-2

Marchau, V., Walker, W., Bloemen, P., Popper, S.W. 2019b. (eds.) Decision Making under Deep Uncertainty. From Theory to Practice. Springer. https://doi.org/10.1007/978-3-030-05252-2

Mäntysalo, R., Balducci, A., Kangasoja, J.K. 2013. "Planning as Agonistic Communication in a Trading Zone: Re-examining Lindblom's Partisan Mutual Adjustment" in Balducci, A & Mäntysalo, R. (Eds.) Urban Planning as a Trading Zone, Springer, 7-22.

Mäntysalo, R., Jarenko, K., Nilsson, K. L., & Saglie, I.-L. 2015. Legitimacy of Informal Strategic Urban Planning—Observations from Finland, Sweden and Norway. European Planning Studies 23(2), 349–366. http://dx.doi.org/10.1080/09654313.2013.861808

Mäntysalo, R., Tuomisaari, J., Granqvist, K., & Kanninen, V. 2019. "The strategic Incrementalism of Lahti master planning: Three lessons", Planning Theory and Practice, 20(4), 555–572. https://doi.org/10.1080/14649357.2019.1652336.

McIntyre 2008 McIntyre, Alice. 2008. Participatory Action Research. Qualitative Research Methods Series 52. Sage Publications.

McPhearson, T., Iwaniec, D.M, Bai, X. 2016. "Positive visions for guiding urban transformations toward sustainable futures", Current Opinion in Environmental Sustainability 22, 33–40. https://doi.org/10.1016/j.cosust.2017.04.004.

Mehaffy, M.W. 2018. "Neighborhood "Choice Architecture": A New Strategy for Lower-Emissions Urban Planning?", Urban Planning 3(2), 113–127. http://dx.doi.org/10.17645/up.v3i2.1296.

Miller, R., 2018. Transforming the future: anticipation in the 21st century. Routledge/Unesco.

Minkkinen, M., Auffermann, B., Ahokas, I 2019. "Six foresight frames: Classifying policy foresight processes in foresight systems according to perceived unpredictability and pursued change", Technological Forecasting & Social Change 149, 119753. doi.org/10.1016/j.techfore.2019.119753

Monstadt, J. 2009. "Conceptualizing the political ecology of urban infrastructures: insights from technology and urban studies", Environment and Planning A 41, 1924-1942.

Moran, D., Kanemoto, K., Jiborn, M., Wood, R., Tobben, J., Seto, K.C. 2018. "Carbon footprints of 13 000 cities", Environ. Res. Lett. 13(6).

Morton, T. 2013. Hyperobjects: Philosophy and Ecology After the End of the World. University of Minnesota Press.

Moses, J. W. & Knutsen, T. L. 2007. Ways of Knowing: Competing Methodologies in Social and Political Research. Palgrave Macmillan.

Myers, D. & Kitsuse, A. 2000. "Constructing the Future in Planning: A Survey of Theories and Tools", Journal of Planning Education and Research 29, 221-31.

Neuvonen, A. & Ache, P. 2017. "Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures" ,Futures 86, 73–83. https://doi.org/10.1016/j.futures.2016.10.003.

Neuvonen, A., Kaskinen, T., Leppänen, J., Lähteenoja, S., Mokka, R. and Ritola, M. 2014. "Low-carbon futures and sustainable lifestyles: A backcasting scenario approach", Futures 58, 66–76. https://doi.org/10.1016/j.futures.2014.01.004.

Newman, P. 2020. "Cool planning: How urban planning can mainstream responses to climate change", Cities 103. https://doi.org/10.1016/j.cities.2020.102651.

Niiniluoto, I.. 1993. "Tulevaisuudentutkimus – tiedettä vai taidetta?", in Vapaavuori, M. (toim.) Miten tutkimme tulevaisuutta?. Tulevaisuuden tutkimuksen seura ry, 13-18.

Niiniluoto, I., 2018. Truth-Seeking by Abduction. Springer.

Nykänen, K. 2020. Flexible precision. Regulatory precision in master planning to advance climate targets. Acta Univ. Oul. H 6.

Oswald, Y., Owen, A., Steinberger, J.K. 2020. "Large inequality in international and intranational energy footprints between income groups and across consumption categories", Nature Energy volume 5, 231–239. https://doi.org/10.1016/j.cities.2020.102651.

Ottelin, J., Heinonen, J. Junnila S. 2018. "Carbon footprint trends of metropolitan residents in Finland: How strong mitigation policies affect different urban zones", Journal of Cleaner Production 170, 1523-1535. https://doi.org/10.1016/j.jclepro.2017.09.204.

Ottelin, J., Ala-Mantila, S. Heinonen, J., Wiedmann, T., Clarke, J., Junnila, S. 2019. "What can we learn from consumption-based carbon footprints at different spatial scales? Review of policy implications", Environ. Res. Lett. 14(9) https://doi.org/10.1088/1748-9326/ab2212.

Plastrik, P., & Cleveland, J. 2019. Life after carbon: The next global transformation of cities.

Prestwood, E., Longhurst, J., Townsend, I., Haines, T., Tsiarapa, E. 2018. "Facilitating stakeholder dialogues on a carbon neutral city: We need to talk about carbon (and air quality)", Air Pollution 230. https://doi.org/10.2495/AIR180461.

Quist, J. & Vergragt, P. 2006. "Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework", Futures 38 (9), 1027–1045. https://doi.org/10.1016/j.futures.2006.02.010.

Ratcliffe, J. & Krawczyk, E., 2011. "Imagineering city futures: The use of prospective through scenarios in urban planning", Futures 43(7), 642–653. https://doi.org/10.1016/j.futures.2011.05.005.

Ravetz, J. 2020. Deeper city; Collective intelligence and the pathways from smart to wise. Routledge.

Ravetz, J., Neuvonen, A., Mäntysalo, R. 2020. "The new normative: synergistic scenario planning for carbon-neutral cities and regions, Regional Studies 55(1), 150-163. https://doi.org/10.1080/00343404.2020.1813881.

Reckien, D., Salvia, M., Heidrich, O., J.M., Church, Pietrapertosa, F., De Gregorio-Hurtado, S., D'Alonzo, V., Foley, A., Simoesi, S.G. Krkoška Lorencová, E., Orru, H., Orrum, K., Wejs, A., Flacke, J., Olazaba, M., Geneletti, D., Feliu, E. Vasilier, S., Dawson, R. 2018. "How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28", Journal of Cleaner Production 191, 207-219. https://doi.org/10.1016/j.jclepro.2018.03.220.

Rescher, N. 1998. Predicting the Future: An Introduction to the Theory of Forecasting. State University of New York Press.

Rip A. & Kemp R. 1998. "Technological change", in Rayner, S and Malone, E. (Eds.) Human Choice and Climate Change. Batelle Press, 327-399.

Rittel, H. & Webber, M. 1973. "Dilemmas in a general theory of planning", Policy Sciences 4, 155–169. https://doi.org/10.1007/BF01405730.

Robinson, J.B. 1988. "Unlearning and Backcasting: Rethinking Some of the Questions We Ask about the Future", Technological forecasting and social change 33(4), 325-338. https://doi.org/10.1016/0040-1625(88)90029-7.

Robinson, J.B. 2003. "Future subjunctive: backcasting as social learning", Futures 35(8), 839–856. ttps://doi.org/10.1016/S0016-3287(03)00039-9.

Robinson, J.B., Burch, S., Talwar, S., O'Shea, M., Walsh, M. 2011. "Envisioning sustainability: Recent progress in the use of participatory backcasting approaches for sustainability research", Technological Forecasting & Social Change 78(5), 756–768. https://doi.org/10.1016/j.techfore.2010.12.006.

Rockström, J., Steffen, W., Noone, K. 2019. "A safe operating space for humanity", Nature 46, 472–475. https://doi.org/10.1038/461472a.

Romero-Lankao, P. 2012 . "Governing Carbon and Climate in the Cities: An Overview of Policy and Planning Challenges and Options", European Planning Studies 20(1), 7-26. https://doi.org/10.1080/09654313.2011.638496.

Rotmans, J.,Kemp, R., van Asselt, M.2001. "More evolution than revolution: Transition management in public policy", Foresight 3(1), 15-31. https://doi.org/10.1108/14636680110803003.

Ruiz-Mallén, I., Gmelch, N., Aibar, E., Bes, M., Cripps, E., Heras, M., Kuh, V., Müller,J. 2016. Responsible Research & Innovation (RRI) for researchers. An introduction. Universitat Oberta de Catalunya.

Sager, T. 2006. "The logic of critical communicative planning: transaction cost alteration", Planning Theory, vol 5(3), 223-254. https://doi.org/10.1177/1473095206068629.

Schot, J., & Steinmueller, W. E. (2018). "Three frames for innovation policy: R&D, systems of innovation and transformative change", Research Policy, 47(9), 1554–1156. doi:10.1016/j.respol.2018.08.011

Schwarz, P. 1991. The Art of the Long View. Doubleday.

Searle, J. 2010. Making the Social World: The Structure of Human Civilization. Oxford University Press.

Shove, E. & Walker, G. 2007. "CAUTION! Transitions ahead: politics, practice, and sustainable transition management", Environment and Planning A 39, 763 -770. https://doi.org/10.1068/a39310.

Shove E., Pantzar, M., Watson M. 2012. The dynamics of social practice: everyday life and how it changes. Sage.

Sneck, T. 2002. Hypoteeseista ja skenaarioista kohti yhteiskäyttäjien ennakoivia ohjantajärjestelmiä. Ennakointityön toiminnallinen hyödyntäminen. VTT Rakennus- ja yhdyskuntatekniikka.

Son, H. 2015. "The history of Western futures studies: An exploration of the intellectual traditions and three-phase periodization", Futures 66,120–137. https://doi.org/10.1016/j.futures.2014.12.013.

Spurling N., McMeekin, A., Shove, E., Southerton, D., Welch, D., 2013. Interventions in practice: re-framing policy approaches to consumer behaviour. Sustainable Practices Research Group Report. Retrieved from https://www.research.manchester.ac.uk/portal/files/32468813/FULL_TEXT.PDF on Dec 17th 2020.

Swanborn, P., 2010. Case Study Research: What, Why and How?. Sage.

Taylor, N.1998. Urban Planning Theory since 1945. Sage.

Throgmorton, J.A. 2003. "Planning as Persuasive Storytelling in the Context of 'the Network Society", Planning Theory 2(2), 125-151. https://doi.org/10.17077/h5mm-k1r6.

Tozer, L. & Klenk, N. 2018. "Discourses of carbon neutrality and imaginaries of urban futures", Energy Research & Social Science 35, 174–181. https://doi.org/10.1016/j.erss.2017.10.017.

Van den Broeck, J. 2013. "Balancing Strategic and Institutional Planning: The Search for a Pro-Active Planning Instrument", disP - The Planning Review, 49(3), 43-47, https://doi.org/10.1080/02513625.2013.859007.

Verschuren, P. & Doorewaard, H. 2010. Designing a research project, 2nd edition. Eleven International publishing.

Vihalemm, T., Keller, M., Kiisel, M. 2016 From Intervention to Social Change. A Guide to Reshaping Everyday Practices. Routledge.

Wangel, J. 2011a. "Exploring social structures and agency in backcasting studies for sustainable development", Technological Forecasting & Social Change 78(5), 872–882. https://doi.org/10.1016/j.techfore.2011.03.007.

Wangel, J. 2011b. "Change by whom? Four ways of adding actors and governance in backcasting studies", Futures 43(8), 880–889. https://doi.org/10.1016/j.futures.2011.06.012.

Wheeler, S.M. 2017. "A Carbon-Neutral California: Social Ecology and Prospects for 2050 GHG Reduction", Urban Planning 2(4), 5–18.http://dx.doi.org/10.17645/up.v2i4.1077.

Wittstock, B., Goerke J, Blumberg M. 2019 "2 DEGREES – understanding the contribution of cities to a carbon neutral society", IOP Conf. Ser.: Earth Environ. Sci. 323. https://doi.org/10.1088/1755-1315/323/1/012072.

Wolfram, M., Ladeia Torrens, J.C., Castán Broto, V., Barnes, J., Fratini, C., Håkansson, I.Hölscher, K. Schmidt-Thomé, K., Vogel, N., von Wirth, T., Wangel, J., Smeds, E., Frantzeskaki, N.l. 2019. "Urban pathways towards sustainability: Concepts, knowledge boundaries and a transformative future agenda", IST conference 2019, Full paper.

WSP Finland Oy, YTK, Demos Helsinki, NOW for Architecture and Urbanism, & Urbanism. 2008. Helsingin seutu 2050. Näkökulmia seutuvisioon. Jatkotyö. WSP Finland. Retrieved from https://www.demoshelsinki.fi/fi/julkaisut/helsingin-seutu-2050/ Dec 17th 2020.

Zapata, M. A & Kaza, N. 2015. "Radical uncertainty: scenario planning for futures", Environment and Planning B: Planning and Design 42, 754–770. https://doi.org/10.1068/b39059.

APPENDIX 1: LINKS TO REPORTS PROVIDING DATA FOR ARTICLES 2 AND 3

Reports providing data for Article 2:

From Local Loops to Global Champions: Scenarios for Sustainable Lifestyles 2050. SPREAD project Deliverable 4.1. https://www.demoshelsinki.fi/julkaisut/from-local-loops-to-global-champions-scenarios-for-sustainable-lifestyles-2050-2/

iFuture – The diversity of sustainable lifestyles. SPREAD project Deliverable 7.1. https://www.demoshelsinki.fi/wp-content/uploads/2014/08/SPREAD_D7.3_iFuture.pdf

Reports providing data for Article 3:

Greater Helsinki Vision 2050 – International ideas competition, jury protocol

https://www.safa.fi/wp-content/uploads/2019/12/ghv_www_protocol_english.pdf

Helsingin seutu 2050. Näkökulmia seutuvisioon. Jatkotyö. https://www.demoshelsinki.fi/fi/julkaisut/helsingin-seutu-2050/

PUBLICATIONS

PUBLICATION I

Planning Meets Futures Studies.
Systemic societal change and the possibility of transformational planning

Neuvonen, A. & Lehtovuori, P.

in process, Planning Theory.

PUBLICATION II

Low-carbon futures and sustainable lifestyles: A backcasting scenario approach

Neuvonen, A., Kaskinen, T., Leppänen, J., Lähteenoja, S., Mokka, R., Ritola, M.

Futures 2014, vol. 58, 66-76.
doi.org/10.1016/j.futures.2014.01.004

ABSTRACT

This study suggests a backcasting scenario method for understanding the relevance of lifestyle-level changes in low-carbon futures. Even though different scenario approaches to low-carbon futures have emerged in recent years, the main focus has been on macro-level development and the lifestyle-level change has been neglected. Focusing on changing lifestyles and social innovation, the outcome of this study is four scenarios depicting the path towards low-carbon futures. The purpose of the scenario study is to describe links between the significance of emerging lifestyle patterns and infrastructure, policy and technological development. Despite the normative constraint regarding material footprint, the scenarios offer a diverse set of lifestyle patterns. The study answers the following question: what lifestyle-level changes could have potential to drive the transition towards low-carbon futures that are within planetary boundaries. We suggest that lifestyle-level scenarios on low-carbon society could have an impact in empowering relevant early adopter groups to become gatekeepers of low-carbon transition.

Keywords: sustainable lifestyles, backcasting, future scenarios, transition management, multilevel perspective, social innovation, choice, infrastructure, low-carbon futures

1. Introduction

Over the course of the last decade, only a few phenomena have shaped the way futures are discussed more than greenhouse gas emission reduction targets that many countries and cities have adopted in their official policies (The Climate Action Tracker 2013; GLOBE international 2013) . Although varying in their formal status (some countries have binding climate laws, others merely indicative guidelines for forthcoming policies), these targets often reach to 2050. Set radical emissions reduction levels (-80-95%) have extended the usual time horizon of political debate and introduced future carbon intensity of technical and social systems as relevant planning principles.

Projected changes in infrastructure and production patterns inspire people to think what life would look like when the shift to low-carbon society has taken place in its various forms. ”Will life be more complicated,” ”Where do I get my income from,” ”What do we eat, how do we travel from place to place,” and ”What does my neighbourhood look like” are all relevant questions when talking about the distant future and a quantitatively radical drop from current emissions figures.

To understand the logic of projected transformation towards low-carbon futures (of energy and transportation systems), different types of future scenarios are often employed. Because the context is defined by a long-term target (emissions level in 2050), the scenarios are usually constructed following the so-called backcasting approach: looking back from future where a desired goal has been met and creating decisive steps and pathways to present day. The most suitable domains for this type of normative approach have been large energy and transportation systems, where long-term investments in infrastructure and economic incentives are the determining factors and thus quantified models depicting possible pathways can be based on these techno-economic drivers.

However, until very recently, systematic scenario studies depicting possible changes in lifestyles and social structures as parts of low-carbon transition have been few (Angel 201 p.881). Although changes in big industrial systems and infrastructure are the domains with the greatest potential in bringing about a sufficient level of emissions reductions, there are also good reasons why the future of lifestyles is worth exploring in the context of low-carbon futures. Firstly, taken into account how large the envisioned change (-80-95% over 40 years) is, it is somewhat likely that transitional changes in technology, economy, laws, and value structures lead into changes in lifestyles as well. Secondly, both the adoption of new technologies as well as advancements in policies are dependent on social structures and changes in behavioural patterns. Lead-users with experimental lifestyles and living patterns offer a platform through which new technical solutions can find their way to wider audiences and markets (Feels 2002; Urban & von Hippel 1988). For instance, a company offering a service for shared car usage today can serve as an agent for change for the society tomorrow.

In this article, we describe how the use of backcasting scenarios was extended from infrastructural analysis to depicting future lifestyles and changes in social structures. The normative goal used in defining these scenarios is sustainable society, where annual per capita material consumption has reached a level that is estimated to be globally sustainable. By defining our goal through figures on material consumption, our approach on sustainable society and sustainable lifestyles thus expands the scope of low-carbon society to cover a wider range of ”planetary boundaries” – such as biodiversity loss, depletion of phosphate stock and acidification of oceans (Rockström et al 2009).

The paper is structured as follows: Section 2 briefly summarises key research developments as regards the future of sustainable lifestyles, their potential role in a transition towards sustainable society, and backcasting scenarios as a method. In

Section 3, a scenario approach implemented in a European Commission funded research project called SPREAD - Sustainable lifestyles 2050 is described and analysed. In Section 4, the four scenarios are deeply introduced through scenario narratives and triggers that bring about change to sustainable lifestyles. Finally, Section 5 discusses the relevance of the backcasting approach as regards research on sustainable lifestyles and mainstreaming of practices (policies, R&D, entrepreneurship, and civic activities) that support the adoption of sustainable lifestyle patterns.

2. Lifestyles approach to sustainable futures

2.1 Making lifestyle-level transitions to sustainable society

The questions "what are sustainable lifestyles" and "what could sustainable lifestyles in look like in the future" have their origins in the wider discussion on sustainable development. In this discourse, sustainable lifestyles constitute a fairly new concept. It was first introduced at the United Nations Commission on Sustainable Development (CSD) conference in 2004 (CSD 2004).

There are three distinct focal points that have dominated the agenda of sustainable development in the past decades: cleaner production (e.g. end-of-pipe pollution control), the question for local action and participation, and sustainable consumption (Wangel 2011). Concentrating solely on the production side of sustainable development overlooks the fact that our consumption levels have multiplied six-fold since the 1960's and consequently form a significant part of the current environmental burden (Backhaus et al 2013). Similarly, it would be unrealistic to limit the analysis of people's behaviour to consumption as it is well known that behaviour is a result of a complex mix of different values, attitudes, surrounding infrastructures, and other factors (DEFRA 2013). While each angle towards sustainable development provides a fruitful starting point, the need for a comprehensive approach linking the different focal points has become evident.

In recent years, sustainable lifestyle choices have become increasingly relevant and accessible options for European consumers thanks to a rise in localised social innovation experiments, an improved supply of eco-efficient goods and services, and increased coverage of sustainability issues in the media raising awareness in the public debate. In public discourse on lifestyle choices, "sustainable lifestyles" often refers to the patterns of action and consumption used by people to affiliate and differentiate themselves from others (Backhaus et al 2013).

However, the formation of sustainable lifestyles cannot be studied merely as something resulting from choices by individuals and groups. Lifestyles are a combination of choices and habits embedded and shaped by our surroundings and context, be they social, cultural, technological, political, economical, or institutional. Also, the ways everyday human behaviour and lifestyles translate into environmental stress are complex (Backhaus et al 2013). Hence what is needed is understanding of the interplay between individual choices and larger macro-level changes (in technology, infrastructure, policy, economic structures and culture).

How to approach sustainable lifestyles from the viewpoint of transitions to a low-carbon, sustainable society? How would the future of sustainable lifestyles differ from a future of lifestyles in general? As for society-wide level of greenhouse gas emissions, it is possible to set indicative targets for long-term decrease of lifestyle-based environmental stress. Total material consumption (TMC) offers a good tool for setting yardsticks to this transition (Bringezu 2009). In the EU, TMC per inhabitant is currently 40–50 tonnes per year, whereas a sustainable level of natural resource use would amount to a maximum of approximately 10 tonnes per capita a year. This estimation takes into account an equal global distribution of natural resources and aims to ensure healthy ecosystems for future generations. Based on Bringezu (2009) and Lettenmeier et al. (2012), the sustainable level of natural resource use for private household activities lies between 6 to 8 tonnes per person in a year.

