



Urban Transitions Conference, Shanghai, September 2016

Energising peer-to-peer urban futures – Challenges for urban governance

Sirkka Heinonen^{a*}, Marjukka Parkkinen^a, Joni Karjalainen^a, Juho Ruotsalainen^a

^a*Finland Futures Research Centre, University of Turku, Korkeavuorenkatu 25 A 2, 00130 Helsinki, Finland*

Abstract

The relationship between urban governance and citizens has to be revisited as citizens and their peer-to-peer networks emerge as central actors in creating the city space. Renewable energy is a key driver, since it enables citizens to produce their own energy. This transition creates pressure for the rigid urban planning system to reinvent itself. No more can urban governance alone define, produce, and create a liveable eco-smart city. This paper claims that new perspectives are needed to help urban planners, city residents, and stakeholders anticipate and shape urban futures co-operatively. Futures images of peer-to-peer organised urban futures and their challenges to urban governance are provided, based on two futures research projects (ENCORE and Neo-Carbon Energy). Core themes influencing the liveability of an urban environment have been identified as 1) meaningful environment, 2) grassroots approaches, and 3) hybrid spaces. To conclude, a conceptual model of anticipatory hybrid governance is presented.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Urban Transitions Conference

Keywords: cities; future; liveability; meaningfulness; Neo-Carbon Energy; peer-to-peer; renewable energy; urban planning

* Corresponding author. Tel.: +358 9 698 0056
E-mail address: sirkka.heinonen@utu.fi

1. Introduction

The world and the cities are changing at an unprecedented pace. When looking towards the urban transition and the future of cities, we have to bear in mind that the future is in its quintessential character all about change. This paper presents insights on the transformation towards liveable and economically viable urban environments built on renewable energy system. The study builds on foresight efforts of two different research projects, ENCORE and Neo-Carbon Energy. In order to tackle the topic of urban transition, a primary task is to reflect upon futures thinking and systematic futures research. This will be done in the introduction. Accordingly, we will first discuss futures research and the potential it provides for anticipating and analysing urban futures. Secondly, we will briefly present two research projects (ENCORE and Neo-Carbon Energy), which form the backbone and motivation for this paper. Thirdly, we will describe the material and foresight methods used. In chapter 2 futures images based on the two aforementioned projects are presented. A model of anticipatory hybrid governance with a view to potential benefits and limitations is provided in chapter 3. The model aims to answer the challenges resulting from the preceding futures images. Conclusions are given in chapter 4.

The nomenclature used in this paper is the following:

Nomenclature	
DIY	Do-It-Yourself
ENCORE	Research project “Economically Viable City Centre and Urbanizing Downtown”
FFRC	Finland Futures Research Centre
LUT	Lappeenranta University of Technology
NEO-CARBON	Research project “Neo-Carbon Energy”
TECHEMOTH	Gigantic corporation mainly in technology, cf. behemoth
TUT	Tampere University of Technology
UTU	University of Turku

1.1. Urban transition as a futures research topic

The future naturally evokes in us futures thinking. This is thinking about how the future will unfold and what the future may hold for us. Futures thinking is an age-old human phenomenon – we as conscious human beings have always been thinking about the future and what kind of changes it will bring along. We have also been planning our life and activities for the future – in a shorter or a longer term. In Ancient Greece and Rome, as well as several other cultures, there were even specific methods for predicting the future.

Modern futures research advances, however, far beyond that. It is based on a robust futures orientation, but is not a general thing, and definitely not an art of prediction. Futures research is defined as a systematic study and exploration of alternative futures – as foresight instead of prediction, or prophesising. Modern futures research was established in the late 1940s as a scientific field [1]. Now it is even a distinct discipline at university level, even though not everybody knows about its academic existence. The University of Turku provides both an international Master’s Programme (<http://www.utu.fi/en/units/ffrc/studying/FutureMasters/Pages/home.aspx>) and Doctoral Programme in Futures Studies. Some other universities also feature futures courses, for example Tamkang University in Taiwan, the University of the Sunshine Coast in Australia, and the University of Houston in Texas. Futures research means systematic, holistic, multidisciplinary and critical long-term analysis and anticipation of future-related issues and alternative trajectories of development in society.

A more recent field is called “foresight”. The EU defines foresight as structured participatory debate about the future of complex issues [2, 3, 4]. It is a very pragmatic approach – we need to have a problem to focus on and look solutions for. In the case of future of cities, the topic of urban transition embodies a challenging research issue: how is urbanisation proceeding and what implications or issues does it bring about. Both futures research and foresight

are intended to support decision-making and strategy work at government, company, organisational, municipal, and even individual level. Both fields – futures research and foresight – use the same approaches and methods for exploring futures, of which the scenario method and Delphi technique are the widest known (see e.g. [5, 6]). Specific foresight methods used in the study presented in this paper are explained later in chapter 1.3.

The main goal of futures research and foresight is to help orientation to future and especially to pay attention to alternative developments and prepare for the future. The three main principles are: 1) the future cannot be predicted. We can only create images and ideas of what events we will be facing in the future; 2) the future is not pre-determined. There is not one future, but numerous possibilities; and 3) the future can be affected. The future is made on today's decisions [7].

Urban transition as a futures research topic is manifold and fruitful. Futures research is essentially a multidisciplinary field, which utilizes i) complexity and systems thinking, with ii) a holistic view, and iii) a long-term perspective. In urban planning, these three approaches should also be always present because: i) the city is a complex system with interconnected elements; ii) it should be regarded as a whole, and iii) planning of its forms, uses and activities should have bearing over a long time perspective [8, 9]. This paper is concentrated in highlighting the emerging issues and weak signals for anticipating urban transition and its implications for urban governance.

1.2. Motivation and background of the study

The relationship between urban governance and citizens has to be revisited as citizens and their peer-to-peer networks are to a growing extent emerging as central actors in creating the city space. Furthermore, renewable energy functions as a key driver, as it enables citizens to produce their own energy. This transition creates pressure for the rigid urban planning systems to be reinvented. The approach of urban governance can no more alone define, produce, and create a liveable eco-smart city [10]. This paper focuses on peer-to-peer approaches in producing, using, and defining an urban environment based on renewable energy, as well as on the challenges these approaches pose to the urban governance. New perspectives and reflective frameworks are needed to help urban planners, city residents, and stakeholders anticipate and shape urban futures co-operatively. This motivates us to attempt exploring urban futures where peer-to-peer activities are combined with renewable energy manifestations.

Both these topics – peer-to-peer and renewable energy – are increasingly present and visible in urban spaces and daily life in cities. Growing number of instances where they are intertwined in some manner is detected on the basis of our horizon scanning. However, they differ in the following aspect. Peer-to-peer grows from inside out, it is an internally rewarding and inspiring activity where people, citizens and consumers, produce things, products and services to their peers – fellow citizens and consumers. Peer-to-peer activity is closely related, though not a synonym, for prosumerism where the consumer becomes a producer as well. Consumers of a peer-to-peer society become “prosumers”, when they increasingly participate in the production phase of the economy. The idea of prosumerism stems from meshing together the words ‘producer’ and ‘consumer’. Futurologist Alvin Toffler [11] coined the term in his book *The Third Wave* to depict “proactive consumers” who personally help improve or design goods and services and expected prosumers to transform the marketplace as well as change the role of the consumer.

The concept of peer-to-peer originates from computing networks, in which workloads and resources – such as files, processing power and data storage – are distributed between equally privileged peers (i.e. individuals). Although the concept of peer-to-peer became popular – or even synonymous – with the music sharing program Napster, the idea is said to date back to the birth of internet [12]. Within peer-to-peer there is no central and hierarchical coordination; peer-to-peer networks are self-organising. Peer-to-peer networks can be conceived as a model for understanding social structures more broadly. In a “peer-to-peer society” citizens cooperate with each other in a non-hierarchical way. Sharing computing power within the network empowers the community around it. Furthermore, a peer-to-peer approach may transform an entire system to better meet the behaviour and approaches of the people using it [12]. According to Benkler [13], peer-to-peer, non-market, and non-proprietary production may become not only possible, but the dominant form of production and organisation in the future due to various economic, technological and cultural drivers. Benkler [13, 14] further notes that commons-based non-proprietary peer-to-peer strategies are the most efficient way to organise an economy that has become structured by creativity and information economics.

The concept of peer-to-peer, as applied to reflect the future of cities, is related to the ways in which citizens can co-operate to create and use urban spaces. Relevance for questions related to renewable energy is also palpable. The so-called neo-carbon energy system (as described in the next chapter) can be organised in a peer-to-peer way, if citizens are allowed to feed energy produced by them into the grid. In a broader sense, new affordable and distributed renewable energy can empower citizens to organise along the principles of peer-to-peer. In such society, everything from work to leisure to decision-making can be conducted among peers.

The future of energy is one of the greatest global challenges for humanity and life in the cities. The urban transition is contingent with the need for energy transition from fossil fuels to renewable energy. In recent decades it has become increasingly clear that business as usual approaches are inadequate for reaching a sustainable future because around eighty per cent of the world's primary energy is still produced with fossil fuels [15]. The emergence of renewables as a technology alone is not enough, more radical and discontinuous scenarios are urgently needed. However, energy as a research field is a complex environment-societal system whose evolution is difficult to model because it includes societal responses and ways of thinking [16]. Renewable energy is an increasingly imposed imperative on the basis of external constraints and the need to cut down fossil fuel use and greenhouse gas emissions. However, renewables can also become a very personal issue, internally motivating factor for responsible urban citizens and their arising new consciousness [17].

1.3. Neo-Carbon Energy and ENCORE research projects

Futures images of peer-to-peer organised urban futures and their challenges to urban governance processes are provided in chapter 2. These results have been constructed utilising material from two ongoing futures research projects called Neo-Carbon Energy and ENCORE that are presented below respectively.