2.2 Motivating discourse on lifestyles: Multilevel perspective of socio-technical change

What is the significance of depicting lifestyle change if the goal is to understand society-wide transition to sustainable society? Is it just a side note of a wider shift, something that is merely a result of changes in politics, technology, and economy? If so, wouldn't it suffice to simply construct scenarios about the transition to a sustainable society and assume lifestyle changes to emerge following the macro-level change? Can a study focusing on the future of sustainable lifestyles help understand some key aspects or causal processes of transition that would otherwise be left poorly understood?

The answer to the questions above depends on the theoretical framework chosen for understanding how changes in our societies emerge and transform. Multilevel Perspective (MLP) of socio-technical change (Urban & von Hippel 1988) is a model behind two sustainability management tools introduced in the 1990's and 2000's.

The concepts of strategic niche management (SNM) and transition management were created to understand how more sustainable patterns evolve, i.e. how new technologies are used to create a more sustainable society. These concepts were developed and introduced by several different technological innovation scholars (see more: Bijker et al 1987; Raven 2005; Elzen et al 1996; Kemp et al 1998; Rotmans et al 2001; Schot et al 1994).

MLP is based on three analytical levels and analysing interacting processes within and between these levels: niches (radical innovations), socio-technical regimes, and exogenous socio-technical landscapes (Geels 2011, p.26).

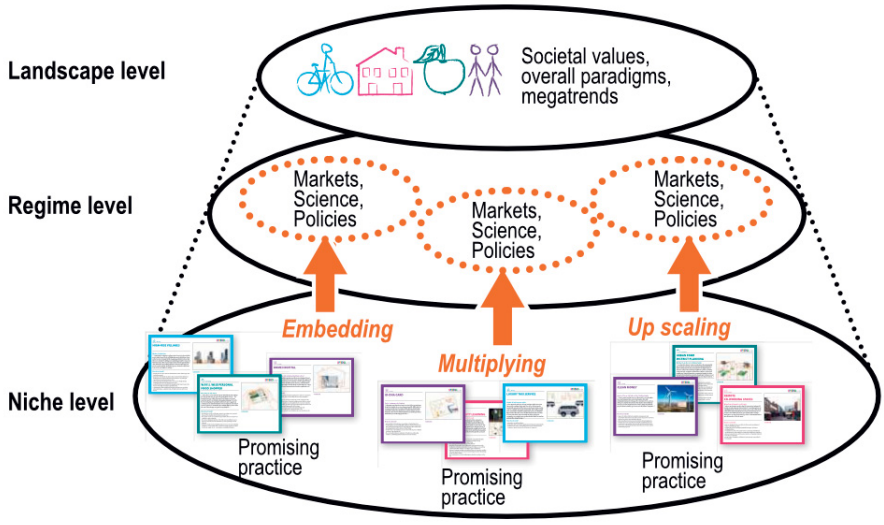

Figure 1. Transition theory on how sustainable lifestyles spread (Demos Helsinki 2012a: Based on Geels 2002).

Regime level changes happen when a large number of people or groups experiment with products, services, behaviour, or technologies that differ from the mainstream in a volume that has an impact on markets or policies. Landscape level changes are achieved when they are visible in trends or common societal values (Geels 2002).

Multilevel perspective is fruitful from the viewpoint of lifestyles because it refers to the process of deliberately managing niche formation processes through real-life experiments. The core idea in taking the multilevel perspective is that experiments

with new technologies and new socio-technical arrangements can stimulate processes of co-evolution. Lifestyle choices and niches are both regulated and affected through regime and landscape level structures as well as cultural codes. On the other hand, individual lifestyle choices can occasionally have an impact on the regime and landscape levels. Research on the future of sustainable lifestyles helps understand the dynamics between the different levels.

Considering how studying can benefit forthcoming policies and business practices, exploring future transition towards sustainable society on the level of lifestyles and everyday practices (typically positioned on the niches level of MLP) makes sense for two reasons. First of all, to find out where scaling up current promising practices (both technological and lifestyle) might lead lifestyles to. Secondly, for many innovations, especially with sustainability promise, market niches and user demand are not readily available because the innovations are not minor variations from the prevailing set of technologies, but differ radically from them. These new creative solutions that are currently unknown or unthinkable arise from the niche level. They represent radical novelties that face a mismatch as regards existing infrastructure, user practices, regulations, etc. Therefore it is highly important to explore how to match innovations with complementary measures that alter current policies and infrastructure.

2.3. Making sense of long-term transitions: backcasting scenarios

Backcasting scenarios is one of the methods that has emerged steadily over the course of the past decade within the field of futures studies, especially concerning the discussion on transitions towards sustainable socio-technical systems. Originally introduced to academic discussion through energy studies in late 1970's and early 1980's, the idea of 'backwards looking analysis gradually spread to cover topics such as sustainable transportation systems, companies' sustainability-led strategies, and regional sustainability policies (Quist & Vergragt 2006).

The most defining characteristic of backcasting is the normative approach to the future that it entails instead of a purely descriptive one. Constructing backcasting scenarios begins by defining criteria for desirable futures and only then building a feasible, logical path between states of the future and the present.

Why select such a reverse and probably more complex approach than a standard forecasting one in which pathways to futures are built on current trends and demand patterns? Many authors have sought to define demand for backcasting scenarios through referring to historical circumstances in development of society and

emerging disruptions in that development (Dreborg 1996; Quist & Vergragt 2006). Backcasting is a relevant option in issues where the mainstream of forecasting studies indicate that long-term development leads to outcomes that have been widely recognised as undesirable (Höjer & Mattsson 2000). What backcasting scenarios offer are new options to be considered as reasonable, widening the rather narrow perception people often have on what could be possible and reasonable in the long-term [e.g. Dreborg 1996; Höjer & Mattsson 2000).

Typically scenarios focusing on technical systems are built to be target-oriented, focusing on normative, quantitatively defined goals and answering the question "what can change." This approach can be contrasted with pathway-orientated backcasting and action-orientated backcasting. Pathway-orientated backcasting aims to bridge the gap between mere technical possibilities of today and actions of tomorrow, answering the question of "how change can take place" through identifying such non-technical triggering measures as planning processes, policies, taxes, and behavioural change. However, in action-orientated backcasting "what" and "how" are being complemented by focusing on answers to the question "who could make the change happen" through identifying actors and stakeholders, either from a list of predetermined actors or through a more exploratory approach. The question of 'who' has been addressed less frequently. (Wangel 2011).

This is no wonder acknowledging the history of backcasting in fields focused in planning and infrastructure. Within planning-led processes (energy systems, transport infrastructure, or regional spatial planning), the structure of agency in transition is typically thought to remain the same. Hence in many backcasting scenarios, social structures, possible changes in lifestyles, and the question of agency are often neglected or assumed to happen according to status quo. In these cases behaviours and lifestyles are thought to be guided by a simplistic and overly rational model of economic incentives and informational campaigns (Wangel 2011).

Introduction of participatory backcasting in the early 2000's complemented the earlier approach that had its foundations in technical systems and their planning practices. It moved the field of backcasting towards a socio-technical approach to sustainable development and lifestyles. By engaging different stakeholder groups in scenario work, participatory backcasting aims to bring about higher-order, value-influencing learning among participants, thus implementing potential results of the scenario method on different societal levels, including that of everyday life (Quist & Vergragt 2006).

Following a growing interest towards the lifestyle approach, there is a wide literature reporting backcasting studies on the future of sustainable production and

consumption patterns [see e.g. Wangel 2011; Quist & Vergragt 2006; Carlsson-Kanyama 2008: Giurco et al 2011; Gomi et al 2011; Eames & Egmose 2011; Svenfelt et al 2011; Vergragt & Brown 20017). However, reports on empirical cases are still few. Hence it is fair to say that a mature and solid theory of backcasting in which social structures would be included as objects of change (Wangel 2011) is still missing.

In this article, an approach has been used that connects the lifestyle-level approach as a way to understand society-wide transitions following the idea of multilevel perspective to societal change. This has been accomplished by using backcasting methodology that connects normative goals to actions that shape the future towards the set aims.

3. Depicting the future of sustainable lifestyles

The project SPREAD Sustainable Lifestyles 2050[4] was one the first research projects ever that approached the transition towards sustainable society from the perspective of a variety of different lifestyles instead of focusing merely on the future of a single consumption category (e.g. food, housing, consumer goods, or transportation). One of the main outcomes of the project was a set of four alternative scenarios on how lifestyles and societies in Europe could evolve by 2050, assuming that the target of not exceeding the Planetary Boundaries would be attained. The scenarios are based on research work done by Finnish think tank Demos Helsinki. The scenarios were built using the backcasting approach and adopting the multilevel perspective to societal change (as presented in the previous section). The normative goals along with the lifestyle-level approach enabled an actor and action based model for the scenario work.

3.1. Methodology: the scenario process

In the previous phase of the SPREAD project, the research consortium collected a vast number of niche level sustainable lifestyle bits that already exist in different parts

[4] The SPREAD project, funded as part of the European Commission's Framework Programme 7 was coordinated by the UNEP/Wuppertal Institute Collaborating Centre for Sustainable Consumption and Production in Germany, and conducted together with 9 partners (Ashoka; Demos Helsinki; Ecoinstitut Barcelona; Energy research Centre of the Netherlands; EuroHealthNet; Politecnico di Milano; Regional Environmental Center for CEE countries; The International Institute Environmental Economics at Lund University; The Northern Alliance for Sustainability) in 2010-2012. (See www.sustainable-lifestyles.eu).

of Europe. The most potential lifestyle bits were called promising practices. The mainstreaming potential of these practices were analysed using Geels' transition theory that describes multi-level and multi-stakeholder change processes (Geels 2002, p. 1261). This desk study was followed by a disaggregative policy Delphi survey (Kuusi 1999) for a crosscutting group of relevant stakeholders and experts to support the definition of the scenario framework and the landscapes.

Based on the Delphi survey and our analysis of earlier research [see e.g. Börjeson et al 2006: Svenfelt 2011; Kuusi 1999) on how to distinct the scenarios from each other, two critical variables or uncertainties to be combined to produce four alternative future landscapes were defined. By combining the two uncertainties into one 2x2 matrix, the scenario quadrants were created through the Shell/GBN method (Lundsgaarde 2008; Wack 1985). These were elaborated into four alternative future landscapes, which formed the basis for our work in the backcasting workshop.

The backcasting workshop gathered 54 participants from 16 countries, representing stakeholder groups from start-up businesses, governments, and multinational companies to NGOs, researchers, entrepreneurs, designers, and independent policy experts. The workshop participants defined four alternative scenario narratives and pathways to more sustainable lifestyles in Europe between 2012 and 2050. Starting with the alternative future landscapes created in advance (see chapter 4.1), participants "counted backwards" from the 2050 to today. Each group was challenged to co-create the pathways to their alternative future where sustainable 8 000 kg lifestyles are societal norms.

To qualify the scenario stories and to collect additional assumptions and arguments for each scenario, a second Delphi survey was conducted based on participants' fields of expertise. Furthermore, to add the views of citizens from across Europe to the process, the scenario drafts were further discussed and evaluated through five participatory iFuture workshops of the SPREAD project (Demos Helsinki 2012b). This was all done to make sure that the scenarios represent the ideas of a vast number of different people with different societal and geographical perspectives.

3.2. Scenario landscapes

As explained in Chapter 3.1, the four scenarios of the SPREAD project are built around a combination of major uncertainties that define the landscapes of 2050. The two critical uncertainties defining the scenarios are the source of technological innovations (y-axis) and a society's governing principle (x-axis).

The sources of technological innovations are divided into pandemic or endemic groups. In the pandemic end of the axis there are a few globally dominant technologies for any task or human need. Dominant technologies for building, transportation, energy production, and communication exist everywhere because of benefits provided by their great scalability.

Endemic sources of technologies refer to locally driven innovation systems. Tools, infrastructures, and solutions are born and grown locally: technologies emerge out of local conditions, resources, and peculiarities. The corpus of global science and technology is wide, yet applications are highly local. The economy is driven by efficiency and innovations gained through thinking and acting locally.

The governing principle of the society is defined to be either meritocratic or human-centred. A meritocratic society circles around professional skills. The most commercially valuable professional skills are the engines of the economy. Division of labour is at its extreme. Rewards of working long hours and harnessing one's most valuable skills at economically most productive contexts are significant.

A human-centric society pivots around widening the use of human capital in all its forms. Both civic and public use of skills is valued. Everyone has something valuable to give or to do, and everyone is allowed to contribute to society through multiple roles in life (as good citizens, family members, neighbours, and professionals). There is some division of labour, but self-improvement through leisure is highly appreciated.

3.3. Ingredients of scenario paths

Typically, scenarios constructed around critical uncertainties with a potential of defining the macro-level structures and the cultural landscape of society are presented through scenario narratives that focus on depicting political and technological changes. These narratives on societal macro structures can be complemented with "a-day-in-life" type of illustrating stories that translate the scenario into practices, events and settings of everyday life.

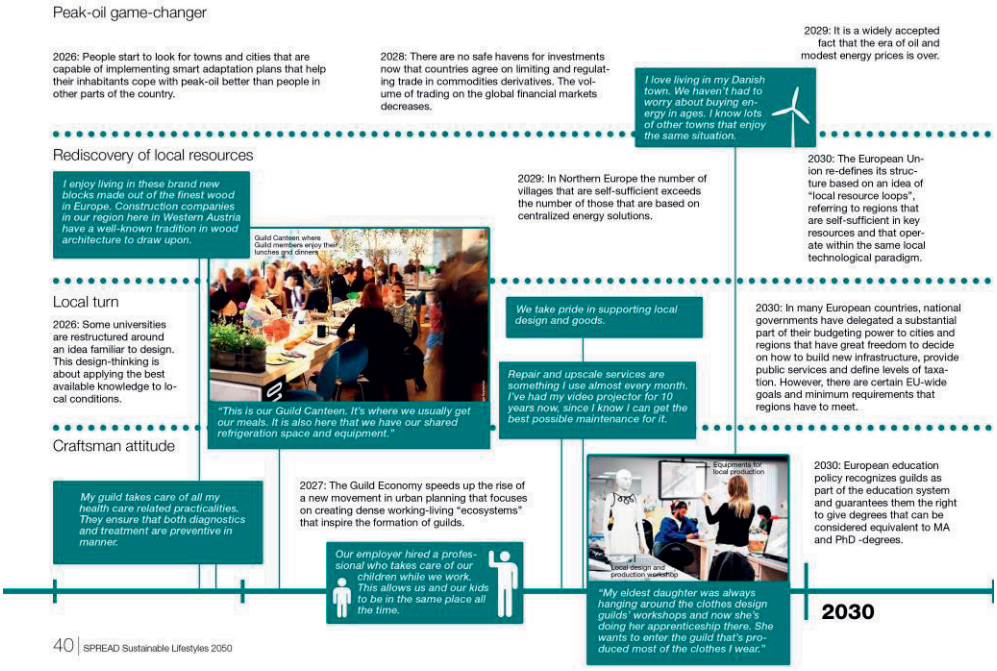

Figure 2. Example of the SPREAD scenarios' timelines: a part of 'Local Loops' scenario (Demos Helsinki 2012a).

Since the goal of SPREAD scenarios was to elaborate the potential role of changing lifestyles in the transition to sustainable society, the scenario narratives had to be built in a way that would emphasise the role of lifestyle innovations and everyday life as parts of a broader change in society and its structures. The solution was to present each scenario as a timeline that brings together both macro-level political, technological, and social events that reflect the impact of the major drivers specific to each scenario, and "bits of lifestyles" exemplifying how changing societal structures shape everyday life and how new lifestyle innovations appear in society.

Part of scenario	No. of occurrences	Purpose	Method
Landscapes	4	To establish four significantly different scenarios. The underlying assumptions were: 1.Technology is either pandemic or endemic. 2. Society's governing principle is either human-centric or meritocratic.	Iterative process, lifestyle relevance, degree of variable independence
Timelines	4: one for each scenario	To enable description of changes arising from diverse sources in the operational environment.	Expert workshop
Macro drivers	16: four for each scenario	To identify and present the critical macro changes necessary to create sustainable lifestyles. These drivers appear as events in the scenario timelines and create a path for macroeconomic and large scale political change.	Back-office work
Macro Narrative Events	160	To create the macro level narrative of societal change.	Expert workshop and back-office work
Bits of lifestyles	87	To demonstrate how various situational and behavioural factors contribute to the development of sustainable lifestyles and to highlight the change of our everyday lives and the decisions we make concerning how we live, move and consume in the future.	Expert workshop
Lifestyle innovations	44	Emerging practices mainstreamed in the path of scenarios.	Future innovation cards and Strategic Design Scenarios.
Lifestyle triggers	24: 6 in each scenario	Lifestyle triggers are essential leverage points that bring about and mainstream lifestyle changes.	Back-office work

Table 1. Summary of elements in scenario backcasts.

The following chapter focuses on describing all four scenarios based on how these scenarios depict lifestyle-level changes. Usually, lifestyles are seen as a result of the macro-level drivers so that macro scale driving forces translate to different lifestyles depending on the socio-cultural context. However, when taking lifestyles as the key focus of backcasting, it becomes apparent that macro drivers and lifestyles form a system where they can impact each other: top-down view of macro structures imposing a change on lifestyles and the bottom-up view of lifestyles accelerating macro-level changes.

Figure 3. Example of SPREAD scenarios' lifestyle innovations from 'Empathetic Communities' scenario (Demos Helsinki 2012a).

Both the macro drivers and the lifestyle triggers describe mainstreaming processes of certain practices. The role of macro drivers is well known amongst futures studies scholars. Lifestyle triggers, however, require further explanation. For each scenario, we chose lifestyle triggers that could be crucial in mainstreaming niche practices into everyday lifestyles. These lifestyle triggers illustrate what could be significant enough on the lifestyle level to speed up the macro-drivers. These triggers serve as potential leverage points for bringing lifestyles into the mainstream.

It is worth noticing that these four scenarios don't fully depict human motivations and possible interactions, but instead serve as a ground to understand certain pathways and motivations based on chosen drivers. A more thorough description on human motivation and society-level drivers can be found on the original scenario work (Demos Helsinki 2012a)

4. The four scenario narratives

4.1 Singular Super Champions

In Singular Super Champions people have to pay substantially more for many of the necessities and luxuries than now. Rising energy prices drive urbanisation, which leads to people needing less resources for mobility. The economic imperative of resource efficiency breathes new life into entrepreneurship, new business models, and people experiment with various aspects of sustainable living at home.

Global data and knowledge flow have opened the world. People gain real time access to detailed data on their own behaviour and science provides increasing amounts of information regarding healthy and sustainable alternatives. Sustainability is accomplished through changes in behaviour patterns and consumption practices along with technological innovations.

Everyone has access to basic education, learning, and knowledge. Leisure time is spent on learning and education that is self-centred yet pragmatic. The most affluent people, The Singular Super Champions, make investments in themselves through studying new skills, both for professional improvement and to become champions of their individual lifestyle.

There are four significant drivers that shape the development towards Singular Super Champions: EU level green new deal that aims to drive economic growth across Europe, transparency of ecological and economic costs, internalization of these costs into prices, technological development that enables upcycling of waste into resource, and emphasis on continuous development of personal and professional skills.

The six lifestyle triggers in the Singular Super Champions scenario combine strong policies and measures and open data with rising price of key resources.

1. Transparent product data allows people to understand the environmental cost of personal consumer choices and overall lifestyle. In 2050 comparing the sustainability of choices of food, housing, mobility, and consumer goods is as easy as comparing prices was in 2012.

2. People prefer short commuting distances, well-serviced neighbourhoods, and a better access to public space, because road pricing and the overall rise of transportation costs change housing preferences.

3. Improved design of public spaces and flats draws people to densely populated areas. People are willing to trade off a spacious dwelling for the status and comfort provided by a flat in a central location.

4. New dietary alternatives emerge from a combination of rising food prices and increased health consciousness. Media, primary education, and catering companies help environmentally rational diets become a mainstream lifestyle option.

5. Apps for personal informatics, educational software, and a diversified educational service sector become attractive and influence people's spending. As a result, there is less desire for material goods, as more people have excellent skills in making rational choices.

6. New upcycling approaches to consumer goods have changed product lifecycles. Material goods are sold with an additional deposit on their material resources.

4.2 Governing the Commons

Governing the Commons is a scenario where people live their lives extensively in the digital reality that helps them break free from many cultural constraints and eventually reach sustainability. Ubiquitous computing enables people to use resources in smart ways and, at the same time, redirects the focus of attention from material consumption and their physical surroundings to interaction in the digital realm. People abandon many institutions of the 20th century, liberate themselves in order to lead more meaningful lives and engage in new forms of collaboration.

The scenario is based on pandemic technology and a human-centric society. Pandemic technology enables instant feedback loops of how people interact, which accelerate rapid sharing of knowledge. New layers of virtual reality and ubiquitous technologies shape the lives of people in this scenario. New ways of belonging to communities exist. Instead of one job and expertise attached to that, people have diverse skills and roles appreciated by the surrounding community.

The four significant drivers that shape the development towards Governing the Commons are: mainstreaming of 3D printers to the mass market, ubiquitous technology and virtual realm becoming parts of peoples' identities, flexible notion of work, and wikidemocracy that connects people to join shared causes in formation of new highly participative system of governance.

The five lifestyle triggers in the Governing the Commons scenario are based on fast technological development. Especially big data collected from users is one of the key sources of innovation.