The research project **Neo-Carbon Energy** (2014–2017) is a strategic research opening funded by Tekes – the Finnish Funding Agency for Innovation, in which a new renewables-based energy production and storage system is being developed by VTT Technical Research Centre of Finland, Lappeenranta University of Technology (LUT) and the University of Turku (UTU), Finland Futures Research Centre. For more information, see www.neocarbonenergy.fi and <https://www.utu.fi/en/units/ffrc/research/projects/energy/Pages/neo-fore.aspx>. The Neo-Carbon Energy project studies an emission-free energy system based on renewable energy, especially solar and wind energy. The foresight part of the project studies how society and economy could be transformed, if energy production is decentralised and the methods of production are transformed, so that even materials based on fossil fuels will be replaced with synthetic ones.

In the project, four transformative scenarios on societal and energy futures until 2050 have been sketched. The scenarios are qualitative, long-term, global, and exploratory rather than serving as direct support for decision-making [18]. All four scenarios explore radical changes, and are thus transformative according to the vocabulary of the scenario archetype approach [19]. The scenarios were constructed using the intuitive logics approach and have two axes of uncertainty, which results in four scenarios [20]. Transformative change takes place through a transition. In the horizon scanning that preceded making of the scenarios, special attention was paid to weak signals and discontinuities.

Fig. 1 illustrates the two axes that form the basis of the transformation. The scenario axes are derived from the vision of 'neo-growth' where economic growth is ecologically sustainable [21], distributed renewable energy is mainly in use [22, 23], and society in which ecological awareness is increasingly profound [24], re-organises into peer-to-peer networks. Old hierarchies inside organisations and in the civil society have faded away (x-axis) and citizens are pragmatic and conscious of the environmental impacts of their actions (y-axis). The four scenarios are summarised in the following. In each scenario, the urban transition is assumed to take place in different forms.

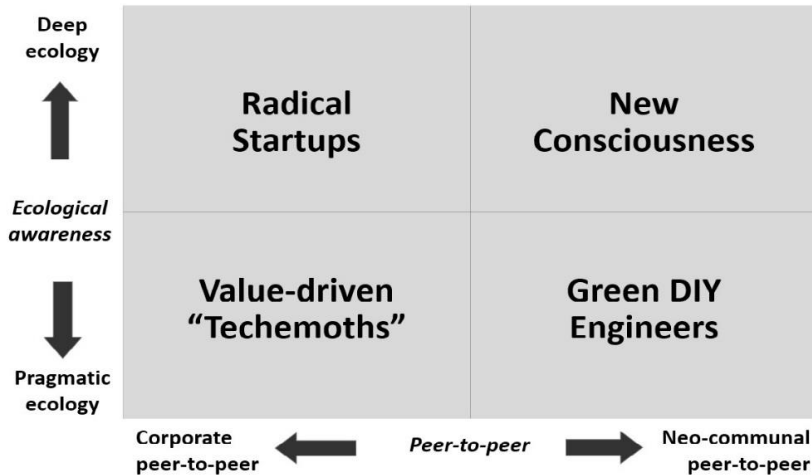


Fig. 1. Four transformative scenarios 2050 of the Neo-Carbon Energy project.

In the **“Radical Startups” scenario** (deep ecology + corporate-driven peer-to-peer society) the economy is driven by a multitude of small-scale startups that are known for their “radical” values and approaches. These startups are drivers of new, deeply ecological lifestyles and novel working practices that emphasise bottom-up-driven managerial approaches and value self-expression. Environmental problems are first and foremost solved commercially. The selling point of startups to the broader society is their promise to do societal and environmental good. The innovative startups develop new energy technologies, services, and solutions that together drive reductions in CO₂ and other emissions. In this scenario, cities are hubs that nurture the talents of diverse entrepreneurs.

In the **“Value-Driven Techemoths” scenario** (pragmatic ecology + corporate-driven peer-to-peer society) markets are assumed to take care of environmental issues. The peer-to-peer ethos is manifested especially inside ethical and value-driven technology giants, so-called “techemoths”. Among other things, these techemoths invest in ambitious energy and technology projects, and represent the Silicon Valley values of emancipation, creativity and open source. Their stance may, however, appear to be somewhat self-contradictory, as the techemoths cherish a “libertarian” hacker mentality, but at the same time their employees are tightly committed to life inside the corporate walls. On the whole, the citizens in a techemoth society are not committed to energy concerns in a heartfelt way. They generally assume that such matters are “automated”, looked after by someone else. In this scenario, corporate headquarters *are* cities, not just an office milieu, as they provide everything for their workers as “citizens” to these surroundings. However, outside “techemoth cities”, the urban belt lacks a lot of amenities and services.

In the **“Green Do-It-Yourself Engineers” scenario** (pragmatic ecology + neo-communal society) countries fail to escape the fossil fuel economy, and consequently, the world faces an ecological collapse. Species extinctions have accelerated, there have been considerable changes in weather patterns, and infrastructure – or what is left of it – is decaying. Consequently, environmental problems of the future must be solved locally with a practical “do-it-yourself” attitude. Engineer-minded citizens have organised as local communities to survive. These communities have to cope mostly with low-tech solutions because global trade has plummeted. Communities are densely built with plenty of shared public space. Some communities are off-grid and totally self-reliant on their energy production. Lifestyles are localized, and long-distance travelling is unusual. National cultures and nation-states as such have more or less withered away. In this scenario, cities are *rurban* communities – rural self-sufficient cities.

In the **“New Consciousness” scenario** (deep ecology + neo-communal society) an ecological crisis, ubiquitous information and communication technologies, and conflicts of hybrid warfare that resemble a “Third World War”

give rise to an entirely new kind of consciousness. The world is understood to function as a system where everything is connected to everything else. Values of deep ecology become a norm. People conceive themselves as parts of nature and are also deeply intertwined with other human beings and life species. In a unified global system, society collaborates openly and globally to share information and resources. Energy is “sacred” and considered as a source of all life, which explains why citizens are extremely committed to energy decisions and policies related to fighting climate change. In this scenario, the cities are the “wombs” for a global brain and hybrid communication between humans, physical infrastructure and virtual reality.

The other research project that we present in this paper is **ENCORE** (2014–2016) that focuses on innovative urban development, and is funded by the Turku Urban Research Programme. The full title of the project is “Economically Viable City Centre and Urbanizing Downtown”. For more information see <http://www.utu.fi/en/units/ffrc/research/projects/Pages/encore.aspx>. Novel success factors of city centres are explored in this project to illustrate the future possibilities in urban planning. The research consortium of the project consists of professors and researchers from the School of Architecture at the Tampere University of Technology (TUT) and from Finland Futures Research Centre (FFRC) at the University of Turku (UTU). The main research question of the foresight part of ENCORE is how can the interaction between different actors – citizens, city management, companies, and organisations – improve the attractiveness and liveability of a city. All development should, according to our pre-determined assumptions, improve social equity and the quality of an urban environment.

The attractiveness of city centres as well as their spatial and functional quality are essential goals for urban planning. The ENCORE project examines the future of urban planning of two Finnish cities, Turku and Tampere, through a three-part process, as illustrated in Fig. 2. In the first part, a case study on the planning procedures of Lyon and Stockholm is conducted at TUT. In the second part, led by FFRC, the change factors and their development paths in urban environments are anticipated with foresight methods such as horizon scanning and the identification of weak signals. In connection, an international survey has been conducted to learn from urban innovation. The third part of the project applies these results from the case study and deliberative foresight to the planning processes of Turku and Tampere.

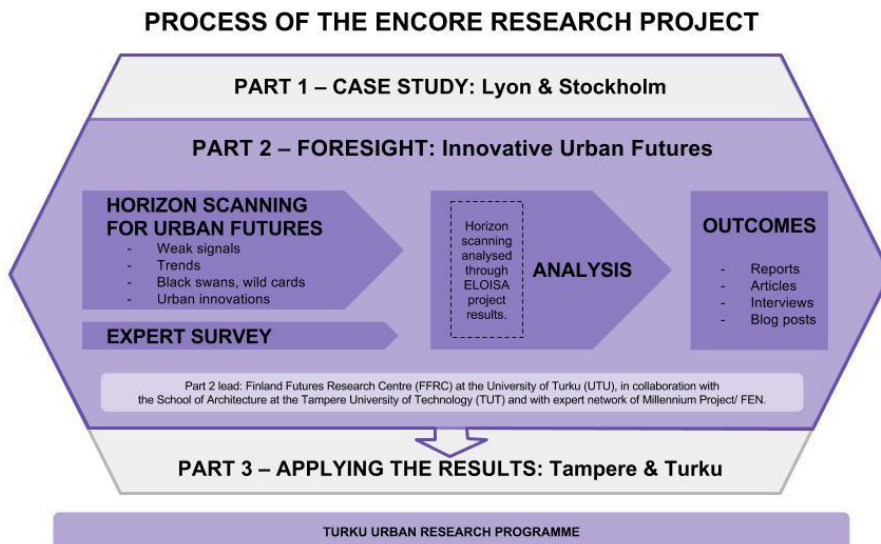


Fig. 2. Flow chart of the ENCORE project and its study modes.

Diverse political, economic and spatial progressions together with the rapidly changing modes of housing, consumption, and work, are influencing the urban environment in unpredictable ways. As earlier suggested, the current planning systems, however, are rigid and answer poorly to these transformations. To achieve enhanced

economic viability, city centres and downtown areas would benefit from a reform of planning systems and an update of related practices, based on a deep and updated understanding of the multiple drivers of urban change. Such insights are being sought through the horizon scanning (see more in chapter 1.4).