1. 1.Smart mobility services change the way people plan their time and how they combine routes and modes of transport. These services help to optimise public transportation use and enable the development of vehicle and ride sharing schemes.

2. Ubiquitous technologies give rise to a new ecosystem of peer-to-peer services that are available for people whenever they need or want them. All appliances and buildings are equipped with the technology to advice users on energy smart use and maintenance requirements.

3. A new generation of virtual reality and online communities becomes popular, which means a decrease in need for large living spaces, furniture, and even foodstuffs.

4. The scale up of 3D-printing changes the way people seek self-actualisation. Consuming goods designed and made by someone else no longer express one's identity and style well enough.

5. Online networks built on a shared interest in lifestyle issues enable people to realise their potential and to constitute themselves as groups with political power.

4.3 Local Loops

Local Loops is a scenario in which a radical energy crisis forces societies to fundamentally re-evaluate the foundations of their wellbeing. Energy and resource systems are increasingly seen through "Local Loops," i.e. local and regional production cycles. The emphasis of many businesses and professions turns to user-centred design that produces smart and creative local adaptations. Work has a special value, partly because local value chains are very visible. A flourishing service sector within the loops helps people to outsource everyday routines such as cooking or doing laundry, which in turn releases time for collaboration.

People spend most of their time in working hubs and collaborating with their guild peers. Therefore less space is needed for homes than in 2012. Most home appliances are shared amongst neighbours and located in shared spaces. There is no need to leave one's neighbourhood often as people live near their work, family, and peers. Cycling routes and walking lanes are in good condition and are built around the best possible scenery to meet multiple user needs.

Tourist destinations have increased in number and provide desirable recreational value such as local biodiversity reserves or farms producing favourite food products.

The significant drivers shaping the development towards the Local Loops scenario are: realisation of peak oil as a significant game-changer through soaring energy prices, rediscovery of local resources and resource loops as a basis of self-sufficiency, an appreciation of local cultures and traditions, and a shift towards guild-based economy and emphasis on craftsmanship that encourages engagement, motivation, and purpose of work.

The six lifestyle triggers in the Local Loops scenario connect the 'local turn' and the new notion of working to appreciation of services and peer-living.

1. Extremely high energy and food prices persuade people to focus on local and secure alternatives.
2. Tight workplace and neighbourhood-based communities enable and encourage people to share spaces and equipment. The need for living space is reduced.
3. People live close to their guild peers. Ample service options mean minimal need to commute outside the neighbourhood.
4. People prefer appliances, furniture, and clothes to be sold as services. Maintenance and adaptation services are improved and they significantly prolong product lifecycles.
5. Consumers can no longer make mistakes: policies built on scientifically backed environmental and health objectives eliminate bad choices.
6. People eat out more. Better food services ensure a healthy diet, adjust portions to optimal size, eliminate food waste, and help people focus on their work and social life.

4.4 Empathetic Communities

Empathetic Communities is a scenario where Western societies have faced a crisis they had long dreaded. The global economy as we now know it fails, followed by a paralysis of nation states and their political decision-making structures. When both the economy and national politics were in a state of paralysis, people started organising "Plan B" solutions on local and regional levels. When food and energy become ridiculously expensive, new solutions start to emerge. New types of technological and social collaboration and innovation emerged and helped people reform political decision-making and workplace practices.

During an era of high unemployment, many people started to explore new and alternative ways to improve living conditions for themselves and their peers. Hundreds of experiments with local energy and food production, energy retrofitting, and different types of peer-to-peer services provision started to take place all over Europe. Daily practices and lifestyles are formed strongly around collective activities and sharing. People understand courtyards, streets, and different types of shared indoor spaces as something that is in their shared possession and active use. Streets and roads are either transformed to farming land or adjusted to support healthy mobility, such as cycling and walking. Urban farming spreads everywhere.

The Empathetic Communities scenario is based on a development of four drivers: an economic system breakdown that leads to energy and food scarcity, empathy-based peer-to-peer networking as a new solution for structural problems, public-private-people model stepping up to build new welfare, and an emphasis on community-oriented urban planning that supports a village model in cities.

Empathetic Communities lifestyle triggers: The five lifestyle triggers in the Empathetic Communities scenario combine high prices of resources and a strong do-it-together attitude.

1. Do-it-yourself (DIY) farming, energy production, and retrofitting solutions gain popularity among many of the unemployed.
2. New local partnerships empower people to shape their neighbourhood to better facilitate self sufficiency in food and energy production and in different forms of communal consumption (shared use of tools, appliances, and spaces).
3. Health ceases to be an individual issue and becomes a communal one. People practice preventive health care in workplaces and neighbourhoods.
4. New tools and services for interior design make people think about their homes in new ways. The functionality and flexibility of homes are features that people in 2050 are able to compare as easily as people used to compare living space in 2012.
5. A reduction in food, living space, consumer expenditure, travel, and other leisure time activities is compensated for by the richness of social life.

5. Conclusions

In this article, we have applied backcasting scenarios to depict alternative futures of sustainable lifestyles. The approach to write and communicate futures in scenarios has been experimental: scenarios combine narratives on macro-level political and technological changes with "bits of lifestyles" and lifestyle innovations. Also, special attention was paid to the dynamics between macro-drivers and everyday practices.

Therefore, critical lifestyle triggers and gatekeepers with potential to unlock behaviour change to sustainable lifestyles were named and described in the four scenarios. With these additions, backcasting scenarios can serve as a meaningful methodology in illustrating and describing how lifestyle changes could happen and how change in lifestyles can accelerate transitions towards sustainable societies that can keep their level of environmental stress within planetary boundaries.

Normatively defined ecological resource constraints for societal development can easily be interpreted as a reason for decline in the quality of everyday life: less choice or a return towards societies and lifestyles resembling those of the early 20th century.

However, it can be assumed that different varieties of demand by different types of people and groups still exist. In other words, new constraints of supply bring about new behavioural patterns and social structures, as suggested by Wangel (2011). These might include innovations in collaborative consumption, i.e. business and consumption models based on sharing goods among a pool of consumers.

One of the outcomes of the scenario process was that sustainable lifestyles or societies can be achieved with different social structures and technological frameworks. By describing lifestyles through future scenarios constructed through backcasting methodology, it is possible to illustrate that sustainable lifestyles are feasible in various different societal models and macro-level environments.

Instead of understanding the transition towards sustainable societies to limit lifestyle diversity, lifestyle backcasting enables us to identify and potentially empower new actors and more diverse lifestyles. We can be fairly certain that we are unable to identify, describe, and empower all the stakeholders that are significant in the formation of sustainable futures (and yet such future remains necessary and critical). Hence the introduction of alternatives in lifestyles remains a significant method in allowing as many actors as possible to see their own current choices as parts of a wider change. This enables them to empower themselves as potential stakeholders in the formation of sustainable futures.

Due to the difficulty of completely covering all key actors, we suggest a new approach to be considered – emancipatory backcasting – that aims not to identify but to non-omit key actors and to empower key actors to understand their role in the formation of sustainable futures. This connection from promising experiments and contemporary everyday choices to a global view on change towards more sustainable structures could possess potential to empower people to participate in further experimenting with and mainstreaming sustainable lifestyle patterns.

Consequently, communicational quality of scenarios increases with attempts to depict lifestyles. Visual scenarios that depict lifestyle level choices and events enable

better understanding on how current emerging practices are linked to mainstreaming sustainable lifestyles. Also, through richly communicated scenarios, it is possible to empower different actors to the significance of lifestyle choices.

We suggest that the transition to sustainable society requires interplay between the evolution of emerging lifestyle practices and infrastructure (both physical and institutional) that either enable or restrict sustainable behavioural patterns. Further research is required to understand how new lifestyle experiments serve as leverage points for the renewal of infrastructure. On the other hand, the renewal of infrastructure can serve as a leverage point for mainstreaming lifestyle practices.

REFERENCES

Backhaus, J., Breukers, S., Mont, O., Paukovic, M., Mourik R. 2013. Sustainable Lifestyles: Today's Facts & Tomorrow's Trends. Sustainable lifestyles baseline report. Retrieved from http://www.sustainable-lifestyles.eu/fileadmin/images/content/D1.1_Baseline_Report.pdf on September 19th 2013.

Bijker, W., Hughes, T., Pinch, T. (Eds.) 1987, The Social Construction of Technological Systems, MIT Press, Cambridge.

Bringezu, S. 2009. "Visions of a sustainable resource use", in: Bringezu S. and Bleischwitz R.

(Eds.), Sustainable Resource Management. Global Trends, Visions and Policies, Greenleaf Publishing, Sheffield, 2009, pp. 155–215.

Börjeson, L., Höjer, M., Dreborg, KH., Ekvall, T., Finnveden, G. 2006 "Scenario types and techniques: Towards a user's guide", Futures 38 (7).

Carlsson-Kanyama, A., Dreborg, K., Moll, H., Padovan, D. 2008. "Participative backcasting: A tool for involving stakeholders in local sustainability planning", Futures 40, 34–46.

The Climate Action Tracker, 2013. Retrieved from http://www.climateactiontracker.org on September 19th 2013.

CSD, 2004. Every little bit helps… Overcoming the challenges to researching, promoting and implementing sustainable lifestyles, Centre for Sustainable Development, University of Westminster, Westminster.

Demos Helsinki 2012a. Scenarios for Sustainable Lifestyles 2050: From Global Champions to Local Loops. Future Scenarios for New European Social Models with Visualisations, Retrieved from http://www.sustainable-lifestyles.eu/fileadmin/images/content/D4.1_FourFutureScenarios.pdf on September 19th 2013.

Demos Helsinki 2012b. iFuture – The Diversity of Sustainable Lifestyles. People's forum workshop summaries. Retrieved from http://www.sustainable-lifestyles.eu/fileadmin/images/content/D7.3_iFuture_report.pdf on September 19th 2013.

Department of Environment, Food & Rural Affairs (DEFRA) 2013. Framework for Sustainable Lifestyles, Centre of Expertise on Influencing behaviours. Retrieved from http://archive.defra.gov.uk/environment/economy/documents/sustainable-life-framework.pdf on September 19th 2013.

Dreborg, K. 1996. "Essence of backcasting", Futures 28 (9), 813–828.

Elzen, B., Hoogma, R., Schot, J. 1996. Mobiliteit met Toekomst; Naar een vraaggericht technologiebeleid, Adviesdienst Verkeer en Vervoer, Rijkswaterstaat, Rotterdam.

Eames, M. & Egmose, J. 2011. "Community foresight for urban sustainability: Insights from the Citizens Science for Sustainability (SuScit) project", Futures 78 (5), 769-784.

Geels, F. W. 2002. "Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study", Research Policy 31 (8–9), 1257–1274.

GLOBE international, 2013- The Climate Legislation Study (the 3rd edition). Retrieved from http://www.globeinternational.info/images/climate-study/3rd_GLOBE_Report.pdf on September 19th 2013.

Geels, F. W. 2011. "The multi-level perspective on sustainability transitions:

Responses to seven criticisms", Environmental Innovation and Societal Transitions 1, 24–40.

Höjer, M. & Mattsson, L. 2000. "Determinism and backcasting in future studies, Futures 32, 613–634.

Giurco, D., Cohen, B., Langham, E., Warnken, M. 2011. "Backcasting energy futures using industrial ecology", Technological Forecasting and Social Change 78 (5), 797-818.

Gomi, K., Ochi, Y., Matsuoka, Y. 2011. "A systematic quantitative backcasting on low-carbon society policy in case of Kyoto city", Technological Forecasting and Social Change 78 (5), 852-871.

Kemp, R., Schot, J., Hoogma, R. 1998. "Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management", Technology Analysis and Strategic Management, 10 (2),175–196.

Kuusi, O. 1999. Expertise in the future use of generic technologies – epistemic and methodological considerations concerning Delphi studies. Valtion taloudellinen tutkimuskeskus, Helsinki.

Lettenmeier, M., Hirvilammi, T., Laakso, S., Lähteenoja, S., Aalto, K. 2012.

"Material Footprint of Low-income Households in Finland – Consequences for the Sustainability Debate", Sustainability 4, 1426–1447.

Lundsgaarde, E. 2008. Building long-term scenarios for development. Methodological state of the art with an application to foreign direct investment in Africa. German Development Institute (DIE).

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

Rockström, J., Steffen, W., Noone, K. 2009. ”A safe operating space for humanity”, Nature 46, 472–475.

Raven, R. 2005. Strategic niche management for biomass: a comparative study on the experimental introduction of bioenergy technologies in the Netherlands and Denmark, Technische Universiteit Eindhoven, Eindhoven.

Rotmans, J., Kemp, R., van Asselt, M.B.A., Geels, F., Verbong, G., en Molendijk, K. 2001. Transitions & transition management: the case for a low emission energy supply. ICIS BV, Maastricht.

Schot, J., Hoogma, R., Elzen, B. 1994. ”Strategies for shifting technological systems. The case of the automobile system”, Futures 26 (10), 1060–1076.

Svenfelt, Å., Engström, R., Svane, Ö. 2011. ”Decreasing energy use in buildings by 50% by 2050 — A backcasting study using stakeholder groups”, Technological Forecasting and Social Change 78 (5), 785-796.

Urban, G. & von Hippel, E. 1988. ”Lead User Analyses For the Development of New Industrial Products”, Management Science 34, (5), 569-582.

Vergragt, P. & Brown, H. 2007. ”Sustainable mobility: from technological innovation to societal learning”, Journal of cleaner production 15 (11-12), 1104–1115.

Wack, P. 1985. ”Scenarios, Uncharted Waters Ahead”, Harvard Business Review, September 1985, 70–90.

Wangel, J. 2011 ”Exploring social structures and agency in backcasting studies for sustainable development”, Technological Forecasting & Social Change 78 (5), 872–882.

Åkerman, J. 2005. ”Sustainable Air Transport – On Track in 2050”, Transportation and Research Part D: Transport and Environment 10 (2), 111–126.

PUBLICATION III

Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures

Neuvonen A. & Ache, P.

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ABSTRACT

The need for new forward-looking tools in urban planning is immense: new functional relations and structures are now stretching beyond our capacity to 'rationally' capture modern metropolitan spaces (Neuman & Hull 2009). At the same time, cities struggle to find tools to help manage their long-term transition towards a low-carbon, resource-smart economy.

In 2006–2007, the municipalities in the Helsinki metropolitan region organised an international competition for ideas titled "Greater Helsinki Vision 2050." It drew a good number of entries in the competition stage and later helped bring together the awarded participants with local planning professionals and citizens.

This paper explores the process behind the vision-making exercise and evaluates its success in providing new tools for the long-term transition to a low-carbon, resource-smart Helsinki metropolitan region. The theoretical framework used in this paper is 'incrementalism with perspective' (Ganser, Siebel & Sieverts 1993) and its ideas on using long-term visions in the integration and coordination of incremental activities in various institutions. We perceive the backcasting scenario method (Dreborg 1996) as a tool for implementing this approach and hence interpret the case example's results through the framework of this method.

The Greater Helsinki Vision 2050 competition was an example of a vision-oriented planning process that provided new tools for bringing the 'unmanageable' metropolitan region within the scope of the manageable. The backcasting approach was deployed as a tool for emancipating stakeholders to imagine alternative futures for metropolitan spaces.

The backcasting scenario method should be considered a viable tool when managing vision-oriented planning processes: longer than usual time horizons help initiate strategic learning among stakeholders. However, in addition to civil servants, citizens and other stakeholders should be widely engaged in order to secure sustainable results.

Keywords: Vision-oriented planning, Backcasting Scenarios, Metropolitan region, Incrementalism with Perspective, Strategic learning

1. Introduction

Metropolitan regions are the urban phenomenon of our age. The concentration of people and economic activities in large metropolitan settings, with new forms of

dynamism, can be seen around the world. This rapid metropolitan development presents unforeseen challenges for urban governance: the capacity to 'configure' metropolitan development is missing, and this capacity will most likely not be found in previous, especially city-based forms of urban governance (Ache 2011).

This paper applies a framework of conceptual ideas and methods that address the challenges of metropolitan governance. The main theoretical lens of 'incrementalism with perspective' (Ganser, Siebel & Sieverts 1993) allows for a 'thick description' (Geertz 1973) of the Greater Helsinki Vision 2050 ideas competition and its subsequent vision process. In addition, we analyse how vision-oriented processes can be reconfigured using the backcasting scenario method.

We conclude that the greatest benefit from using the backcasting scenario method is that it aids strategic or higher order learning (Giddens 1984, Brown 2002, Quist et al 2011) by a variety of stakeholders and actors. It facilitates the formation of a visionary field that provides new tools for bringing previously unmanageable issues within the scope of the manageable, by increasing awareness of alternative future(s) and converting these alternatives into strategic opportunities, both at the individual level and at the level of stakeholder groups.

2. Metropolitan Development beyond the Reach of Planning

The 'Metropolitan Millennium' is here (UN Habitat, 2008). Looking at core indicators, a further concentration of people and businesses is visible in large urban settings, creating highly dynamic 'metropolitan regions' based on polycentric city agglomerations (Burdett & Sudjic, 2007; UN Habitat, 2009). With this development, Jean Gottman's Megalopolis of the 1960s has turned into a global phenomenon (Gottman, 1961). In his time, Gottman spoke of a 'megalopolis' and had (fore)seen the dawn of a 'new age', not only in terms of a dominating urban form, but especially in terms of strategic thinking – the megalopolis being the cradle of innovative ideas that could solve the problems of modern society. Fifty years later, Edward Glaeser (2012) rehearses the claim in his book, Triumph of the City – How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier. Metropolitan regions embody the success factors of the global economy in the sense that it is in these places where competition for the best talent, the greatest investment flows, and the most disruptive innovations is fiercest. On the other hand they can be seen as 'islands floating in deserts' (Veltz 2004) or 'spiky structures in geography' (Florida 2005), creating ruptures and difference, including greater divides inside that very same urban society (Fainstein, 2014).

This view, however, of an unleashed Prometheus and a city of ideas, referring to the original meaning of the megalopolis in Gottman's writing, still faces one particular challenge: the development of creative new planning and management approaches (Ache 2013). The new functional relations and structures are stretching beyond our capacity to 'rationally' capture modern metropolitan spaces (Neuman & Hull 2009). Within a relational world (Taylor 2010) a new metropolitan governance defies the traditional structures of government that originate from the era of nation states (Alanen et al 2010). From the actor point of view, the metropolitan region is not merely a territorial form but a 'transitional object' that helps mediate between, on the one hand, the actor's (internal) preferences and intentions, and on the other hand, challenges produced by the outside world (Ache 2011).

Yet it is not only the new form of urban change in metropolitan development that poses great challenges to the prevailing methods and structures of urban governance. The global problem of climate change creates a need to radically transform physical structures and functions in all societies worldwide. The EU countries have agreed to cut their GHG emission by 80% by 2050 (European Commission 2011) and the same target has also been included in most European national policies. The large majority of GHG emissions can be attributed to urban areas, regardless of whether we take the production-based or the consumption-based allocation point of view on emissions (Nevens et al. 2013). A substantial number of cities in Europe and elsewhere have set measurable and time-bound targets for cutting their emissions to a level considerably lower than that of today.

These radical emissions reduction levels (-80-95%) have lengthened the usual time horizon of the political debate and introduced future carbon intensity of technical and social systems as a relevant planning principle for cities (Neuvonen et al. 2014). Hence, the challenge goes far beyond an energy-carbon issue, covering such everyday-life territory as housing, mobility, and food as well as basic categories of society such as work, infrastructure, enterprise, and technology. If metropolitan regions are to be seen as the paramount catalysts for innovations and the global economy (as both Gottman and Glaeser suggest) it is quite evident that it is in metropolises where the dominant part of the new low/zero carbon neutral practices need to be created, tested, and introduced to the masses.

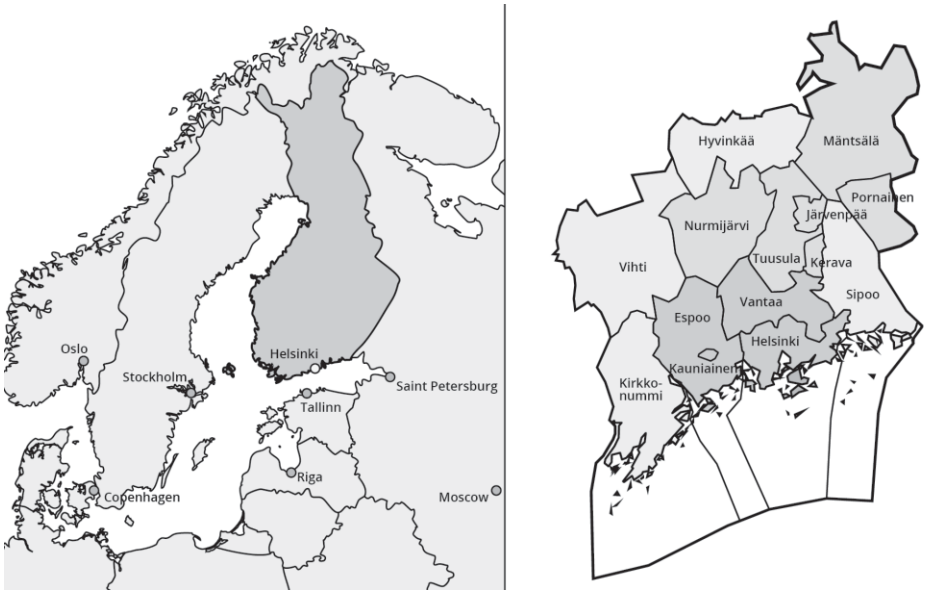

Figure 1. Helsinki on the map of Northern Europe (left) and map of the competition area and its 14 municipalities (right) (Jury, 2007).