1.4. Materials and methods

The futures studies methods used in the two research projects presented in chapter 1.3 are horizon scanning that pays a special emphasis on identifying and analysing weak signals, and emerging issues more generally. These often manifest themselves around discontinuities and disruptive innovations. The identification and analysis of weak signals has been conducted in different ways. In the Neo-Carbon Energy project, the horizon scanning was performed to provide building blocks in the construction of transformative scenarios. In the ENCORE project, the aim instead was to structure the horizon scanning material according to a three-fold categorization of identified core themes that influence the liveability of an urban environment. These core themes that open up avenues for urban transition are 1) meaningful environment, 2) grassroots approaches, and 3) hybrid spaces. These themes are presented in this paper with a few illustrative examples, and with comparative reflections to the scenarios of the Neo-Carbon Energy project. Finally, the weak signals material is viewed through the anticipatory lens of governance, outlining how urban planning could better answer these pivotal transformational developments. This framework is depicted in Fig. 3.

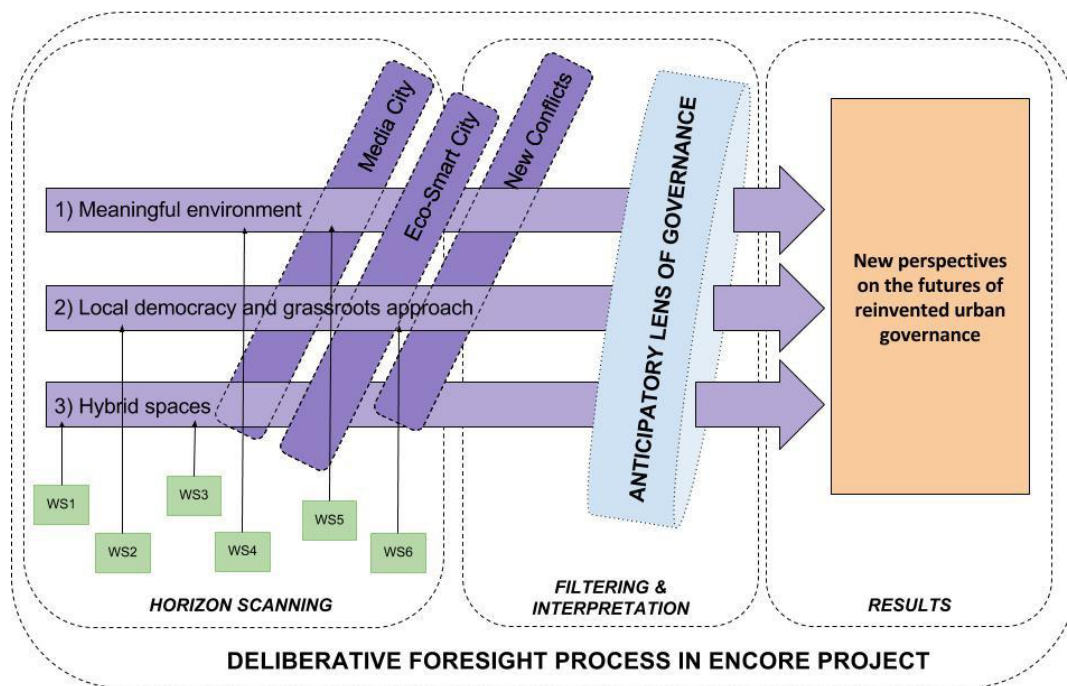


Fig. 3. Horizon scanning process as focused on weak signals.

In the foresight part of both research projects of ours, futures studies methods are utilised especially to tackle the non-linearities, disruptions, and uncertainties of the changing world with the aim to support urban development and planning. The futures of urban transformations and the quality of city centres are explored in interaction with

networks specialized in futures research, such as the Millennium Project. Current developments in city centres and downtown areas are analysed in relation to pivotal transformational developments (trends) and especially to emerging new phenomena as indicated by weak signals. The research results will provide new perspectives and reflective frameworks that help city planners and city residents shape urban futures – to meet their present goals and anticipate desirable futures.

The results offer new perspectives on the futures of reinvented urban governance. As a result, a model of anticipatory hybrid governance is presented in chapter 3. According to the study, the reinvented governance 1) understands the ever-shifting urban environment proactively through systemic and holistic foresight process, 2) opens up beyond its strict traditional boundaries, reaching out to citizens, new partnerships, and fourth sector, and thus 3) leads the way toward fully utilising the potential of digitalisation to create a versatile, inclusive, and liveable urban environment. These points derive from the ENCORE project framework. Moreover, as underscored by the Neo-Carbon Energy project, this approach also needs to account for the context of 4) ecological limits and 5) a pressure to increase amount of renewable energy in urban settings.

The qualitative approach in futures research is to think about the future at three perspectives: possible, probable, and preferred futures. We can relate these to the question of what kind of urban transition is possible, what is the probable development, and what is the urban transition that is desirable and to whom. All these perspectives are important, but the main thing is to explicitly indicate which one is being used in which context.

Horizon scanning is used for identifying future signals – signs or “early warnings” for futures. The strongest ones are megatrends, which can also be manifested as global challenges. Then there are trends, and weak signals – signs of emerging things that may strengthen themselves and grow into trends or not. Weak signals are indicators of the future in the present moment. They give early information about forthcoming changes or they are the first signs or symptoms of such changes [25]. Hiltunen [26] even claims that they provide the most important knowledge available about the futures. The fourth category for scanning the futures is the black swans [27] or wild cards. They are highly improbable events, but if they occur, they will have dramatic impacts on society. In this paper we concentrate on identifying and analyzing weak signals for urban transition (Fig. 3). Such weak signals represent possible futures, rather than necessarily very probable ones. Whether they are signs for preferred futures in the trajectory, remains to be further analysed and open to subjective interpretations.

The strongest futures signs – megatrends – can be perceived and analysed as global challenges. One framework for tackling them is given by the Millennium project and its framework of 15 Global Challenges [28]. By paying attention to the challenges and their interconnectedness you may anticipate their impact on any sector or topic – such as work, housing, mobility, energy, education and culture. Urbanisation is one of the most evident megatrends and global challenges, and so is energy. Besides using the framework of 15 Global Challenges, the Millennium Project conducts various long-term oriented studies. The most recent one – which is of highest importance to society – is a scenario project on Future of Work/Technology 2050 [5]. What skills are needed in the future, what implications from new technology e.g. robotisation, artificial intelligence, 3D printing, are emerging for work and employment? How could we move towards 100% renewable energy world? What kind of education system is needed? What do the third and fourth industrial revolution mean and offer to us as learning human beings and urban actors? All these questions are pertinent to the urban transition currently taking place.

2. Energising peer-to-peer urban futures

This chapter presents the results of our horizon scanning, focusing on emerging issues and weak signals pointing to early indications of possibly strengthening phenomena. Implications for urban governance are pointed out from each example. References to an expert survey are also made [29]. In addition, comparisons are drawn to the four worlds of the transformative Neo-Carbon Energy scenarios.

2.1. Meaningful environment

Citizens have a need to experience the environment as meaningful. By a meaningful environment we address a space or a place that offers specific and different meanings to citizens. According to our claim, the meaningfulness of a space is connected to an individual perception, and thus differs from actor to another.

Meaningful environment as a theme is strongly defined by the rise of “experience economy” and the search for meaning. In the future, this seek for meaningfulness is emphasized, as people connect to their environment using increasingly more electronic and virtual means of communication instead of belonging merely physically to a certain space. At the same time, the ways in which urban spaces will provide arenas in which citizens construct the meaningfulness of their lives will be different, as they meet novel expectations. Meaningfulness and experience are both related to individual interpretation, and thus a space, environment, or the ways to use them may be meaningful in different ways to different people [30]. Thus the meaningfulness is also connected with human interaction. The individual experience of meaningfulness is further connected with the complexity of cities. As Michael Batty states, city is always understood and articulated in different and individual ways, making cities multiple in ideas, perceptions and theories [31]. The three examples illustrating this are the ZOKU working and living space in Amsterdam, lessons learned in the City of Medellín, and the Waiting Wall project in London.

The **ZOKU** hotel in Amsterdam, opened at summer 2016, facilitates global living and working for the traveling professional. The ZOKU introduces a new category in the hotel industry: a flexible home/office hybrid, suitable both for a short or long stay, with the services of a hotel and the social buzz of a thriving neighborhood. You can live, work, relax and socialize with like-minded people – while getting wired into the city. “Zoku” is a Japanese word meaning family, tribe or clan, to highlight the cosy milieu and sense of belonging. Much emphasis is also being paid to the food which is made of fresh ingredients, herbs and vegetables catered from the roof garden. According to the hotel’s manifesto the venue is a second home for residents, a neighbourhood to share their ideas and ambitions. ZOKU has a strong resemblance to the Radical Startups scenario, as it provides a space for a community born around work. Like-minded people connect via work, which transforms into a platform encompassing all fields of life. Similarly to the scenario world, work and leisure mix in ZOKU. Lifestyle influences work, and work penetrates free time.

The **City of Medellín** in Colombia experienced a metamorphosis from a city with high criminal rates and notorious drug gangs into one of the most liveable and equitable urban environments. Various infrastructural improvements were made, with an emphasis on sustainability and inclusiveness. According to the city planning commissioner Jorge Pérez, the idea was to create public spaces that bring further opportunities for the citizens. These opportunities took the shape of UVAs, Unidades de Vida Articulada (Articulated Life Units) that can be described as neighbourhood-level urban interventions. One example is the redesign of water tanks around the city. The tanks – previously inaccessible for the citizens – have been transformed into parks and public spaces supporting the interaction of different communities. As the transformation of the City of Medellín was a top-down process, it resonates with the Value-Driven Techemoth world, in which large corporations provide for the citizens’ needs. In the scenario giant but ethical companies have partly adapted the responsibilities that traditionally belonged to cities. Similarly to a techemoth-as-a-city, Medellín offers its citizens facilities for self-organised action.