Meanwhile, most metropolitan regions in industrialised western societies are in a situation where the paths towards renewing the city and its structures are now restricted: the replacement rate of the existing building stock is low and extensive mega-projects usually face challenges such as lack of vacant spaces, narrow funding frames, and fragmented political support. Traditionally, forward-looking policies and progressive business initiatives have been characterised by top-down planning and visible lighthouse projects that have initiated change in various corners of society (Campbell 1996). In the post-modern, networked, neoliberal, slow-growth early-21st century European societies, however, these types of 'great leaps' are much more difficult to achieve. Hence the focus now is on shifting more towards change that happens incrementally, for instance via retrofitting projects or through stimulating the local economy to create new jobs in services.

2.1 'Incrementalism with Perspective'

These types of rigid and multiplying factors often make the future perspective rather short and even evoke a sense of immobility and friction. At the same time one thing is evident: "we can only manage if we can imagine" (Ache 2011). More specifically: we will not find tools to manage and govern metropolitan regions and create new forms of urban development in quantity and quality, unless we hone our capacity to

develop our visions and alternative futures together with a diverse group of peers, experts, and other stakeholders. The quality of the metropolitan region as a transitional object (Ache 2011) and as a 'soft space' (Allmendinger & Haughton 2010) can be seen as a means of shifting focus away from the constraints of material reality (note that we do not suggest escapism here) and more towards its potential, embedded mainly in human capital, i.e. in the skills, motivations, and ambitions of people, and their capacity for collaboration. Hence we need to acknowledge some type of incremental mode of planning for post-industrial societies where an extensive built urban environment is already in place.

One such proposed approach is 'incrementalism with perspective', as practiced in relation to the International Building Exhibition Emscherpark in Germany during the 1990s (Hutter 2006, referring back to Braybrooke & Lindblom 1963; Ganser, Siebel & Sieverts 1993). The general concept operates with two basic principles, identifies a general framework that sketches out possible future development horizons, and experiments with new practices. The part relating to an incremental approach is an established position in planning theory since the 1960s; practices of stakeholder-focused planning approaches still apply this idea. However, the element of developing a perspective, which was not included in the original outline, creates tension within the concept and therefore also creative and propelling momentum. The perspective attempts to sketch out a development horizon.

As such, incrementalism with perspective can be compared with current concepts as defined above for the transition management approach. The latter aims to provide governance tools for transformations that entail systemic innovations operating between different layers and sub-systems of culture, structures and practices (Loorbach & Rotmans 2010, Nevens et al 2013). Both approaches share the experimental aspects, which have been rather prominently visible for some years now under the name 'urban labs', not only in a transition context, but also in the form of living labs in technology and innovation contexts (OECD 2006).

A particularly interesting aspect of incrementalism with perspective is of course the 'perspective' element, which in this paper is understood as being provided by a vision, an image of the future. More specifically, the vision is interpreted as a norm that is negotiated within an action arena constituted by institutional and other actors working on the vision process (Ache, 2011). In conceptual terms, we add here dimensions from the institutional analysis and development framework (Ostrom 2005). That compares, again, with ideas of transition management, where the envisioning process sets up 'a governance niche', the necessary time and space in which stakeholders can create and discuss new strategies and actions on a more

conceptual and holistic level without the usual barriers of planning practice, such as a strong command and control mode and a need to move immediately towards concrete outcomes (Nevens). The future image or vision is then composed of and complemented through incremental action by various institutions. Different types of experiments help stakeholders in connecting these alternatives with a broader narrative of the transition (Ibid).

As can be seen, both conceptual ideas share similarities but also some differences. Ultimately, the issue at hand is to explore the complex interactions of stakeholders in an open action situation with unspecified rules, distributed responsibilities and distributed resources.

How, then, can the tool of imagination bring something un-manageable, such as a relational metropolitan space, into the domain of management? Planning is and should be the 'mobilisation of hope' (Hillier & Healey 2008), and planners certainly have a 'bias for hope' (Friedmann 2002). In the current poly-centric (literal meaning) setting of societies with lots of distributed resources and responsibilities, a strong vision can give structure to hope and nudge people and actors to take a responsible step forward and re-interpret and re-adjust existing policies and practices (Ache 2013). At the core of this process is strategic learning: a process by which actors understand the surrounding conditions and structures in a new light and subsequently begin to perceive new opportunities for path-dependency breaking action (Allmendinger 2009). Beyond increased awareness of alternative futures and strategic opportunities this type of higher order learning in a visioning process can initiate new collaboration among various stakeholders that can lead to further diffusion of the vision and its adoption as a guiding image of the future (Quist et al 2011).

2.2 Case: Greater Helsinki Vision 2050

Helsinki is a smaller-sized metropolis (based on for example the OECD scale) that nevertheless shares many attributes with larger metropolises. The city is growing in population (there are currently 1.4 million inhabitants in the metropolitan region) and continues to consolidate its role as the engine of the Finnish economy while expanding beyond its old municipal governance structures. Urban sprawl, funding of big infrastructure investments, allocation of tax revenues among the municipalities, and the burden of sharing the costs of public services among these municipalities (as well as between the municipalities and the state), are all issues that contribute to Helsinki's growing need of new planning and governance tools.

At the same time Helsinki is in fierce global competition with other metropolises for both the best talent and international investments. This means that the city needs to constantly hone its international brand and present itself as an inspiring and attractive world capital. In recent years Helsinki has gained plenty of positive publicity in international media: it is consistently ranked in the top five in lifestyle magazine Monocle's Quality of Life Survey; in the top ten of The Economist's Most Liveable Cities ranking, and again in the top ten of the world's most competitive cities list, compiled by IBM's Global Location Trends report (Economist 2014, IBM 2013, Monocle 2014). All of these rankings of course represent mere reflections of the so-called relational world: highly selective content marketing that is sponsored by the very cities and companies that are profiled on its pages. Additionally, Helsinki gained lot of attention in the international press during its year as World Design Capital in 2012. If nothing else, this media attention demonstrates that Helsinki is gaining a good international reputation as a metropolis – and that the symbolic value of Helsinki is of importance to its leaders.

In 2006 the international ideas competition "Greater Helsinki Vision 2050" (GHV2050) was jointly announced by the region's fourteen municipalities, in cooperation with the Ministry of Environment and the Finnish Association of Architects. The aim of GHV2050 was to create a joint vision for the sustainable development of land use, housing and transportation. The basic assumption of the brief was a rate of population growth similar to that of recent years, leading to an estimated total of 1.8 million inhabitants by 2050. At the same time the competition brief acknowledged the impact of global societal trends. The following changes and challenges were listed in the brief: climate change, strain on ecosystems, sufficiency of capital for future investments, changing structure of enterprises and industries, attractiveness of urban spaces, spaces that enhance wellbeing, tension between spaces of creativity and safety, places for tolerance and equality, and places that support the potential of every child. The brief also specifically addressed that Helsinki needs to build a stronger brand for itself and create stronger clusters of innovation that will help it succeed in global competition. (Jury 2007).

Altogether 109 entries were submitted in 2007. Out of these, nine entries received awards, which were presented in December the same year. According to the jury protocol, the competition assignment proved difficult. Hence the spectrum of entries was broad and their emphases varied considerably (Ache 2011).

3. Greater Helsinki Vision 2050 as a Case Study on Vision-Making and Backcasting

This article presents and discusses conceptual ideas on the vision-making processes used in GHV2050. It builds on the documentation of the GHV2050 process previously published in Ache (2011). The authors of the current article take this further by adding 'incrementalism with perspective' as an approach that could serve as a generic model on which to develop the governance of metropolitan regions. However, what is still needed are tools and methods through which imagination by individuals can be conjoined into a shared 'perspective' or 'vision'. Previously we have suggested such models as 'territorial response capacity' (Ache 2011), in which expertise, foresight, norms, and strategy have been chosen with one uniting interest, and 'emancipatory backcasting' (Neuvonen et al. 2014), which aims not to identify, but rather to include the key actors and to empower them with understanding of their respective roles in the formation of sustainable futures. Hence, in addition to the main idea of 'incrementalism with perspective', the "Greater Helsinki Vision 2050" process will in this paper be analysed as an exercise of 'emancipatory backcasting'.

3.1. Method: Backcasting Scenarios

To facilitate the understanding of the underlying logic of society-wide transformations, such as the emergence of the low-carbon society in a metropolitan context, different types of future scenarios are used. Because the context of a transformation is defined by the long-term target (e.g. emissions level in 2030 or 2050), the scenarios are usually constructed following the so-called backcasting approach: looking back from a future where a desired goal has been met and creating decisive steps and pathways from that vision back to the present day.

Ever since its spreading to wider use in the 1990's, the term 'backcasting' has referred both to a conceptual approach on backwards-looking analysis and to a more operational methodology (Robinson et al. 2011, Quist et al. 2011). Many authors have justified the need for this type of a normative scenario approach by referring to historical circumstances and emerging disruptions in that development (Quist & Vergrat 2006; Dreborg 1996). Backcasting is a relevant option when forecasting studies indicate that long-term developments seem to lead to undesirable outcomes (Höjer & Mattsson 2000). Backcasting scenarios allow for new options to be considered, thus widening the perception of what could be feasible and realistic in the long-term (e.g. Dreborg 1996; Höjer & Mattsson 2000; Neuvonen et al. 2014). Furthermore, backcasting exercises can bring about higher order learning at group

level that is often linked to an emergence of spin-off and follow-up activities (Quist et al. 2011).

To this day, the majority of scenarios on urban futures focus on technical systems (e.g. large energy and transportation systems) and are by definition target-oriented, concentrating on normative, quantitatively-defined goals and answering the question "what can change." This approach can be contrasted with 'pathway-oriented backcasting' and 'action-oriented backcasting'. Pathway-oriented backcasting bridges the gap between the mere technical possibilities of today and the actions of tomorrow, answering the question "how can change take place?" In action-oriented backcasting, the "what" and the "how" are being complemented by exploring answers to the question "who could make the change happen". This is done through identifying actors and stakeholders. (Wangel 2011). Emancipatory backcasting is an application of action-oriented backcasting that focuses on the perceptions and motivations of 'gatekeeper stakeholders'. It aims to provide stakeholders with a deeper futures perspective on activities they themselves initiate and undertake. (Neuvonen et al. 2014).

In emancipatory backcasting the transformation towards desirable futures is thought to require innovation spurts and greater engagement of the different stakeholders in society, as opposed to mere regulation and top-down control. In this sense it helps provide an understanding of cities and metropolitan regions as transitory, soft spaces. This is essentially the same goal as that of the 'incrementalism with perspective' approach: to provide tools for governance that carry out larger-scale yet gradual changes in contexts where classic management or complete control is impossible.

In previous studies impacts of similar, action-oriented backcasting experiments have been analysed by dividing the results into three categories: (1) network formation, (2) future visions, and (3) institutionalisation. These categories are derived from various network theories that aim to characterise the forms of relationships, learning and other types of influence among participants. Network formation is analysed through variables of actors, activities and resources. The role of future visions is seen in the shape of 'guidance' and 'orientation'. Institutionalisation depicts institutions, practices and rules. (Quist et al. 2011).

In the following sections of this paper, we describe the GHV2050 process in three stages: the competition entries, the contest's follow-up process in 2008, and the post-follow-up process in 2009-2015. In what follows, we analyse the case of GHV2050 and look at its different stages with regard to how those stages exemplified the idea of "incrementalism with perspective" and how it was

operationalised with the help of the backcasting approach, creating changes in network formation, emergence of a future vision and institutionalisation. All the while of course acknowledging the fact that the process was neither originally nor officially planned as an exercise in backcasting methodology.

3.2 GHV2050 Competition Entries – formulating futures

The general focus of the GHV2050 competition entries was in depicting alternative futures for the Helsinki metropolitan region, its global status and overall competitiveness in the global economy. In more detail, the proposals looked at different models for regional spatial structure, proposed more sustainable transport and residential solutions, and explored new models of governance and cooperation (Ache 2011).

The winning entry Emerald focused strongly on re-defining the 'urban form' for the metropolitan space. The team developed an urban program comprising of several layers from building programs to infrastructure systems to green spaces. Out of the three second-ranked contestants, Boundary Strips was concerned mainly with a new definition of the relationship between nature and urban fabric and the development of 'edges', Holistic Uniqueness on the conceptualisation of different functional urban spaces, and Towards City 2.0 tried to reach beyond the built form depicted the metropolis as a 'social silicon valley' (City 2.0) that creates a 'super diversity' and fully employs its citizens and their creative potential. (Ache 2011). [5]

Most entries addressed future megatrends and the most frequently mentioned factors were climate change, ageing population, rise of health and environmental awareness, ethical consumer behaviour, diversification and the individualisation of lifestyles, changes in the nature of paid employment, and increases in work-based mobility (Ache 2011). The proposals were often built around measures that would provide the metropolitan region with either new spatial or new governance structures (Ache 2011). Among these mentioned regional spatial structures was the so-called finger model (based on the Copenhagen example, see Miljöministeriet 2007; Vejre, Primdahl & Brandt 2007), offshore extensions to the sea, and green corridors or 'islands' excluding parts of the land from building and thus securing ecosystem services.

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[5] For detailed descriptions on the competition entries consult the jury report: http://www.safa.fi/document.php?DOC_ID=477&SEC=3b7e84702d5cd67f9d9cc253bb456b30&SID=1#ghv_www_protocol_english.pdf

In order to secure the necessary implementation power for this kind of macro-level planning, many proposals suggested that municipal borders be either completely removed or at least loosened through inter-municipal cooperation. A wide range of softer (information and negotiation) governance tools were proposed to complement these comprehensive administrative tools: various regional electronic databanks, guide books, and collaborative forums were suggested that would help promote activity, market the region, and facilitate planning.

However, behind these rather traditional top-down tools, one could also see ideas on citizen participation, branding, and communications that would initiate new thinking, action, and shaping of identities among the residents and other stakeholders. Hence the entries gave rather detailed thought to the names and the general organisation of the different cooperative bodies, going as far as to rethink their logos.

In interpreting all of this, it is quite evident that over the course of history large-scale building projects and reforms on governance structures have served the purpose of communicating messages to the people on the direction of change. Thus the idea of casting a perspective with the intention of engaging stakeholders into future-oriented action has been present before. If not necessarily in the direct sense of creating a 'soft space', that would initiate imagination (Allmendinger & Haughton 2010), then at least in the sense of producing a platform for 'hard space', showing the way for the rest of the activities.

3.3 The Follow-up Process

A follow-up project was launched after the competition. It was set up thanks to a suggestion by the jury: the jury did not follow the classic decision of identifying just one winner but instead invited all of the winning proposals to work together on an integrated vision. What followed was a process that could in itself be called backcasting: it (1) set a horizon of desirable alternative futures in the form of competition entries, (2) offered ingredients for constructing the necessary steps towards those futures (in the form of separate ideas identified from the competition works), and (3) engaged stakeholders of the metropolitan region to envision alternative processes towards those futures and ultimately to formulate one 'integrated vision'.

The main part of this follow-up process took place within thirteen months from the end of the competition. The process consisted of a deeper analysis on the

winning entries, a workshop with experts, and open communication with the public (Ache 2011.).

At the start of the follow-up process, the research team – consisting of the winning team's representatives, one of the three second-place teams, and a group of university researchers – analysed and restructured the elements in the competition works. More than 250 different 'ideas' were identified. Further, the research team identified synergies between these ideas: solutions that would provide potential answers to the great societal challenges already visible today. These ideas and thematic 'ideas flocks' formed the material for a series of workshops, in which city officials, the nine prize-winning teams, other planning experts, and citizens together evaluated the proposals in light of current economic, social, and pending environmental challenges (Helsingin seutu 2050 ; Ache 2011).

By far the biggest of these workshops was the expert workshop for city officials, prize-winning teams, and other regional planning experts. This workshop was supposed to elaborate on the elements for a regional vision and strategy, using the selection of ideas as a starting point. The session was initiated with a role-play session in which the participants were asked to adopt the point of view of a fictional future metropolitan citizen and evaluate the idea from that position. Based on the resulting descriptions the experts then assessed the ideas from their main professional role.

In the second part of the workshop, participants had to 'evaluate' the ideas in the context of future challenges, and based on this, discuss the elements of and solutions to an integrated vision. The future challenges were formulated in the following way: facing a multicultural society, finding a new work-life balance, heading towards a low-carbon society, confronting the multiplication of lifestyles and values, improving the quality of the environment, and strengthening global competitiveness. The workshop resulted in initial evaluations on how the ideas could provide solutions to the listed challenges, and in addition to that, created generic evaluation criteria for the solutions of the same challenges.

How should one then understand this process from our chosen vantage point of 'incrementalism with perspective' and 'backcasting'? The workshop and its role-play intended to immerse the experts in the desirable future, and thus enable them to examine from a future point of view the criteria and conditions under which that vision could be realised. Positioning them back to their expert roles and evaluating the same ideas again from that old standpoint was a way to create awareness on the necessary and sufficient elements needed to create the pathways between the years 2007 and 2050. This is essentially the desired effect of backcasting scenarios:

widening the horizon of the possible and providing enhanced understanding on the time-scales of development.

The workshop can thus be considered in some respects as a 'learning event'. It achieved a mutual confirmation of ideals for desired situations. On the other hand, the workshop also included elements of 'un-learning', which is equally important as Neuman and Hull (2009) remind us. In planning, un-learning is often about breaking well-known paths, escaping mentally from one's 'path dependency' (Ache 2011). It is the realisation that the future is not determined, but rather a result of (political) choices based on values (Robinson 1988). The workshop enabled the experts to question with each other whether widely-accepted solutions from past decades (for instance, the prioritisation of low-rise buildings in the densification of residential areas) would still be relevant in the future. As a group process taking place in a peer group of professionals, it can be seen as resulting in higher order learning that potentially paved the way for further steps of the vision process (see 3.4) (Brown et al. 2003, Quist et al. 2001).

The expert workshop was complemented by three shorter, open workshops for citizens as well as online discussion. These activities too were based on the idea of assessing the ideas extracted from the competition entries. The vision material and the ideas with the most potential were compiled together into a final report, which provided ingredients and acted as basis (like the title of report "Näkökulmia seutuvisioon" - "View-points to a regional vision" suggests) for the continuation of the vision process. The report also utilised the backcasting approach: it presented the highlighted potential key implementation activities with a number of ideas from the competition works in the form of a future timeline, thus building bridges between inspiring future visions and the more immediate and attainable steps.

However, the follow-up process neither resulted nor was expected to result in a single vision statement that would be shared by the 14 municipalities in the Greater Helsinki Region. Instead it initiated a new network and a dialogue on the issues that the forthcoming vision should tackle, thus expanding the scope of the visionary field. The report of the process was sent to and received by the Land-Use, Housing and Transport Collaboration Group of the 14 municipalities, but did not lead to any formal decisions.

3.4 The Post-Follow-Up Process

The action arena initiated in the GHV2050 follow-up process finally gave rise to a number of initiatives that partly converged towards other processes of the visionary field. The GHV2050 process took place parallel to an existing context that included a substantial number of institutions and stakeholders. Between 2003 and 2011 the municipalities of the Helsinki metropolitan region in different constellations and different departments of the national government also worked on visions and strategies covering different sub-topics (economy and competitiveness; public service provision; traffic systems; land use; environment; governance and public participation). The different strategies, visions, expert networks and processes around them can be considered a 'visionary field' within which a co-evolution between different ideas could gradually emerge (Ache 2011).

At the end of 2009 the municipalities agreed on a common vision for the region. The shared vision states that

The Helsinki Region is a dynamic world-class centre for business and innovation. Its high-quality services, arts and science, creativity and adaptability promote the prosperity of its citizens and bring benefits to all of Finland. The Metropolitan Area is being developed as a unified region close to nature where it is good to live, learn, work and do business. The harmonious urban structure of the region is based on public transport; it is versatile in its operations as well as eco-efficient and low carbon. The compact core area is encircled by a network of distinctive centres. (Helsingin seudun yhteistyökokous 2009).

This vision states rather obvious and commonly held views on the strengths and desirable directions of development for any European metropolis. Hence the GHV2050 did not result in an outcome that would make it stand out from all the other city and metropolitan visions in the world. Yet the vision has indeed provided a steady platform for formalising (and potentially also institutionalising) the structures of cooperation. One piece of evidence of this is that the 14 municipalities have adopted a shared brand, calling themselves the 'Helsinki Region' (omitting the word 'Greater'). There is now also a website for the Helsinki Region that serves both as a service database for citizens and as an information channel for regional cooperation (Helsinki region 2016).

Figure 2. This is the Helsinki region 2050 – A road map to the better city. Examples of short-term and long-term actions. Many of them based on the ideas of competition". A future timeline presenting the implementation activities for 2008–2050 as envisioned in the GHV2050 follow-up process, from the report Helsingin seutu 2050.

However, the vision and the brand built around it were just one of the many components of the Greater Helsinki Region process towards new forms of metropolitan governance. After the follow-up process in 2008, the 14 municipalities of the Helsinki Region have produced the first iterations of a joint process for their strategic planning. There are three parallel planning processes currently running in the municipalities of the Helsinki Region: one on land-use, another on housing and a third on transportation. The shared land-use agreement for the Helsinki Region was approved by the 14 municipalities and the national government in June 2016. Its implementation time frame is until 2025, with generic frames for urban and regional structures running until 2050. The emphasis of this work is in assessing the impacts and prioritising the areas in which to build. (Helsingin Maankäyttösuunitelma 2014).