The **Waiting Wall** is an art project by Alan Donohoe and Steven Parker that makes the emotions of city dwellers visible in the urban environment. It features a digital display on a train station in Brighton showing confessions and fears that have been submitted anonymously by strangers. The contents of these messages vary from work-related confessions to disclosures of love life and worries about health. The artists suggest that the piece is a modern adaptation of the Wailing Wall in Jerusalem, broadcasting the inner woes of anonymous submitters with the aim to remind “*we are none of us alone in the extent of our troubles and lamentations*”. In general, it can be stated that such emotions presented in an urban environment are divided; the commercial entities avoid issuing negative feelings, which are rather considered private rather than belonging to public space. The Waiting Wall resembles the world of New Consciousness, where citizens deeply connect to each other and the nature. The Wall promotes a multiplicity of emotions in an urban space utilising communication technologies, and it can be seen as an initial step towards emphatic communities.

These three case examples illustrate a meaningful environment from various aspects. The three examples all relate to meaningfulness by enabling encounters between different people, yet with different logics. ZOKU revolves around work and free-time, utilising meaningfulness as a service. The City of Medellín enables encounters more openly and uncontrollably in various urban locations, as an inseparable part of city life. Both offer a platform for meaningfulness. The Waiting Wall connects anonymous people and observers through digital technology and negative emotions. Sustainability is also at the core of meaningfulness. Zoku and the City of Medellín both feature an urban space that aims for social, ecological, and economic sustainability. The City of Medellín enhances the equitable and inclusive city by offering spaces for the citizens to create and self-organise. All three examples connect to peer-to-peer ways of organising. The City of Medellín and ZOKU enable the platform for such activities, and the Waiting Wall is an example of peer-to-peer communication.

2.2. Grassroots approaches

By grassroots approaches we refer to two distinctive characteristics of this theme. They are 1) influencing the local decision-making of one's environment, and 2) proactive and self-imposed ideation and action. Freedom and co-creation are central parts of this theme [30]. This theme depicts the flows defining urban life by the citizens and their aspirations. As examples of the local democracy and grassroots approaches three different phenomena are presented: the Restaurant Day in Finland, the regenerated area of De Ceugel in Amsterdam, Netherlands, and the DIY libraries in New York.

Restaurant Day is a food carnival event, which started in 2011 in Finland. Four times a year, anyone can set up their own pop-up restaurant or a café for a day anywhere they wish. Participants plan for their own menus and announce their restaurant on the event web page. Currently, an association facilitates the event. The event spread around the world quickly. On the first Restaurant Day in May 2011, there were 45 restaurants – all in Finland. In August 2013 there were almost 1700 restaurants in 35 countries. According to the association, restaurants have popped up in 74 different countries during the past years. The motivation to the initiative was the frustration towards slow and bureaucratic process of opening a restaurant in Finland. According to the Restaurant Day founders, someone had imagined for a day, where regulation would not exist. Restaurant Day features DIY-driven – even libertarian-like ethics, as anyone can create a restaurant service of their dreams without considering the bureaucratic demands related to opening a real restaurant. Similar events and phenomena may function as platforms to support new ways of organising work, as a field for an emerging industry to be explored in a light way without grand economic commitments. Self-imposed creation can even lead to temporary activities becoming firmly established practices, as even seemingly risky ideas can be first tested in events.

De Ceugel in Amsterdam, Netherlands used to be a polluted and abandoned shipyard area. In 2012, the City of Amsterdam launched an idea competition for the re-development of the area. The winner of the competition was a creative concept around recycling, vegetation (to decrease pollution), retrofitting old boats, and low-tech experiments. Over ten years, a multidisciplinary group of architects, landscape architects, builders, and sustainability experts would clean up a polluted soil, which de Ceugel will transform into an urban oasis. Today, de Ceugel is a sustainable, closed-loop incubator that hosts a thriving community of creative social enterprises, built with support from Bureau Broedplaatsen. By recycling houseboats, cleaning the soil, and using low-cost clean technologies to improve the sustainability of the development, this former shipyard is now an example of a creative urban community in a circular economy. Using recycled materials, it was built by a large group of passionate entrepreneurs and volunteers. De Ceugel is equipped with over 150 photovoltaic panels (PV) that yearly produce around 32 500 kWhs of power, equivalent to cover the electricity demand of the heating systems, and a part of the remaining electricity need of the offices. Each office boat has an air-to-air heat pump and a heat exchange ventilation system. As warm air leaves the boat, over 60% of the heat is captured and circulated back inside. Examples akin to de Ceugel could result from the activities of green DIY engineers, as the space is realised with scarce resources in the middle of polluted infrastructure. Furthermore, de Ceugel could be a space that enables the approaches of radical startups that are bottom-up driven.