With regard to housing, the previous agreed goal among the municipalities was to build 12500 new flats annually. This target has been updated in the joint housing strategy, completed in 2015.

The regional transportation system plan has a longer history, dating back to the pre-GHV2050 era. The new transportation system plan was completed in 2015. (Helsingin seudun liikennejärjestelmäsuunnitelma 2015)

Meanwhile the political debate both on the regional and on the national level has dealt with forming legally-authorised governance structures for the metropolitan region. In national politics, the reforming of municipal structures countrywide has been one of the biggest and most complex debates in recent years. None of the coalitions so far have been able to formulate clear suggestions on the needed reform.

At the end of August 2014 the coalition presented a model that would have introduced a new layer of administration to the Helsinki metropolitan region. The model included a regional council that would be elected by popular vote but would not have the authority to collect taxes. This model received plenty of criticism from the municipalities involved, and with the general elections approaching in April 2015, the prime minister's party decided to withdraw the proposal in February 2015. Hence it was left to the forthcoming coalition to decide whether the suggested model for deeper cooperation between the 14 municipalities would be reconsidered or if an alternative model would be developed in its place.

To return to our point of departure, incrementalism with perspective and backcasting, we ask: are there any examples to be seen of the approach or the method? It is quite apparent that the processes have converged towards the standard arenas of regional governance, existing structures of land-use, and transportation planning. However, once the issues started to gradually move along the traditional path (land-use and transportation planning processes, reform and institutionalisation of regional governance structures) the more holistic and comprehensive approach on society-wide change took theback seat. In other words, the visionary field was first intentionally expanded both in terms of issues and participants, only to then be followed by a phase of convergence towards the traditional agenda and level of engagement.

Yet the planning criteria (approved in April 2014), applied to both land-use and the transportation system plan, still retains a backcasting-like approach to long-term change. These criteria determine the plans to be presented in the form of a long-term structural plan (reaching beyond 2050) as well as an implementation plan (up until 2025). It is also specified that there should be a vision for the solutions that are hoped to be reached by year 2040. (Helsingin seudun yhteistyökokous 2014)

Previously the long-term vision had no formal status in the Finnish planning system, nor had it been stated that there should be several separate interim goals on the way towards this vision. In this respect we once again come across the idea of

setting a 'perspective' and backcasting, or tracing it gradually along the timeline towards the more immediate future, where concrete solutions can begin to be implemented.

4. Visioning - impact on planning process and visionary field

Our argument emphasises the role of the vision as a communicative device, challenging and encouraging stakeholders to take on new responsibilities in advancing that envisioned and desired future. The central purpose of the vision is to collect and consider together the views of decision-makers, experts, and the general public on the future of the region, strengthening expert networks and thereby committing all those parties to the vision's implementation. Communicating that vision and achieving buy-in for it from everyone is a long-term project and requires continuous dialogue and interaction with the public.

In section 3.2 we presented three categories for analysing the influence of a vision-oriented backcasting scenario exercise. Looking at those dimensions, the GHV2050 process reveals similarities as it contributed to (1) network formation, that was mainly organised around working on (2) a future vision on different levels of abstraction, and with rather explicit goal of (3) institutionalising the collaboration in a new metropolitan governance for the Helsinki region.

A substantial part of the GHV2050 process was focused on building the planning professionals' ownership of the shared vision and its elements. In the follow-up workshop, the experts had the opportunity to explore those vision elements, extracted from the competition submissions, and to attempt to compose a shared vision based on them. It was a communicative approach that made an effort to grasp the central intentions of the experts and to critically validate the vision elements from their point of view (Ache 2011). This can be interpreted as a learning process within the peer group of participating professionals that brought their prevailing images of the future closer to each other's. The further the (post-)process progressed, the more the competition entries came to be understood as new explorations into the built forms of the metropolis of the future. In this sense it can be argued that the vision had an 'implicit' or 'catalytic' effect on the governance of the Helsinki Region. It gathered and ignited a new network of like-minded civil servants around an innovative, shared agenda and shared images of the future. Perhaps this 'emergent agenda' (Mintzberg 1994) can sustain the processes in Helsinki Region's long-term planning despite coming and going political impasses, thus making the process of metropolitan level planning more robust to political change.

When we compare these results with other similar reported cases (Quist et al 2011) we can claim that stakeholder involvement was intense but focused strongly on a narrow group of experts whilst not paying very much attention on engaging the wider public. The work resulted in a single vision (something that is usually considered to enhance the stakeholders' attachment to the vision) that was finally rather technical, if not uninspiring and therefore did not provide a tool that would help in embedding the shared goals in the stakeholder organisations. However, subsumed under the very generic vision formulation there are a number of long-term goals that define the numerous sub-programs and strategies within the visionary field, listed in chapter 3.4 on the The Post-Follow-Up Process. Finally, institutionalisation has taken place while the vision process has initiated several (albeit loose) new governance entities (also mentioned in chapter 3.4) endorsed by the municipalities and the state. Yet these structures have not provided very substantial protection to the vision approved in 2009 and its function as a tool for regional governance seems marginal. However, within the same 'visionary field' municipalities have agreed on a number of strategic goals on land-use and housing that have gradually replaced the original vision as symbols of their shared long-term imagination.

A kind of 'visionary field' emanates from various institutions and actors – there has to be some kind of ownership and definition of the field in question. Therefore the resulting visions correspond at least partially to agreed functions and perform the specific tasks assigned to their respective institutions. Some of the agendas around the visions can be considered 'free format', stretching the existing administrative and political horizons. In this sense, an outward-looking vision exercise carries a learning function, not only on the level of individuals but also as joint learning among regional actors who share a new definition of the problems and solutions available (Brown et al 2003, Quist et al 2011) . In principle, we have no reason to assume a definitive limit on how long this learning process can last. Usually, though, the limiting factor is embedded in the implementation capabilities of the actors themselves: most of the resources in institutions are tied to old problems and thesis solutions, meaning that actors lack the resources to explore innovative solutions to emerging challenges (Auerswald 2012).

5. Conclusion and questions for further research

In this paper we assess the "Greater Helsinki Vision 2050" process from the point of view of the 'incrementalism with perspective' approach, and further, try to

interpret it as an example of backcasting. We analyse whether processes like the GHV2050 could be used as new tools for governance in metropolitan regions, and whether they could play a greater role in solving the wicked problems of the metropolises of tomorrow.

Looking at the process through our conceptual framework of 'incrementalism with perspective', it seems that the GHV2050 in particular initiated a visionary field for the development of the metropolitan region. By using vision-making as a new planning process, the metropolitan space, as composed of fourteen in(ter)dependent but not jointly managed municipalities, came into the scope of the manageable. For the period of the ideas competition and especially the follow-up processes, a metropolitan action arena was created. GHV2050 started with the 'usual suspects' and traditional institutions, but failed to integrate new ones. Hence, the idea of a vision as a tool for bringing in new resources and stakeholders, that could create an augmented form of metropolitan governance and subsequently increase territorial response capacity, was not fully exploited in the process.

Based on our observations, the vision making and backcasting approach was deployed in GHV2050 primarily as a tool for emancipating existing key stakeholders (or the planning professionals from the 14 municipalities), allowing them to imagine alternative sustainable futures for their metropolitan spaces and to identify the essential steps needed to achieve those desirable goals. The process thus prepared them for the forthcoming macro-level changes in their operating environment. To this end it is an example of emancipatory backcasting (Neuvonen et al. 2014), or pathway-oriented backcasting (Wangel 2011). In other words it does not focus on mere technical possibilities, but aims to function more as a bridge towards future-oriented action. Hence, what resulted from the process was strategic learning (Hay 1995, cited in Allmendinger 2009), in which the actors involved re-interpreted their surrounding structures, consequently opening them up to new opportunities (and constrains) for action and potentially initiating new avenues for collaboration (Quist et al 2011).

However, the element of strategic learning in the overall GHV2050 process would probably have been substantially stronger had there been a more ambitious and well-integrated method behind it. In particular, engaging citizens and other stakeholders in addition to civil servants needs to be mentioned here. Achieving this could have potentially resulted in wider action and greater impact reaching well beyond institutional structures.

Finally, as the example also shows, the specific vision process under consideration was from its inception embedded in a wider field of vision and strategy-making

(Ache, 2011). Whereas the process itself aimed to be (and also succeeded as) a learning process, it also experienced a setback in its subsequent stages, which returned to classic formats and implementation processes. As has been shown, this reflects the power of existing institutional structures and inertias. There is an ongoing discussion on reforming these structures by merging the fourteen municipalities (and the entire region) into a single, new metropolitan organisation. In a way, a metropolitan action arena opened up but did not fully unfold. However, in our view the issue at hand is not to create a mere superstructure perpetuating an existing framework, but instead, to initiate more and deeper vision making processes, and with this unleashing – returning to Gottman's words – the 'Prometheus' and creating a metropolis of ideas.

REFERENCES

Ache, P. (2011). 'Creating futures that would otherwise not be'– Reflections on the Greater Helsinki Vision process and the making of metropolitan regions, Progress in Planning 75, 155-192. doi:10.1016/j.progress.2011.05.002

Ache, P (2013). Between vision and response capacity – configuring metropolitan development, inaugural speech by Prof. Dr. Peter Ache. Available from: Radboud Repository. [5 September 2014].

Alanen, O., Hautamäki, A., Kaskinen, T., Kuittinen, O., Laitio, T., Mokka, R., Neuvonen, A., Oksanen, K., Onnela, S., Rissanen, M., Vassinen, S., Viljanen, V., (2010). The Well-Being of the Metropolis, Helsinki: Demos Helsinki,.

Allmendinger, P. (2009). Planning Theory (2nd edition). Basingstoke: Palgrave Macmillan,.

Allmendinger, P., & Haughton, G., (2010), 'Spatial planning, devolution and new planning spaces, Environment and Planning C: Government and Policy 28, 803-818. doi:10.1068/c09163

Auerswald, P. (2012). The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy. New York: Oxford University Press.

Braybrooke, D. & Lindblom, C. (1963). A strategy of decision. Free Press : New York

Burdett, R.., & Sudjic, D. (Eds.). (2007). The Endless City. The Urban Age Project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society. London: Phaidon.

Campbell, S., (1996). 'Green Cities, Growing Cities, Just Cities? Journal of the American Planning Association 62 (3), 296-312. doi:10.1080/01944369608975680

Dreborg, K., (1996). Essence of backcasting. Futures 28, (9), 813–828. doi:10.1016/S0016-3287(96)00044-4

Economist (2014). 'The best places to live', The Economist daily chart 19 August. Retrieved from: <www.economist.com>. [6 September 2014].

European Commission (2011). A Roadmap for moving to a competitive low carbon economy 2050. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Retrieved from: EUR-Lex. [6 September 2014].

Fainstein, S. S. (2014). The just city. International Journal of Urban Sciences, 18(1), 1-18. doi:10.1080/12265934.2013.834643

Florida, R., (2005) The World Is Spiky. The Atlantic Monthly October 2005, 48-51.

Friedmann, J., (2002). The prospect of cities. Minneapolis: University of Minnesota Press,.

Fuenfschilling, L., & Truffer, B., (2014). The structuration of socio-technical regimes – Conceptual foundations from institutional theory. Research Policy 43, 772-791. doi:10.1016/j.respol.2013.10.010

Ganser, K., Siebel, W., & Sieverts, T. (1993). Die Planungsstrategie der IBA Emscher Park - Eine Annäherung,. RaumPlanung 61,112-118.

Geels, F. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy 31 (8–9), 1257–1274. doi:10.1016/S0048-7333(02)00062-8

Geels, F. (2011) The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions 1, 24–40. doi:10.1016/j.eist.2011.02.002

Geertz, C. (1973). Thick Description: Toward an Interpretive Theory of Culture., in The Interpretation of Cultures: Selected Essays (pp. 3-30). New York: Basic Books.

Giddens, A.(1984). The Constitution of Society. Outline of the Theory of Structuration. Cambridge: Polity Press.

Glaeser, E. (2012). Triumph of the City. Pan Macmillan.

The Global Commission on the Economy and the Climate (2014). Chapter 2: Cities. in Better growth, better climate: The new climate economy report. http://newclimateeconomy.report/2014/wp-content/uploads/2014/08/NCE-cities-web.pdf

Gottmann, J. (1961). Megalopolis. The urbanized Northeastern Seaboard of the United States. Cambrigde (MA): M.I.T. Press.

Government Office for Science (2010) Land Use Futures: Making the most of land in the 21st Century, Executive Summary. London.

Haughton, G., Allmendinger, P., Counsell, D., & Vigar, G. (2010). The new spatial planning. Territorial management with soft spaces and fuzzy boundaries. New York: Routledge.

Hay, C. (1995) Structure and Agency: Holding the Whip Hand. in D. Marsh and G. Stoker (eds), Theory and Method in Political Science. London: Macmillan.

Helsingin Maankäyttösuunnitelma (2014). Maankäytön, asumisen ja liikenteen seutuyhteistyö. Helsingin Maankäyttösuunnitelma. Retrieved from : <http://www.helsinginseutu.fi/hki/HS/Maankayttosuunnitelma/Maankayttosuunnitelma/mika+mal>. [6 September 2014].

Helsinki region (2016). Cooperation in the Helsinki Region. Retrieved from: <http://www.helsinkiregion.fi/www/HS/en/cooperation/> [4 July 2016]

Helsingin seudun liikennejärjestelmäsuunnitelma (2014). HLJ 2015. Retrieved from : <https://www.hsl.fi/hlj>. [6 September 2014].

Helsingin seudun yhteistyökokous (2009). Helsingin seudun visio. Retrieved from : <http://www.helsinginseutu.fi/hki/hs/helsingin+seutu/yhteisty_elimet/helsingin+seudun+yhteisty_kokous/helsingin+seudun+visio>. [6 September 2014].

Helsingin seudun yhteistyökokous (2014). Helsingin seudun yhteistyökokouksen esityslista 13.5.2014. Retrieved from : <http://www.helsinginseutu.fi/hki/hs/Helsingin+Seutu/Yhteisty_elimet/Helsingin+seudun+yhteisty_kokous/Esityslistat/El+Hsyk+1+2014>. [6 September 2014].

Helsingin seutu 2050 – Näkökulmia seutuvisioon. Jatkotyö Greater Helsinki Vision 2050 -kansainvälisen ideakilpailun palkittujen töiden pohjalta (2008). Helsingin kaupungin talous- ja suunnittelutoimiston julkaisuja 5/2008. Helsinki.

Hillier, J., & Healey, P., (eds.) (2008), Foundations of the planning enterprise. Critical essays in planning theory (vol. 1),. Aldershot: Ashgate,.

Hutter, G. (2006). Strategische Planung. Ein wiederentdeckter planungsansatz zur Bestandsentwicklung von Städten. RaumPlanung 128, 210-214.

Höjer, M., & Mattsson, L. (2000). Determinism and backcasting in future studies. Futures 32, 613–634. doi:10.1016/S0016-3287(00)00012-4

IBM Institute for Business Value (2013). Global Location Trends – 2013 annual report. Retrieved from: <www.ibm.com/iibv>. [6 September 2014].

Jury (2007). Greater Helsinki Vision 2050 – International Ideas Competition, Jury Protocol. Helsinki: SAFA.

Massey, D. (2005). For Space. Oxford: Blackwell.

McCann, E. (2001). Collaborative Visioning or Urban Planning as Therapy? The Politics of Public-Private Policymaking. The Professional Geographer53 (2) 207-218. doi: 10.1111/0033-0124.00280

Miljöministeriet (2007). Fingerplan 2007. Landsplandirektiv for hovedstadsomradets planlaeging. Copenhagen: Miljöministeriet,

Mintzberg, H. (1994). The rise and fall of strategic planning. New York: The Free Press,.

Monocle (2014) Quality of Life Survey 2014 (video), Retrieved from: <http://monocle.com/film/affairs/quality-of-life-survey-2014/>. [6 September 2014].

Neumann, M., & Hull, A. (2009). The futures of the city region. Regional Studies 43 (6), 777-787. doi: 10.1080/00343400903037511

Neuvonen, A., Kaskinen, T., Leppänen, J., Lähteenoja, S., Mokka, R., & Ritola, M. (2014). 'Low-carbon futures and sustainable lifestyles: A backcasting scenario approach. Futures 58, 66-76. doi: 10.1016/j.futures.2014.01.004

OECD. (2006). Competitive cities in the global economy. OECD Territorial Reviews. OECD Publishing.

Ostrom, E. (2005). Understanding Institutional Diversity. Princeton, New Jersey: Princeton University Press.

Quist, J., Vergragt, P. (2006). Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework. Futures 38 (9), 1027–1045. doi:10.1016/j.futures.2006.02.010

Quist, J., Thissen, W., Vergragt, P. (2011). The impact and spin-off of participatory backcasting: From vision to niche. Technological Forecasting and Social Change 78 (5), 883-897. doi: 10.1016/j.techfore.2011.01.011

Rittel, H., Webber, M. (1973). Dilemmas in a general theory of planning. Policy Sciences 4 (2), 155-169. doi: 10.1007/BF01405730

Robinson, J. (1988). Unlearning and Backcasting: Rethinking Some of the Questions We Ask about the Future. Technological Forecasting and Social Change 33, 325-338. doi:10.1016/0040-1625(88)90029-7

Robinson, J. Burch, S., Talwar, S., O'Shea, M., Walsh, M. (2011). Envisioning sustainability: Recent progress in the use of participatory backcasting approaches for sustainability research. Technological Forecasting and Social Change 78, 756-768. doi: 10.1016/j.techfore.2010.12.006

Taylor, P. (2004). World city network. A global urban analysis. London: Routledge.

UN Habitat (2008). State of the world's cities 2010/2011. Bridging the urban divide. London: Earthscan.

Vejre, H., Primdahl, J., & Brandt, J. (2007). The Copenhagen finger plan. Keeping green space tructure by a simple planning metaphor. in B. Pedroli, A. Van Doorn, G. d Blust, M.L. Paracchini, D. Wascher & F. Bunce (eds) Europe's Living Landscapes,, (pp. 310-328). Zeist :KNNV Publishing.

Veltz, P. (2004). The rationale for a resurgence in the major cities of advanced economies. Paper presented at The Resurgent City, Leverhulme International Symposium 2004.

Wangel, J. (2011) Exploring social structures and agency in backcasting studies for sustainable development. Technological Forecasting & Social Change 78 (5), 872–882.

WSP Finland, Demos Helsinki & YTK (2008). Greater Helsinki Vision 2050. International ideas seminar, Summary report. Helsinki: WSP Finland.

PUBLICATION IV

The New Normative: Synergistic Scenario Planning for Carbon-Neutral Cities and Regions

Ravetz, J., Neuvonen, A., Mäntysalo, R.

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ABSTRACT

Carbon-neutral targets are a 'new normative' for cities and regions around the world. Such targets call for rapid system transformations, beyond the normal remit of urban-regional planning. In response we propose a framework of theory and practice, in three parts: 'trading zone' concepts for collaborative planning; 'scenario back-casting' for longer horizons; and 'synergistic thinking' for systems transformation. We demonstrate this with the carbon-neutral journey of Greater Manchester. The results suggest the 'new normative' for cities and regions can be greatly facilitated by 'synergistic scenario planning', in theory and practice.

Keywords: Back-casting; trading zone; boundary object; net-zero; carbon-neutral: collective intelligence; Greater Manchester

INTRODUCTION

"Transformative changes in transportation networks, energy systems, commercial centers, neighborhoods and even governance practices are essential to meeting the challenge of cutting greenhouse gas emissions at least 80% by 2050" (Carbon Neutral Cities Alliance 2016). The imperative of cutting carbon emissions to 'net-zero' or 'neutrality' in just one generation, calls for a rapid expansion in the scope of urban and regional planning. System level socio-technical transformations are needed in the energy, transport, industry and buildings sectors, far beyond the normal spatial or economic planning remit. The transformation imperative constitutes the 'new normative' for urban-regional planning – but as yet the implications are unclear and contested.

The carbon neutral goal (also termed 'net-zero') is defined by the Carbon Neutral Cities Alliance (hereafter 'CNCA'), as a city or region where the net greenhouse gas emissions 'associated' with that territory, are zero or less (Plastrik and Cleveland 2019). In technical terms this can be achieved, either by changing the energy mix (supply or demand) within the boundary, generating excess renewable energy ('energy positive'): or by purchase or management of carbon offsets elsewhere. The concept links to the Greenhouse Gas Reporting Protocol (2016), which includes Scope 1 emissions (within the boundary), Scope 2 emissions from electricity generated elsewhere, and Scope 3 emissions 'embedded' in goods and services. In engineering terms the way forward seems quite feasible: decarbonize fuel sources and power generation on the supply side, increase efficiency on the demand side,

while managing land-use, waste and other greenhouse gas sources. But in reality each system and subsystem is complex and conflicted, a multi-level array of social, technical, economic and political challenges and uncertainties. The different carbon neutrality options and emissions 'scopes', with typical agendas for urban-regional stakeholders, are summed up in Table 1.

INSTITUTIONAL AGENDAS	PUBLIC SECTOR POLICY & PLANNING	PRIVATE SECTOR / PARTNERSHIP	WIDER PUBLIC & CIVIC SOCIETY
Carbon neutrality (a): via positive (exported) renewable energy	Local energy resource planning	Local energy resource planning	Local energy resource planning
Carbon neutrality (b) via carbon offsets / sequestration / other	Incentives & standards for energy firms	Incentives & standards for energy firms	Incentives & standards for energy firms
SCOPE 1: on-site direct emissions	Building regulation & transport planning	Building standards & transport technology	Integrated urban form & infrastructure
SCOPE 2: indirect emissions via off-site electricity generation	Building standards & transport technology	Energy system quotas & incentives	Energy system stewardship
SCOPE 3: indirect emissions via traded products & services	Integrated urban form & infrastructure	Public procurement, innovation incentives	Supply chain & value chain stewardship

Table 1. Carbon neutrality & urban-regional planning agendas (Source: authors, based on CNCA 2016 & Greenhouse Gas Protocol 2016)

The implication is that the targets of the CNCA, C40, Covenant of Mayors and similar groups may be aspirational but problematic, lacking clear definitions and responsibilities (Bansard et al.2017). Apparently simple de-carbonization programs have to engage with large complex infrastructures, macro-economic forces, real estate markets, sector supply chains, professional institutions, and lifestyle patterns. Meanwhile the 'ghost at the table', the 'Scope 3' indirect emissions from international trade, is a reality check on the direct carbon neutrality. For instance, the UK has now exported most of its former heavy industry, so its Scope 1-2 emissions show rapid

improvement, while its Scope 3 account shows rapid growth in imports with higher carbon intensities (Defra 2019).

Moreover, it seems that policy is often ambiguous between a linear approach to 'problem solving', and a more complex socio-technical systems transformation. At the global level, the targets for emissions budgets, call for extremely challenging rates of change, estimated by some at 15% emissions reductions per year (Anderson 2015). At the local level, many cities around the UK and EU are (as of 2019) declaring 'climate emergencies', where aspirations are strong, but local powers and resources are weak. Most carbon studies focus on energy technology and economics, and tend to assume that policy levers can be pulled, or that coordination can be achieved. Some look more systematically at the policy challenges, for instance the Association for Conservation of Energy (Guertler and Rosenow 2016), but, as yet, few address the scale of transformation needed.

Aims, scope and methods

In that context, this paper aims firstly to contribute on the theoretical-methodological side, with a framework which can help both practitioners and academics to respond to the 'new normative'. Secondly we aim to demonstrate this with a single case study, which allows some detail and reality-checking. Thus, our theoretical-methodological contribution helps to map complex systems, and the opportunities of the 'new normative' transformation. Our practical contribution should help cities and regions to achieve carbon neutral targets, by means of a rational and transparent approach to system transformation, here titled 'Synergistic Scenario Planning' (hereafter 'SSP').

The case material has been gathered through a long series of collaborative research-policy projects (see policy references in the next section). Documentary evidence from stakeholder dialogue was used for methodological development, in three main phases. Firstly, the Sustainable City Region program (1993-2000) developed an urban metabolism / integrated policy model (Ravetz 2000). More detailed resource modelling and supply / value chain analysis then followed (Ravetz 2006 & 2010). A third phase (2010-2020) explored the cognitive side of policy learning, socio-technical transition, urban-regional foresight and collective intelligence (Ravetz and Miles 2016: Ravetz 2020). Meanwhile the three main components of the SSP framework have been developed over some years by each co-author, and the combination is presented here for the first time.

With that in mind, the paper is set out in six parts. Following this introduction is a brief review of 'debates and tensions' in the literature around the new normative challenge. A third section outlines the case study of Greater Manchester (GM) and its many phases of climate / carbon policy. The central section then sets out the SSP framework in three main parts: futurity, alignment and transformation. The fifth section applies the framework to the case study for insight on both problems and forward opportunities. Finally, we highlight some implications for theory and practice on urban-regional futures, to help on the journey towards the 'new normative'.

CARBON-NEUTRAL PLANNING: A LANDSCAPE OF TENSIONS

Here we sketch some topical debates and tensions in the field, as context to the SSP framework detailed in the next section. In summary, the SSP framework contains three key dimensions: futurity and the practice of scenario planning, alignment of wider communities of interest, and transformation or structural socio-technical change. This conceptual 3D space then locates around it, three key debates and conceptual tensions, as pictured in Figure 1: 'institutional tension', 'experimental tension', and 'systemic tension'.

Institutional tension? Territorial planning versus systemic

The perennial tension of spatial / territorial planning versus non-territorial political economy, comes to a carbon neutral head – should the unit of analysis and governance be cities and regions, or global supply chains and corporations? Many critique idealized models of strategic planning that bypass institutional / political realities: and this is highlighted by carbon neutral goals, which shift from rigid statutory frameworks with outdated zoning tools, towards networked 'soft' space governance (Steele & Ruming 2012; van den Broeck 2013; Mäntysalo et al. 2019a)

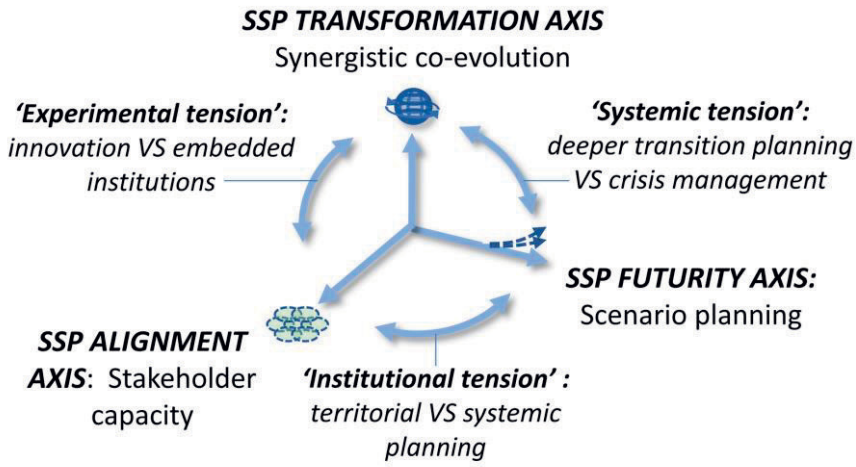

Figure 1. Synergistic scenario planning: framework & tensions

As Newman has noted, existing forms of strategic planning are "not just a convenient contrast to the ideal form… but the origin and residue of previous institutional designs that generate constraints and forms of path dependence" (Newman 2008, p. 1374). Where carbon neutral policy calls for both a legalistic spatial planning, alongside an entrepreneurial approach to supply chains and technologies – the coexistence of such parallel systems raises many ambiguities (Castan Broto & Bulkeley 2013). The barriers to institutional change are then a major concern, even more so with headline carbon targets which highlight gaps and mis-matches all around (Granqvist & Mäntysalo 2020). While 'soft space' approaches raise both opportunities and ambiguities (Allmendinger & Haughton 2010; Bäcklund et al. 2018; Mäntysalo et al. 2015), new concepts of collaborative 'co-governance' with hybrid organizations are equally relevant to the carbon neutral agenda (Ravetz 2020, 225-237: Johanson and Vakkuri 2018).

Experimental tension? between innovation and vested interests

A second tension arises between the goals of transition / transformation, and the realities of incumbent institutions. Luque-Ayala et al (2018) suggest that traditional forms of urban-regional policy are not (yet) capable of the structural changes implied by carbon neutrality. With the focus on networked infrastructure (energy, transport,

construction supply chains etc), transitions in such large and complex systems call for new forms of governance, with new forms of engagement of multiple stakeholders, through 'triple helix' or similar models of engagement (Bulkeley et al 2013: Etzkowitz and Leydesdorff 2000).

This opens up a wider agenda, one of complexity, emergence and collective learning in urban and regional analysis (Komninos 2015: Uyarra & Flanagan 2010). Looking beyond evolutionary thinking on path-dependencies and spillovers, co-evolutionary thinking now explores 'path-inter-dependencies' and 'transversalities' (Cooke 2012), with 'platforms for industrial interaction' and wider public-private-civic-academic ecosystems (Asheim 2018). As for starting points, one is urban experimentation, as an enabler of institutional collaborations across the public-private-civic divide (Luque-Ayala et al 2018). The 'experimental city' of small-scale Living Labs and embedded innovations, also highlights the granularity of change and transition in large complex systems (Evans et al.2015: Hodson et al.2019). It also renews interest in learning for organizational change, now applied to strategic planning as 'extended co-production' (Argyris and Schön 1996: Albrechts 2012). Strategic or higher order learning can prepare and empower stakeholders for future-oriented action (Neuvonen & Ache 2017; Quist et al.2011), and mobilization around strategic frames (Healey 2009). However on the ground many tensions arise, where such experimental / learning zones are seen as risky or vulnerable to special interests, with open questions on the 'transformative capacity' of cities and regions (Wolfram 2016).

Systemic tension: transition planning versus crisis management?

A third tension is on the mismatch between longer-term transition planning, and short-term crisis management (in this case, 'climate emergency'). Transition theory and practice has also spawned a new approach to 'system innovation', not only in niche technologies or business models, but in the wider system architecture (OECD, 2015; Schot and Steinmueller, 2018). In reality this is the beginning of a dialogue, which for carbon neutral policy includes many stakeholders: finance, infrastructure, regulators, construction, labour, households, digital providers and public services, to name a few (Weber and Truffer 2017; Borrás and Edler, 2020). And while such engagement can look good on paper, the reality is often one of disconnected policy, market hurdles and split incentives, for example in housing retrofit (next section) (Webber et al 2015: Guertler and Rosenow 2016). A strategic response would aim to

enhance the 'collective anticipatory intelligence' via urban-regional foresight, but this faces a typical reality of under-resourced and dis-empowered local government (Ravetz and Miles 2016).

Parallel thinking also comes up for the energy sector itself, with some similarity to SSP, which contrasts a linear problem-solving approach, to evolutionary innovation, to strategic systems transformation (Grubb et al.2015). But again, even the most simple carbon targets conceal a jungle of organizational conflicts (Lippert 2012), and the gap grows between the nuances of planning theory (Watson 2008; Alexander 2020), and the urgency of the climate crisis (Cf. Phdungsilp 2011). The rapid emergence of Extinction Rebellion in 2019 is a stark reminder of the possible tipping points in global systems, with unquantifiable risks of catastrophic impacts on many cities and regions (Fischer et al. 2018).

Overall, a picture emerges of many tensions in theory and in practice; between different transformation agendas, different future horizons, and different policy frames and institutions. Some results on the ground are demonstrated by the 'Long road to low-carbon' case study which follows.

A LONG ROAD TO LOW-CARBON: THE CASE OF GREATER MANCHESTER

Greater Manchester (hereafter, 'GM') is the UK's second city-region after London, a hub of investment and innovation, and a global destination for young people, culture and sport. It is also a sink of unemployment and deprivation, poor housing and low productivity, costing around £5 billion per year in net public expenditure. GM also considers itself a showcase for urban renewal and regeneration, devolution and public-private partnerships, and its climate / carbon targets are framed in that context. Several phases of strategic spatial planning have emerged in GM, in parallel with climate / carbon policy (Hodson et al.2018). This shows scenario planning in both 'explicit' forms (technical modelling and social deliberation on alternative futures): and more typically, 'implicit' forms, where scenario-type thinking is part of a wider policy process.

Carbon as an environmental agenda

Climate change and carbon awareness in GM emerged in 1992, and practical action took shape following the 1997 Kyoto protocols, building on evidence from the TCPA Sustainable City-Region project (Ravetz 2000). The UK then took the lead as the first nation with a mandatory carbon budget, in the Climate Change Act 2008

and the Low Carbon Transition Plan (DECC, 2009). In parallel, the (then) Regional Development Agencies each produced a climate change strategy to meet the new national target for 80% carbon reductions, with support from the 'Regional Economy-Environment Input-Output' scenario model (Ravetz 2010). Meanwhile the Manchester Independent Economic Review set up a city-region version of the global Stern Report, the GM 'Mini-Stern' (McKillop et al.2009). With scenario modelling for the urban-regional economy and energy system, this report provided a long-lasting 'boundary object' (as defined in the next section), a common reference point between different sectors.

However, progress was not straightforward. In 2008 a public referendum was held on a proposed Congestion Charge and public transport plan for the whole inner urban area, which aimed to contribute to the carbon targets (Sherriff 2013), and the scenario modelling showed a clear carbon benefit of 10-15 percent of all local transport emissions. However, the proposals were framed by a free-market opposition as an attack on civil liberties and low-income motorists, and after a heated campaign, the proposals were rejected by a large majority. With growing uncertainty on the GM low carbon strategy in the face of public and media scepticism, the 2008 financial crisis displaced much long term thinking, followed in 2010 by the coalition government, committed to cutting 'red-tape' and 'rolling back' the public sector. The general effect was to keep carbon targets on the policy agenda, but to sideline most of the practical actions: for instance, both regional innovation clusters and the national Code for Sustainable Homes were abolished, with little to replace them.

Meanwhile, the newly established GM Combined Authority (GMCA) set up an Environment Commission, later renamed the GM Low Carbon Hub, with a multi-sector partnership (www.ontheplatform.org.uk). The GM Climate Change Strategy (GMCA 2013) then aimed at a short term carbon reduction of 48% (1990-2020). With a range of scenario model results, the Strategy acknowledged that the 'easy wins' since 1990 had been made already, including the national shift from coal to gas for power generation, improvements in vehicle technology, and export of heavy industry to the developing world.

Carbon as an economic agenda

Meanwhile, the moves towards city-region devolution were gathering pace. Regional Development Agencies were replaced by a patchwork of Local Enterprise Partnerships: the 'Northern Powerhouse' was in many ways a re-branded inter-regional strategy, and critiqued by some as a 'Northern Poorhouse' (Moran &

Williams 2016). Shortly after, the 'Devo-Manc' experiment in devolution was set up in 2014, with enhanced powers including housing, transport, skills and infrastructure (Haughton et al.2016). In parallel, the GM Spatial Framework was launched in 2016, with three scenarios / options for growth, ranging from 152000 to 336000 new dwellings over 20 years; in parallel was a modest target of 60% carbon reduction (1990-2035), but with few specific actions (GMCA 2015: Deas 2014).

One headline policy was the national Green Deal, promoted as the 'world leader' for energy retrofit in housing, but on the ground a near total failure, GM being the only city which enrolled more than a few households (Webber et al.2015). Currently the UK lacks any programs beyond the most basic (at the time of writing), for energy efficiency in housing or commercial buildings, or the fuel poverty which still afflicts 15% of GM households.

As for 'explicit' scenario planning and foresight, various methods were tried with mixed results. An interactive 'sustainable eco-region' model was tested with stakeholders (Ravetz 2010). The DECC 'Pathways' program put up an interactive online energy model, with stakeholder workshops to debate the implications (http://2050-calculator-tool.decc.gov.uk/#/guide). Another strand came via the UK Foresight on Future of Cities, which in GM this demonstrated some advanced foresight methods (including a forerunner of 'synergistic scenario planning'), to inform energy, transport and housing strategies. However at that time it seemed that exploration of the 'future' was over-shadowed by the 'Devo-Manc' agenda of the 'present' (Ravetz & Miles 2016).

Carbon as 'Climate Emergency'

Against a turbulent context, the incoming GM Mayor set up a Green Summit 2018 which put new carbon targets at the centre of a new five-year Environment Plan (GMCA 2019). The calculations were based on the energy /emissions model SCATTER ('Setting City and Area Targets and Trajectories for Emission Reduction'), with detailed energy / carbon scenarios and priorities for action, backed up by sectoral studies such as 'retrofit regeneration' (UKGBC, 2017). The key graph at the top left (a) of Figure 2 shows that carbon neutrality is possible under Scenario 4, but this is far more ambitious than current UK targets, being "on the boundaries of the application of current technologies … with unprecedented transformational change and extraordinary national financial investment" (Kuriakose et al.2018).

The carbon budgeting method translates global commitments and national multi-year budgets, into tangible goals for the city-region (Anderson & Bows 2011). The

recommendations are for GM to make its 'fair' contribution, with immediate and drastic action for emissions reduction at 15% per year (and for aviation, to stabilize emissions by 2030 and then reduce to zero by 2075). However, the detailed action plans show many leaps of optimism, with for instance a proposed 'retrofit accelerator' innovation hub, or 'national fiscal policies to be identified'. There is an over-arching sense of near-impossible aspiration, which fits with the GM self-image of bold innovation and creative action: and so the technical carbon targets are as pieces in a larger game or discourse, or as we explore below, boundary objects in a wider 'trading zone'..

A SYNERGISTIC SCENARIO-PLANNING FRAMEWORK

The GM story shows how the transformations of buildings, transport, industry, land-use, energy and waste systems cross between sectors, challenge policy structures and change the power relations between stakeholders. It seems evident that new theoretical-methodological frameworks and practical tools are needed, (a) to understand the implications of the 'new normative', and (b) to apply this in practice.

The analytical framework we propose addresses three key challenges: how to link future goals with present day actions, how to bring stakeholders into alignment, and how to look beyond problem-fixing towards system transformation. The first is about the 'longer' horizons of scenario planning which we link particularly to the back-casting approach. The second concerns the 'deeper / wider' inter-connections between knowledge and value between different groups, and the alignment or coordination between them, drawing on the insights of boundary objects and trading zones. The third challenge concerns the 'further' agenda of system transformation, which we tackle with the synergistic approach. Interestingly, a current handbook on carbon neutral cities follows quite similar principles: i.e. innovation culture, ecological 'abundance', social 'sharing', and future-oriented adaptive governance (Plastrik and Cleveland 2019). In this section, we first introduce these three components, and then combine them into an integrated framework, with visual mapping methods shown in Figure 2, and the analytical fields in Table 2.

Scenario planning and back-casting

The simplicity of carbon targets and the possible complexity of responses, suggests the use of 'scenario planning with back-casting'. Such methods emerged in the 1970s for sustainability transitions such as food, energy, water and climate change (Quist

2007). Back-casting scenarios are formed by defining normative criteria for desirable futures (e.g. sustainable level of carbon emissions), and then building a feasible, rational pathway towards them (Börjeson et al.2006). In other words, back-casting (a) assumes a normative frame to the future, in addition to the descriptive, and (b) explores the human intentions and strategy to achieve the goals (Dreborg 1996).

Carbon neutrality targets are an interesting case for scenario planning: the more ambitious the target, the larger the 'aspiration-reality gap' that can undermine their credibility as practical policy tools. In this context the overall purpose of normative back-casting scenarios is to expand the scope of future options, and thus find ways around gaps and barriers to systems change (Höjer & Mattsson 2000; Zegras & Rayle 2012).

Scenario planning in practice often utilizes the medium of narratives or stories, sharing 'rich' information in a simplified format (Harris 2016; Mäntysalo et al. 2019b). Some examples from GM (next section) have resonance as stories, even where technical evidence may be lacking, for instance 'Transition Towns' or 'Incredible Edible', (Figure 3, centre right d), using an 'implicit' scenario approach, which describes positive visions in contrast to 'business as usual' dystopias.

Back-casting scenario methods have been applied in urban-regional planning in various ways, from generalized 'visioning' to specific policy development (e.g. Phdungsilp 2011; Viguié et al.2014). Most urban-regional plans are developed with a narrow range of demographic, traffic and economic forecasts and scenarios based on technical modelling (Chakraborty et al. 2011; Myers & Kitsuse 2000), leaving the transformative agenda to fuzzy aspirations such as 'sustainable', 'smart', or 'livable'. Some cities and regions have followed the integrated foresight approach, where scenario studies are integrated to capacity building and road-mapping / strategy development (Ravetz and Miles 2016; Phaal et al.2007). Figure 2 at the top left (a) shows a narrow functional version of back-casting, while on the top right (b), there is a synergistic version with a wider and deeper scope.

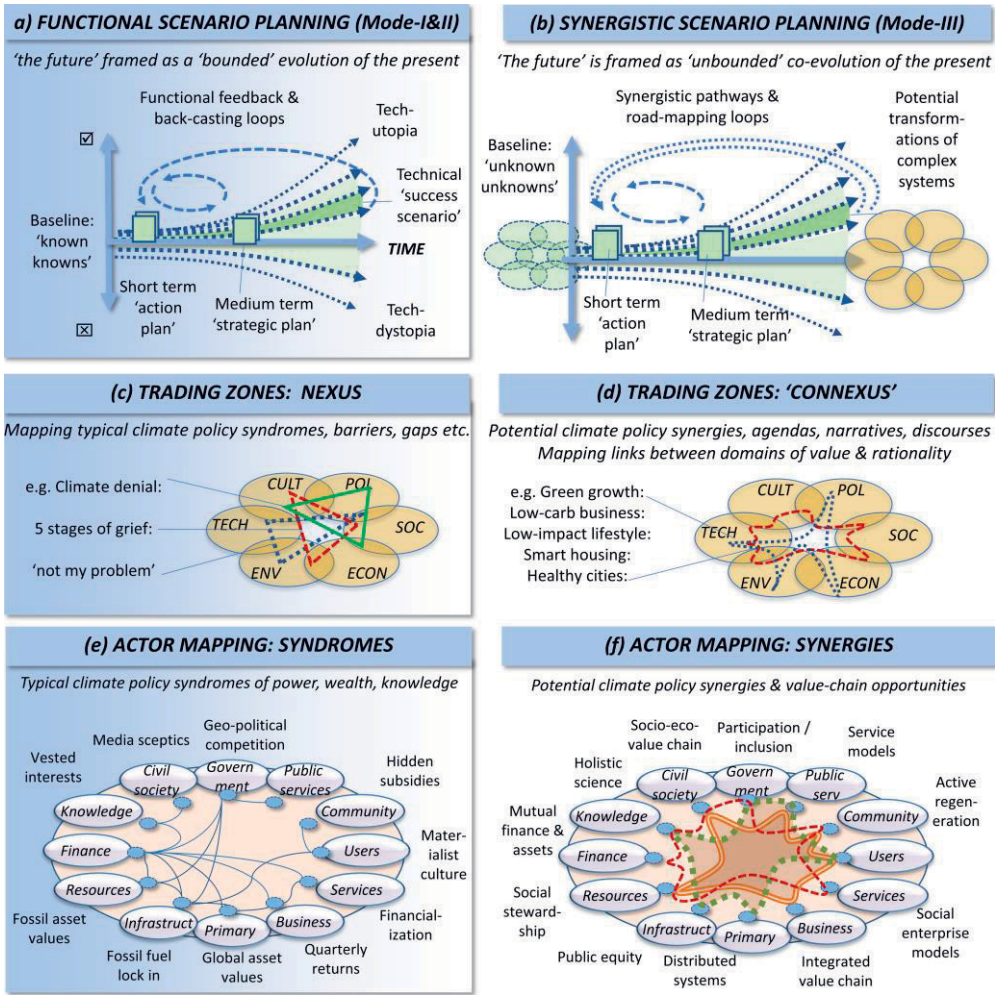

Figure 2. Synergistic Scenario Planning: overview with visual mapping

Boundary objects and trading zones

The concept of 'boundary object' was coined by Star and Griesemer (1989), to explain the boundary-crossing capacities of coordinated action, involving multiple actors from different "social worlds". A simple carbon target can be considered a boundary object of a sort, but one with weak connections to the agencies and interests of its stakeholders; whereas an elaborated carbon strategy, which connects visions to actions, could be much stronger (e.g. carbon policy with specifics on urban greenspace or public transport). This suggests the role of multiple interconnected boundary objects, in a cognitive chain where the carbon object is connected to other

more tangible or 'material' objects, e.g. carbon policy / public transport / clean air / quality of life.

Such chains may then grow into locally or regionally grounded trading zones between many stakeholders, in which boundary objects can emerge (Galison 1997; 2010). The concept of 'trading zone' refers to hybrid platforms where information and services are "traded" between different actors, with different problem framings or value systems, but where there is scope for alignment, by trading in boundary objects "enabled by the thinness of interpretation rather than the thickness of consensus" (Galison, 2010, p. 36). Boundary objects and trading zones, and their implications for social learning and policy innovation have also been examined in the strategic planning context (e.g. Fuller 2006; Balducci & Mäntysalo 2013; Mäntysalo & Jarenko 2014). Figure 2 centre left (c) shows a typical 'nexus' of climate policy syndromes, gaps, barriers or conflicts between the values and objectives of different domains. Meanwhile at centre right (d) are some typical inter-connecting synergies, agendas, narratives and discourses, linking between multiple domains of value and rationality.

Synergistic thinking, methods and tools

'Synergistic' methods and tools then bring together the 'longer' scenario perspective, and the 'deeper / wider' trading zone approach, to look 'further' beyond functional problem fixing towards system transformation (Ravetz 2015 and 2020). With a combination of visual thinking (Figure 2) and analytic matrices (Table 2), the method helps to map complex problems and explore forward pathways.

A typical 'functional' scenario planning process is shown on the upper left (a) of Figure 2: the carbon scenario modelling outputs show a range of options from 'business as usual' to 'aspirational'. Intermediate options can be debated as a balance of risk, innovation, social change, policy effort and financial cost. For example the IPCC reports and UNFCC protocols provide the aspiration of a "1.5 degree world", with an agreed target for a "2 degree world", which contrasts to current trend projections for a "3-4 degree world" (Tyndall Centre 2018).

A more realistic picture shows on the upper right (b) of Figure 2: here the baseline axis includes for complex realities, and future scenarios are more about system-wide transformation, involving many stakeholders with many domains of value, summed up with the flexible menu known as 'STEEPC' (social, technological, economic, ecological, political, cultural) (Loveridge 2008). As in the centre right (d), for system transformation the many actors will need to coordinate and collaborate, via supply

chains, markets, finance, regulations, skills, procurements and so on, within and between the various trading zones. In each there is a process of collaborative value chain development, which rests on collective ('co-') learning, co-creation or co-production; i.e. the components of an overall collective intelligence for carbon policy, or a 'collective carbon intelligence'. Such intelligence can then work in different 'modes' of systems complexity (Ravetz 2015 & 2020):

- 'Mode-I' or 'linear' complexity: functional energy / carbon systems, which can be framed as bounded problem-solving with 'known knowns'.
- 'Mode-II' or 'evolutionary' complexity, for adaptive / optimizing energy / carbon markets or enterprises, framed as partially bounded problems of innovation or competition (Modes-I and II are shown together on the left sides of Figures 2 and 3).
- 'Mode-III' or 'co-evolutionary' energy / carbon systems (shown on the right of Figures 2 and 3): framed as collective learning, thinking, co-creating and co-production.

Similar frameworks for co-evolutionary systems have emerged in various fields, such as energy / climate economics (Grubb et al.2015), organizational learning (Argyris and Schön 1996), and the widely shared aspiration for 'new forms of government which are adaptive, responsive, participative and deliberative' (Revi et al.2014).

By comparing the concept mappings for Mode-II and Mode-III, we can explore the opportunities in the trading zone behind the single-issue carbon targets, for both value systems and for real stakeholders. On the lower left (e) of Figure 2, we see a typical set of stakeholders ('actors') in the energy / carbon system, with typical syndromes, gaps, barriers, split incentives, moral hazards or 'lost in translation', where the 'new normative' targets are difficult or impossible to achieve.

A positive alternative then emerges on the lower right (f) of Figure 2, with many potential synergies and value-chain opportunities in various trading zones. For example, a low carbon supply-chain depends on synergy between finance, designers, builders, citizens and municipalities: or a low carbon finance model can work on the synergies between eco-stewardship, public procurement and green municipal bonds. Here the extended trading zones, shown in the centre right (d), enable stakeholders to make shared commitments or investments (economic, political, technological). Likewise, the boundary object concept helps to realize the practical applications of the carbon targets: so that 'carbon per unit of GVA' is an environment-economic object for firms or sectors, or 'carbon per household' is a socio-environmental object, as in Table 2.

	SYNERGISTIC TRANSFORMATION		
	MODE-I LINEAR	***MODE-II EVOLUTIONARY***	***MODE-III CO-EVOLUTIONARY***
TARGETS / BOUNDARY OBJECTS	***(functional complexity)***	***(emergent complexity)***	***(deeper complexity)***
Low carbon overall targets	e.g. CO2 total emissions	CO2 as adaptive target	CO2 footprint as proxy for global responsibility
Low carbon economy	CO2 / GVA	CO2 as market opportunity	CO2 as proxy for economic transformation
Low carbon society, etc	CO2 / person or household	CO2 as product / service (CO2 per unit of 'benefit')	CO2 as proxy for social transformation
SCENARIO PLANNING PROCESSES			
Systems *(relational thinking)*	'Known knowns': material functional systems	'Unknown knowns': incentives, enterprise	'Unknown unknowns' with cognitive complexity
Scenarios *(divergent thinking)*	Tangible trends, projections, forecasts	Evolutionary trends / scenarios	Co-evolutionary transformation
Synergies *(emergent thinking)*	Functional problem solving	Innovation & problem insight	Societal co-creation & co-design
Strategies *(convergent thinking)*	Specific actions / responses	Entrepreneurial strategy & road-mapping	Transformation via collective intelligence

Table 2. Synergistic scenario planning: a combined framework

Overall, synergistic thinking can enable collaborative learning, thinking, co-creation and co-production, in other words, the components of a collective intelligence. It also helps to integrate scenario planning with the mapping of trading zones, often opaque and compromised in practice. In response, the synergistic method helps to map and manage a more systematic cycle of knowledge flows and cognitive learning, linking present and future, with a process model for different modes of thinking, from 'relational to divergent, emergent and convergent' (Ratcliffe & Krawczyk 2011).

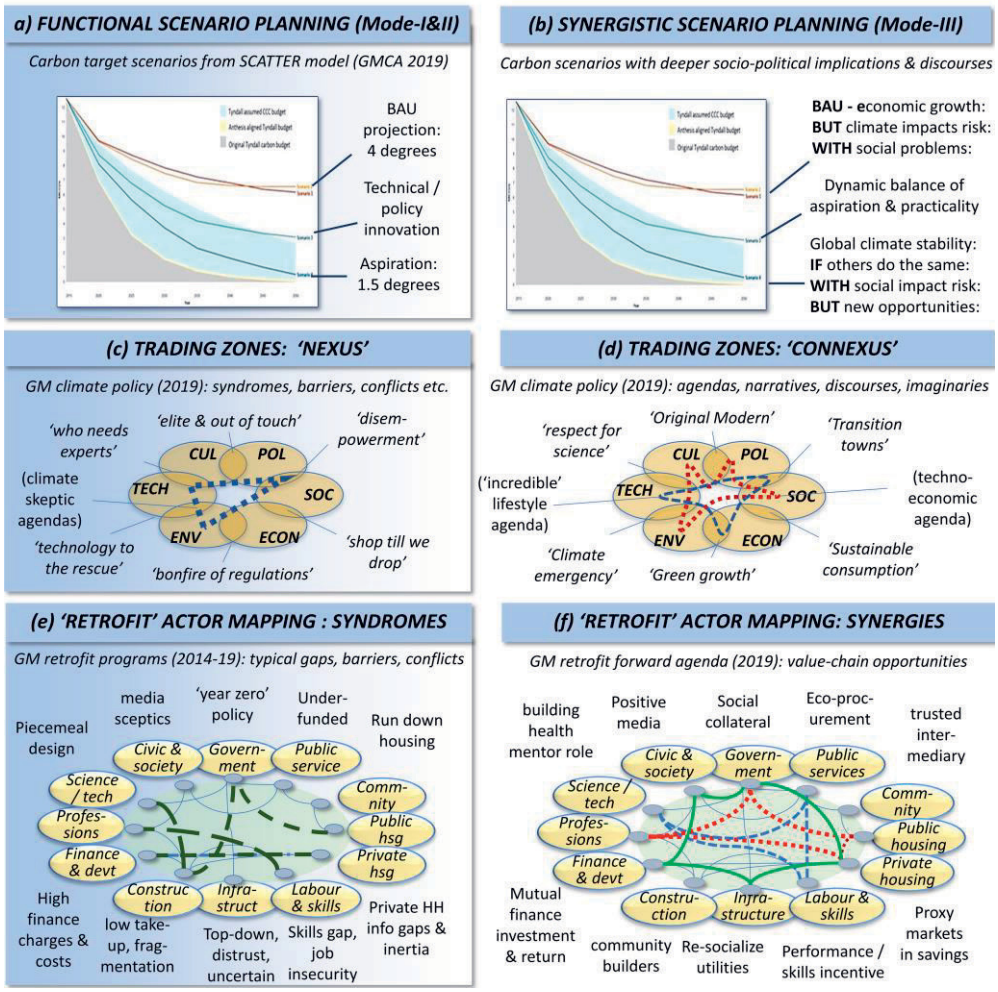

Figure 3. Synergistic Scenario Planning: the case of Greater Manchester. Sources: GMCA (2019); Tyndall Centre (2018); Ravetz and Miles (2016)

The synergistic cycle then includes four stages:

- *Baselines* – problems, challenges, and the underlying systems, in the present; ('relational thinking' which explores the trading zones with actor mapping);
- *Scenarios* – forces of change, uncertainty, and alternatives in the future; ('divergent thinking', centred on the back-casting process);
- *Synergies* – visions, opportunities, innovations and inter-connections, for the future; ('emergent thinking', for transformation and the collective intelligence to enable it);

- *Strategies* – pathways and road-mapping for action, which link the future back to the present; ('convergent thinking', and the strategic planning and management to implement it).

Further detail on these stages is available as the 'synergistic toolkit' (Ravetz 2020).

Towards a combined framework

These three conceptual approaches (back-casting scenario planning, boundary objects and trading zones, and synergistic thinking) can then be combined into the SSP framework, summed up with a simple matrix as shown in Table 2:

- 'New normative' carbon targets, elaborated into interconnected boundary objects and trading zone platforms;
- Back-casting scenario planning processes, linking future goals with present day actions;
- Systems transformation: with synergistic mapping from linear (Mode-I) and evolutionary (Mode-II), to co-evolutionary (Mode-III).

The matrix analysis, in combination with visual thinking, can help to analyse a case such as GM, with typical gaps and mis-matches between problems, targets, pathways and solutions.

APPLICATION TO THE CASE STUDY

The case of GM shows how apparently simple carbon targets raise many challenges in the transformation of a major city-region. Here we explore some of the nuances and implications, using the SSP approach, with both matrix and visual mapping techniques.

From scenario planning to action planning

The carbon scenario modelling from the SCATTER program forms the key diagram in the GM Environment Strategy (GMCA 2019), shown on the upper left (a) of Figure 3. This shows a typical range from the 'aspirational' (targets for 1.5 degrees of global warming IF replicated around the world), the 'desirable' (rapid policy innovation, technology rollout and social change), the 'probable', with less ambitious change, and the 'do nothing' option which points towards a four degree rise. Some key policy discourses are then interpolated from the Strategy and supporting documents, on the upper right (b) of Figure 3. Either economic growth continues

but with growing climate risks: or, global climate stability could result IF others do the same, but at risk of societal impacts, and so on.

Looking more closely at the nexus of syndromes, many climate –skeptical patterns in GM surfaced around the 2008 Congestion Charge episode, and continue in various forms. Some, such as the 'bonfire of regulations' or 'who needs experts' are from national politicians, others are more apparent in popular media.

In contrast is a mapping of a 'connexus' of synergies, in Figure 2 centre right (d), with key 'trading zones' in the Strategy (these are interpolated and not always explicit). We can track the 'climate emergency' rhetoric in the technical-environment trading zone, 'green growth' in the environment-economy zone, 'sustainable consumption' in the economy-society zone, and 'livable city' in the urban-environment zone. Each of these in various ways combines political discourses, lifestyle trends, media narratives or policy agendas: each also represents various shades of ambiguity or managed tension. Mapping of underlying layers may reveal deeper assumptions or archetypes, such as 'trust in policy-makers' or 'respect for science' which are often contested in public life (Inayatullah 2018). The implication of such multi-layer mapping is that successful climate / carbon policy will focus on key trading zones, systematically shifting negative syndromes towards positive synergies, as identified in the right hand column of Table 3.

Sector examples

The housing energy retrofit agenda is very topical in GM, with its stock of older less efficient dwellings (Ravetz 2008). This is a challenge which appears technically simple and cost-effective, but where syndromes, gaps and barriers of every kind seem to block progress (Guertler and Rosenow 2016). The stakeholder / actor mapping, on the lower left (e) of Figure 2, shows many gaps, myopias, perverse incentives, 'moral hazards', 'landlord traps' and other barriers around the table (Ravetz 2020).

Learning from the failure of the national Green Deal program, as above, GM is developing a new policy model for a 'retrofit accelerator' (at the time of writing). So, shown on the lower right (f) of Figure 3 is an alternative mapping of the same actors, now co-creating new 'synergies' and value-chains, with various pathways to mobilize them. The policy model looks for synergies between procurement and sector innovation, finance and home ownership, poverty alleviation and area regeneration, warm homes and public health benefits, retrofit and skills training, and so on (UKGBC 2017). Some pathways are focused on finance or technology, some more social and lifestyle-related, and others are more ethical and cultural. Each of these

and more are currently debated in an ongoing program of forums, 'listening events', business breakfasts, citizens' assemblies and online consultations, and then assembled into policies and road-maps.

On the social and cultural side, Carbon Literacy is an award-winning program, born in GM and now working internationally, providing training in basic climate change knowledge, and capacity building for organizations and institutions (https://carbonliteracy.com/). Carbon Literacy works in the 'baseline' area of the matrix, to create a Mode-I type systems understanding, and also in the Mode-III 'synergy' area, where it enables creative interactions between a wider circle of stakeholders. This program emerged from a previous venture of 2005-2009, 'Manchester is My Planet', which asked organizations and individuals to make a 'pledge' to reduce their emissions.

On the sectoral supply chain agenda, green public procurement is in principle a good place to start a low carbon innovation ecosystem and supply chain transformation. However, the current reality in the UK is one of scarce funds and skills, low tolerance of risk, and fragmentation of local government and public services (Georghiou et al.2014). The boundary objects / targets on the right of the matrix help to identify the potential role and scope, not just as procurement of low carbon products which may be higher cost and risk, but as strategic leadership of a fast growing economic sector, in collaboration with other public bodies, with social co-learning all around .

Green or low carbon finance is a complex and controversial agenda in the UK: the Green Investment Bank was reduced and sold off, and capital controls on local authorities restrict the scope of long term green finance (ING Bank 2015). However, in GM there are interesting developments under the heading of Natural Capital (ecosystems and their services), and the current Investment Plan aims to bring together 'wider' stakeholders, with 'deeper' layers of value, to collaborate on 'further' social-eco-business models, all in the zone of Mode-III thinking (Eftec et al.2019). Work is now in progress on specific low carbon policies as part of the national Transforming Cities Fund and Brownfield Fund.

TARGETS / BOUNDARY OBJECTS	***MODE-I LINEAR***	***MODE-II EVOLUTIONARY***	***MODE-III CO-EVOLUTIONARY***
Low Carbon targets: annual emissions / multi-year budget / base year change	e.g. CO2 direct emissions in tonnes	CO2 as indicator of change & development	Carbon neutral as civic responsibility, ethical stewardship

Low carbon economy: 'green growth' / 'circular economy' / eco-business	CO2 / GVA indicators, total or sectoral	CO2 reduction as market opportunities, supply chain innovations	Carbon neutral as economic & livelihood transformation
Low carbon society: 'sustainable consumption' / 'clean inclusive growth'	CO2 / person, household,	CO2 / pp for social incentives, peer pressure, performance benchmarks	Carbon neutral as social & civic transformation
Low carbon city: livable cities / accessible neighborhoods	CO2 / community, town or other settlement	CO2 / community for benchmarks, peer learning etc	Carbon neutral as livable & healthy urban future
PROCESSES			
Systems	GM data: 2.75 million persons: £56 bn GVA: 10.3 mt CO2 per year (2019)	'CO2 economy' / energy efficiency & low carbon transition in firms, sectors, markets	Innovation on cognitive side, e.g. Carbon Literacy, pledges, extended CSR
Scenarios	'SCATTER' model scenarios: BAU / policy push / 1.5^0 outcome	Some economic modelling, but lacking sector level scenarios.	Transformation scenarios are implicit in political discourses
Synergies	Current opportunities in 'devolution'	Incentives in efficiency, market opportunity, business model innovation	Alternative ventures, e.g. 'Transition Towns', 'Incredible Edible', 'Beyond Carbon' etc.
Strategies	5-year strategies, technically correct but vulnerable to 'unforeseens'	Sector strategies dependent on firm / stakeholder / national government support	Emerging models for 'accelerator' or '*Collaboratorium'* (work in progress)

Table 3. Greater Manchester case: 'synergestic scenario planning' analysis.

Process analysis

Overall, some key challenges and potentials of SSP for a carbon neutral GM, are summed in the matrix at Table 3. The 'carbon targets' here are framed as boundary objects linking different sectors and domains: economy-environment, socio-economic, eco-technical, and so on. The 'process' views the scenario planning

methods in their context of the four-stage process model presented above, i.e. 'systems, scenarios, synergies and strategies'. The table columns then show different levels of system complexity, from the Mode-I 'functional' and Mode-II evolutionary, to a Mode-III co-evolutionary transformation. The experience in GM shows how policy typically puts up material carbon targets, supported by energy-emissions modelling in the background (functional Mode-I type thinking); and to achieve the targets relies on markets, innovations and incentives for other actors beyond its direct control (Mode-II thinking). However, making such incentives work in reality calls for mutual learning and collaboration in a wider community, which then calls for new forms of 'associative and deliberative' governance (Mode-III thinking). There are also ongoing tensions between mainstream policy and a 'wider' range of actors who argue for 'deeper' economic or political transformation. The synergistic process model also provides another perspective on current gaps in GM and any further potentials:

- Systems / baselines ('relational thinking'): despite a multi-year program of evidence building there is no overall inventory and little wider understanding of the city-region carbon system or metabolism. The Carbon Literacy program above has spread basic awareness, but this needs to multiply up into every sector at every level.
- Scenarios ('divergent thinking'): there is some explicit scenario planning in the previous and current GM climate / carbon strategies: and various 'implicit' scenario methods in the background to many policies: here the previous insights on ambiguities help to explain the viable scope of scenario planning (Mäntysalo and Grišakov 2017).
- Synergies ('emergent thinking'): GM is clearly fertile ground for the co-creation of synergies and innovations. However, there is critique of an inner circle of 'usual suspects' working in a neo-liberal framework, lacking an open 'trading zone platform' which could involve wider communities (Hendrick 2014). And to accelerate the transformation up to 15% carbon reduction per year, the synergy formation process is even more critical, and the spaces / resources / skills more urgent.
- Strategies / pathways (with 'convergent thinking'): in principle the road-mapping of actions (short, medium and long term), should follow logically from the synergy formation, and mobilize action from all stakeholders concerned. In practice nothing is simple: the public sector is under-funded and over-stretched, the business sector focused on survival or growth, and the academic sector often disconnected from

local needs. However, with an exceptional stakeholder community, GM continues to work on carbon neutral pathways. The policy agenda includes (at the time of writing) low carbon supply chain initiatives, energy up-skilling, micro-generation and carbon finance: public sector eco-stewardship and natural capital finance: next generation smart transport and waste systems. Meanwhile, civil society is designing countless experiments, social innovations, living laboratories, Fab-labs, Carbon Coops, and similar spaces for collective learning, thinking, co-creation and co-production.

DISCUSSION: CHALLENGES & WAYS FORWARD

Cities and regions around the world are planning their pathways towards climate neutrality and the 'new normative'. But the chances of success are small, if they lack the most effective methods and tools, together with the theory behind them. In this paper, 'synergistic scenario planning' is proposed, both to understand the challenge of systems transformation, and to facilitate practical pathways towards it. This final section sketches (a) the implications and transferability of the GM case study, and (b) the relation to broader planning debates. It then points to (c) beyond the state of the art, and (d) implications for urban-regional planning practice.

Practical implications and transferability

The GM case shows by experience, three key challenges for synergistic scenario planning: how to link future goals with present actions, how to bring stakeholders into alignment, and how to design a system transformation. GM over 25 years has seen many versions of climate policy, scenario methods, and experiments in stakeholder alignment and capacity building. The goals of system transformation are often contentious, but arguably there is more awareness of the challenge now, than in previous decades.

For transferability, the GM experience is in many ways typical of a post-industrial secondary city-region. However, in contrast to others, GM sees ongoing experiments in devolution of powers (while the UK remains one of the most centralized of all developed nations). The urban infrastructure of energy and transport is largely privatized, in terms set by national government, and so calls for special efforts for alignment and synergy at the city-region level. The growth agenda of GDP and urban expansion, as seen in many countries, in GM is quite constrained. Meanwhile there is a culture of active innovation in GM which is not easy to

replicate: all the more reason for GM to lead the way, with its many experiments in deliberative democracy, action learning sets, citizens' assemblies and crowd-sourced forums.

Broader planning debates

For our first challenge of 'futurity', strategic urban-regional planning has often been slow to adopt the principles and practices of scenario planning (Chakraborty et al. 2011). Basic economic or population scenarios are often used for "vision documents" that serve multiple jurisdictions, and then the 'central estimate' is applied for technical land-use or economic policies; but such documents are often opaque and disconnected from the main policy process (Myers & Kitsuse, 2000). In response, the scenario back-casting approach aims to be more explicit and transparent, in both technical modelling and participative envisioning. Here the urban-regional scenarios are contested zones of vision, aspiration, imaginaries and discourses, ripe for deliberation and negotiation, asboundary objects themselves (Zegras & Rayle 2012). Climate / carbon scenarios are particularly topical, combining simple headline targets with the complexities of responses.

For the second challenge of 'alignment', the concepts of trading zones and boundary objects help with mapping a complex territory, to identify potential synergies between different actors (Mäntysalo et al. 2019b). Some of the most crucial trading zones lie between future scenarios, physical maps/plans, and wider stakeholder engagement, but such links are often missing in practice (Petrov et al. 2011), and this calls for skills and methods to enable such links (Freestone 2012). And for the wider urban-regional community, the principles of 'collaborative co-production' can be more explicit and effective by the SSP approach (Healey 2009: Albrechts 2012).

Thirdly, for the challenge of 'system transformation', SSP provides practical methods and tools. It addresses the perceived gaps and common shortcomings, in exploring multiple futures, engaging diverse stakeholders, and in linking scenarios to practical strategic planning (Bartholomew, 2007; Zapata, 2015).

For the 'institutional tensions' in section 2, of spatial versus economic planning, the mapping of trading zones may help to resolve and move forward. The 'experimental tensions' may be addressed through the mapping of actors / stakeholders and their value chain opportunities: and for the 'systemic tensions' of transition versus crisis management, the mapping of co-evolutionary change helps to see the overlaps and differences.

Beyond state of the art?

The 'new normative' points towards 'beyond state of the art' in planning for urban-regional futures. The urban-regional as a unit of governance is under pressure from all sides: the political economy of (carbon-related) infrastructure is increasingly globalized, while many displaced communities are seeking a new kind of local identity and empowerment (Goodhart 2017). More workplaces and social networks are global, while the physical impacts of climate change are stubbornly local. All this calls for a new generation of planning theory and practice, to rationalize and enable and mobilize, with longer time horizons, wider communities, deeper values, and further levels of transformation. The SSP proposed here is one contribution, which fits alongside other emerging initiatives, such as, bio-regional participative planning (Robinson et al.2012); stakeholder deliberation forums (Mulgan 2016); and 'urban living labs' for grassroots innovation (Evans et al.2017). All this suggests an update of the current communicative paradigm of planning theory, responding to the implications of the new normative, with new insights on co-evolutionary 'Mode III' governance for system transformation.

Implications for urban-regional planning

This paper proposes the SSP concepts and tools for carbon-neutral planning: meanwhile the mainstream continues in very different situations around the world, calling for comparative research on the international context of carbon-neutral cities and regions. Many of the CNCA members (Melbourne, London, Stockholm etc), it seems, are affluent well-organized metropolitan areas, resting on a post-colonial legacy, and highly dependent on global trade, technology and finance. Vancouver for one prides itself on its Zero Emission Building Plan, electric vehicles and reforestation of its hinterland, all building on abundant hydroelectric power resources. However just over its city boundary are other municipalities in the wider metropolis, which are (at the time of writing) set on a trajectory of intensive fossil-fuel mobility and globalized consumption (Robinson et al.2012).

Meanwhile, there is a sense of urgency and looming catastrophe. Many cities and regions set off on a 'climate emergency' with high aspirations and simple carbon targets, then find themselves entangled in energy economics, infrastructure renewal, real estate markets, fossil-fuel lobbies, supply chain inertia and, not least, public resistance. There is an urgent need for a new generation of 'future-proof' urban-regional planning to respond, for which the SSP aims to contribute. This paper takes

a first step on that journey, with a mapping of the challenges, review of a major case study, outline of the Synergistic Scenario Planning approach, and wider implications . We aim for this to stimulate further advances in theory, and urgently needed practice, for the 'New Normative'.

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REFERENCES

Albrechts, L. (2012) Reframing strategic spatial planning by using a coproduction perspective. Planning Theory 12(1), 46–63.

Alexander, E. (2010). Introduction: Does Planning Theory Affect Practice, and If So, How? Planning Theory 9(2): 99-107.

Allmendinger, P. & Haughton, G. (2010) Spatial planning, devolution, and new planning spaces. Environment and Planning C, 28(5), 803–818.

Anderson K, & Bows A. (2011) Beyond "dangerous" climate change: emission scenarios for a new world. Philos Trans A Math Phys Eng Sci. 2011;369(1934):20–44.

Anderson K. (2015) Duality in climate science. Nat Geosci [Internet]. 2015 Dec;8(12):898–900.

Argyris C. and Schön D.A. (1996) Organizational Learning II: Theory, Method, and Practice. New York: Addison-Wesley.

Asheim, B.T. (2018): Smart specialisation, innovation policy and regional innovation systems: what about new path development in less innovative regions? Innovation: The European Journal of Social Science Research

Bäcklund, P.; Häikiö, L.; Leino, H. & Kanninen, V. (2018) Bypassing publicity and transparency for getting things done: between informal and formal planning practices in Finland. Planning Practice & Research 33(3), 309-325.

Balducci, A., & Mäntysalo, R. (eds.) (2013) Urban planning as a trading zone. Dordrecht: Springer, Urban and Landscape Perspectives, Volume 13.

Bansard, J.S, Pattberg, P, Widerberg, O, (2017). Cities to the rescue? Assessing the performance of transnational municipal networks in global climate governance, International Environmental Agreements 17: 229-246.

Bartholomew, K. (2007). Land use-transportation scenario planning: promise and reality. Transportation 34, 397–412.

Bartholomew, K. and Ewing, R. (2008) Land Use–Transportation Scenarios and Future Vehicle Travel and Land Consumption: A Meta-Analysis, Journal of the American Planning Association, 75:1, 13-27.

Börjeson, L., Höjer, M., Dreborg, K-H., Ekvall, T. and Finnveden, G. (2006). "Scenario types and techniques: Towards a user's guide", Futures 38, 723–739.

Borrás, S. and Edler, J. (2020), "The roles of the state in the governance of socio-technical systems' transformation", Research Policy, Vol. 49, pp. 1-9,

Bulkeley, H., Castán Broto, V., Maassen, A. (2013). Governing urban low carbon transitions. In Bulkeley, H., Castán Broto, V., Hodson, M. and Marvin, S. (Eds.). Cities and low carbon transitions. NY, Routledge 2013.

Carbon Neutral Cities Alliance (2016). Framework for Long-Term Deep Carbon Reduction Planning. Copenhagen, Innovation Network for Communities. https://carbonneutralcities.org/initiatives/resources-and-reports/

Castan Broto, V, Bulkeley, H, (2013) A survey of urban climate change experiments in 100 cities. Global Environmental Change 23(1):92-102

Chakraborty, A. and McMillan, A. (2015). Scenario Planning for Urban Planners: Toward a Practitioner's Guide. Journal of the American Planning Association, 81(1), 18-29.

Chakraborty, A., Kaza, N., Knaap, G., & Deal, B. (2011). Robust plans and contingent plans. Journal of the American Planning Association, 77(3), 251-266.

Cooke, P, (2012): Complex adaptive innovation systems: relatedness and transversality in the evolving region. NY, Routledge

Deas, I., (2014). The search for territorial fixes in subnational governance: City-regions and the disputed emergence of post-political consensus in Manchester, England, Urban Studies, 51(11), 2285-2314.

DECC, 2009. Low Carbon Transition Plan for the UK. London, DECC

Defra, 2019: UK's Carbon Footprint 1997 – 2015. London, Defra

Dreborg, L. (1996). "Essence of Backcasting", Futures 28, 813-828.

Eftec, Environmental Finance and Countryscape (2019): Greater Manchester Natural Capital Investment Plan: Manchester ,GMCA.

Etzkowitz, H. and Leydesdorff, L. (2000) The Dynamics of Innovation: From National Systems and 'Mode 2' to a Triple Helix of University–Industry–Government Relations, Research Policy, 29, 109–123

Evans, J., Karvonen, A., and Raven, R., (2017) (eds) The Experimental City, Abingdon, Routledge.

Fischer, H., Meissner, K.J., Mix, A.C., et al. (2018): Palaeoclimate constraints on the impact of 2 °C anthropogenic warming and beyond. Nature Geoscience

Freestone, R. (2012): Futures Thinking in Planning Education and Research, Journal for Education in the Built Environment 7:1, 8-38, DOI: 10.11120/jebe.2012.07010008.

Fuller, B. (2006) Trading zones: cooperating for water resource and ecosystem management when stakeholders have apparently irreconcilable differences. Cambridge, MA: MIT Press.

Galison, P. (2010) Trading with the enemy. In Gorman, ME (ed) Trading zones and interactional expertise: Creating new kinds of collaboration. Cambridge, MA: MIT Press, 25-52.

Georghiou, L, Edler, J, Uyarra, E, Jillian Yeow, J, (2014). Policy instruments for public procurement of innovation: Choice, design and assessment. Technological Forecasting and Social Change 86:1-12

GMCA (2013) GM Climate Change Strategy. Manchester, GMCA

GMCA (2019) 5-Year Environment Plan. Manchester, GMCA

GMCA, (2015) GM Spatial Framework: Strategic Options, Manchester, GMCA.

Granqvist, K. & Mäntysalo, R. (2020). The Strategic Turn in Planning and the Role of Institutional Innovation. In: Hagen, A. & Higdem, U. (eds.), Innovation in Public Planning. Calculate, Communicate and Innovate. London: Palgrave Macmillan.

Greenhouse Gas Protocol (2016) "FAQ | Greenhouse Gas Protocol". www.ghgprotocol.org

Grubb, M, with Hourcade, J-C, and Neuhoff, K. (2014): Planetary Economics: energy, climate change and the three domains of sustainable development. NY, Routledge

Guertler, P, and Rosenow, J, (2016): Buildings and the 5th Carbon Budget. London, Association for Conservation of Energy

Harris, T.M. (2016) From PGIS to Participatory Deep Mapping and Spatial Storytelling: An Evolving Trajectory in Community Knowledge Representation in GIS, The Cartographic Journal, 53:4, 318-325.

Haughton, G., Deas, I., Hincks, S. and. Ward, K., (2016) Mythic Manchester: Devo Manc, the Northern Powerhouse and rebalancing the English economy, Cambridge Journal of Regions, Economy and Society.

Healey P (2009) In search of the 'strategic' in spatial strategy-making. Planning Theory and Practice 10(4), 439–457.

Hendriks, F., (2014) Understanding Good Urban Governance: Essentials, Shifts, and Values, Urban Affairs Review, vol. 50: 4, 553-576.

Hodson, M, Marvin, S, McMeekin, A, (2018) The amenable city-region: the symbolic rise and the relative decline of Greater Manchester's low carbon commitments, 2006–17. In: Luque-Ayala, A, Marvin, S, and Bulkeley, H, (Eds). Rethinking Urban Transitions : Politics in the Low Carbon City. NY, Routledge 2018

Hodson, M., McMeekin, A., Froud, J., Moran, M., 2019. State-rescaling and re-designing the material city-region: Tensions of disruption and continuity in articulating the future of Greater Manchester. Urban Studies 004209801882018.

Höjer, M. and Mattsson, L-G. (2000). "Determinism and backcasting in future studies", Futures 32, 613-634.Inayatullah, S. (2011) City Futures in Transformation: Emerging Issues and Case Studies, Futures, 43, 654–661.

ING Bank (2015): Rethinking finance in a circular economy: Financial implications of circular business models: ING Bank, Amsterdam.

Johanson, J-E, and Vakkuri, J (2018). Governing Hybrid Organizations: exploring diversity of institutional life. NY, Routledge

Komninos, N. (2015) The Age of Intelligent Cities: Smart environments and innovation-for-all strategies. NY, Routledge

Kuriakose, J, Anderson, K, Broderick, J, & McLachlan, C (2018). Quantifying the implications of the Paris Agreement for Greater Manchester. Manchester, Tyndall Centre

Lippert, I, 2012. Carbon classified? Unpacking heterogeneous relations inscribed into corporate carbon emissions. Ephemera, 12(1/2):138–161, 2012.

Loveridge, D (2008): Foresight: The Art and Science of Anticipating the Future: London, Taylor & Francis

Luque-Ayala, A., Marvin, S., and Bulkeley, H. (2018). Introduction. In: Luque- Ayala, A, Marvin, S, and Bulkeley, H, (Eds). Rethinking Urban Transitions : Politics in the Low Carbon City. NY, Routledge

Mäntysalo, R, and Jarenko, K, (2014) Communicative planning theory following deliberative democracy theory: Critical pragmatism and the trading zone concept, International journal of e-planning research 3(1): 38-50.

Mäntysalo, R.; Jarenko, K.; Nilsson, K.L. & Saglie, I.-L. (2015) Legitimacy of informal strategic urban planning - observations from Finland, Sweden and Norway. European Planning Studies 23(2), 349-366.

Mäntysalo, R.; Olesen, K. & Granqvist, K. (2019b). 'Artefactual anchoring' of strategic spatial planning as persuasive storytelling. Planning Theory, https://doi.org/10.1177/1473095219893002

Mäntysalo, R.; Tuomisaari, J.; Granqvist, K. & Kanninen, V. (2019a) The Strategic Incrementalism of Lahti Master Planning: Three Lessons. Planning Theory & Practice 20(4), 555-572.

McKillop, T., O'Neill, J., Glaeser, E., Coyle, D., and Kestenbaum, J., (2009) Manchester Independent Economic Review. Wigan, AGMA

Mulgan, G. (2016) Big Mind: How Collective Intelligence Can Change Our World, New Jersey, Princeton University Press.

Myers, D. & Kitsuse, A. (2000). Constructing the Future in Planning: A Survey of Theories and Tools. Journal of Planning Education and Research 19(3), 221-231.

Neuvonen, A, & Ache, P. (2017) Metropolitan vision making – using backcasting as a strategic learning process to shape metropolitan futures. Futures 86 (2017) 73–83

Newman, P. (2008). Strategic spatial planning: Collective action and moments of opportunity, European Planning Studies, 16(10), 1371–1383.

OECD (2015), System Innovation: Synthesis Report, Directorate of Science, Technology and Innovation,

Petrov, L. O., Shahumyan, H., Williams, B., & Convery, S. (2011). Scenarios and indicators supporting urban regional planning. Procedia - Social and Behavioral Sciences 21, 243-252.

Phaal, R., Farrukh, C.J.P. and Probert, D.R. (2007): 'Strategic roadmapping: a workshop-based approach for identifying and exploring innovation issues and opportunities', Engineering Management Journal, 19 (1), pp. 16–24

Phdungsilp, A. (2011). "Futures studies' backcasting method used for strategic sustainable city planning", Futures 43, 707-714.

Plastrik, P, and Cleveland, J, (2019), Life After Carbon: The Next Global Transformation of Cities. San Francisco, Island Press

Quist, J. (2007). Backcasting for a sustainable future: the impact after 10 years. Eburon Academic Publishing.

Ratcliffe , J, and Krawczyk, E, (2011) Imagineering city futures: The use of prospective through scenarios in urban planning: Futures Vol.43:642–653

Ravetz, J, & Miles, I.D, (2016) Foresight in cities: on the possibility of a "strategic urban intelligence", Foresight, 18(5):469-490

Ravetz, J, (2000): 'City-Region 2020: integrated planning for a sustainable environment': London, Earthscan with the Town & Country Planning Association

Ravetz, J, (2008). State of the stock: what do we know about existing buildings and their future prospects, Energy Policy 36:4462–4470

Ravetz, J, (2010): Rethinking low-carbon strategy in the regions: applications of the territorial principle in a networked landscape: In: Regions and the Environment: Seaford, Regional Studies Association

Ravetz, J, (2015): The Future of the Urban Environment & Ecosystem Services in the UK: (Report to the Government Foresight on Future of Cities): London, Government Office of Science.

Ravetz, J, (2020). Deeper City; collective intelligence and the pathways from smart to wise. NY. Routledge

Revi, A. et al, 2014: Towards transformative adaptation in cities: the IPCC's Fifth Assessment. Environment & Urbanization Vol 26(1): 11–28.

Robinson, J., Burch, S., Talwar, S., O'Shea, M. and Walsh, M. (2011) Envisioning Sustainability: Recent Progress in the Use of Participatory Backcasting Approaches for Sustainability Research. Technological Forecasting & Social Change, 78, 756–768.

Schot, J. and Steinmueller, W.E. (2018), "Three frames for innovation policy: R&D, Systems of Innovation and Transformative Change", Research Policy, Vol. 47(9), pp. 1554-156

Sherriff, G. (2013) From burden to asset – the political ecology of sustainable transport. Town & Country Planning, Vol.82(10): 431-434

Star, S.L. and Griesemer, J. (1989) Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39, Social Studies of Science 19:3, 387-420.

Steele, W., & Ruming, K.J. (2012). Flexibility versus certainty: Unsettling the land-use planning shibboleth in Australia. Planning Practice &Research, 27(2), 155-176.

Tyndall Centre (2018). The implications of global warming of 1.5ºC and 2ºC: WP 164. Manchester, Tyndall Centre

UKGBC, 2017. Regeneration and Retrofit: Task Group Report. London, UKGBC

Uyarra, E & Flanagan, K (2010). From regional systems of innovation to regions as innovation policy spaces. Environment and Planning C, 28(4):681-695

Van den Broeck, J. (2013). Balancing strategic and institutional planning: The search for a pro-active planning instrument. disP, 49(3), 43-47.

Viguié, V., Hallegatte, S. and Rozenberg, J. (2014). "Downscaling long term socio-economic scenarios at city scale: A case study on Paris", Technological Forecasting & Social Change 87, 305-324.

Watson, V. (2008).Down to Earth: Linking Planning Theory and Practice in the 'Metropole' and Beyond, International Planning Studies, 13 (3): 223-237.

Webber, P., Gouldson, A., Kerr, N., 2015. The impacts of household retrofit and domestic energy efficiency schemes: A large scale, ex post evaluation. Energy Policy 84, 35–43.

Weber, M. and Truffer, B. (2017), "Moving innovation systems research to the next level: towards an integrative agenda", Oxford Review of Economic Policy, Vol. 33 (1), pp. 101–121

Wolfram, M., 2016. Conceptualizing urban transformative capacity: A framework for research and policy. Cities 51, 121–130.

Zapata, M.A. and Kaza, N. (2015) Radical uncertainty: scenario planning for futures, Environment and Planning B: Planning and Design, 42, 754 – 770.

Zegras, C. and Rayle, L. (2012) Testing the rhetoric: An approach to assess scenario planning's role as a catalyst for urban policy integration, Futures, 44:4, 303-318.

Goodhart, D, (2017). The Road to Somewhere: The Populist Revolt and the Future of Politics. London, Hurst

Inayatullah, S, 2011: City futures in transformation: Emerging issues and case studies: Futures 43: 654–661

Moran, M, & Williams, K, (2015): 'Devo Manc': 'Northern Powerhouse' or 'Northern Poorhouse'? http://speri.dept.shef.ac.uk/2015/04/07/devo-manc-northern-powerhouse-northern-poorhouse/

Ravetz, J, (2006). "Regional innovation & resource productivity – new approaches to analysis and communication" In: Randles S & Green K (Eds) Industrial ecology & spaces of innovation: Aldershot, Ashgate