A number of private **do-it-yourself (DIY) libraries** were opened in New York in 2015. Libraries often concentrate around specific type of literature, and are open for members only. One example is Wendy's Subway, a non-profit and shared working space and a "literature hub". DIY libraries are an interesting extension to sharing

economy, transforming a service traditionally considered as a part of the public realm into a peer-to-peer operation. The phenomena reflects the community-centered way of solving a problem in Green Do-It-Yourself Engineers. The rise of the libraries started after the economic hardships of public libraries in New York. As budgets decreased, the nature of public libraries started to change. Events, workshops, and other services were provided instead of these libraries solely concentrating on books. The boutique libraries are an interesting example of a DIY response to shifts in the provision of public services. DIY libraries redefine the concept of library by turning it into a space for a niche community around a specified genre. They provide a very different kind of platform for communities compared to public libraries that are open for everyone and aim to serve the needs of a grand audience.

All these cases illustrate bottom-up approaches that have a different emphasis. Not surprisingly, all three cases resonate with Green Do-It-Yourself Engineers scenario. Restaurant Day is based on proactivity and prosumerism where the urban environment is influenced through the self-organised grassroots activity of citizens. De Ceutel is a community of entrepreneurs, artists and volunteers, supported by the municipality, which lives by the principles of a circular economy. DIY libraries expand sharing economy on the field of public services, and offers a space for a semi-closed community. This is an example of urban culture becoming more individualised that perhaps better meets the needs and tastes of the citizens. However, if public services are replaced by highly fragmented grassroots activities, cultural bubbles can become more common. DIY culture depicts grassroots approaches in the context of urban governance. After initially being conceived as counter-culture, Restaurant Day has later been strongly supported by the City of Helsinki, and is listed as one of the visitor attractions of Finland. De Ceutel is designed and built with self-organised methods and low tech and low budget approaches. Eco-smartness is a key value in some of these projects. Conclusively, it can be stated that the relationship between the grassroots and the establishment are flexible. However, none of these examples presents very radical grassroots solutions to urban problems. Solutions of the future could, in turn, pose even more complex challenges to urban governance.

2.3. Hybrid spaces

We define hybrid spaces as spaces that combine different functions, aesthetics, and spheres of life. They are fusions of old and new, public and private, housing, leisure and working environments, or digital, virtual and physical. The theme concentrates on the services and actions taking place within such fusion spaces, focusing on the user. [30].) The examples in this category are The Neighbourhood University in Hamburg, Germany, the Garden Bridge in London, UK, and the Smart Nation initiative in Singapore.

The **Neighbourhood University** (Universität der Nachbarschaften, UdN) was an experimental platform, where hands-on approach and contemporary forms of education based on culture, knowledge and urban development were tested. The venue was an abandoned government building that was turned into an education space by a group of volunteers. Low-cost and upcycled material was used in the process, and instead of monetary support people were asked to participate and bring their skills and knowledge. The aim of the Neighbourhood University was to develop own principles of work and studying, remove the knowledge creation process from the ivory towers of established institutions, and explore the process of concrete urban transformation. The experiment ended in 2014. Neighbourhood University echoes the possible worlds of Radical Startups and Green Do-It-Yourself scenarios. The space both stems from and enables tight startup-like communities based on DIY ethics. The space could also function as an initial platform for emphatic New Consciousness communities, as sharing knowledge and peer-learning are at the core of the experiment.

The **Garden Bridge** in London is supposed to be finished by 2018. The building of the bridge started in Spring 2016 on the South Bank of River Thames. The Garden Bridge will be covered with plants and trees, and it is designed as a space for the whole community to enjoy. However, the many residents of the area have expressed dissatisfaction with the plan. Firstly, the bridge is suspected to cause crowding in the area. The locals are afraid that commuting with bicycle will become difficult. Secondly, the bridge has been viewed as elitist, as despite its public nature, it is intended to be occasionally closed for corporate events. The bridge project gives insight to a top-down governance project with hardships to meet the demands of the citizens. Although the bridge has been designed to represent diversity by design and its ways of utilisation, it also illustrates the diverse expectations different instances

have towards urban planning. Illustrative of the Value-Driven Techemoths scenario, unequal access to the bridge shows the experienced fears of the masses in the urban belt outside the prosperous techemoths, as they are left without resources.

Singapore's Smart Nation initiative promotes a sensor-intensive infrastructure, which also encompasses apartments. The initiative aims to measure 'everything'. Interestingly, it is not completely clear yet, what these smart technologies can be used. The idea has been to build first and develop the applications after. This top-down delivered smart city initiative resembles a digital panopticon. Even though there are many advantages for well-being and decrease of pollution caused by traffic, privacy issues have mostly been left without discussion. Such an initiative could take place in a Value-Driven Techemoth world, where citizens are not even concerned of their privacy and trust the corporate organisation to ensure their wellbeing.

All the above three spaces are hybrid with their multifunctional ways of combining different tasks, as well as social and physical spaces. The Neighbourhood University offers a space combining research, housing, education, and workshops. The Garden Bridge is a proposal of a space combining transport, leisure, and education, with different segments of the green areas representing different cultures around the area. These two cases differ in the level of governance. While the Neighbourhood University a hybrid space defined by the community (*bottom-up*), the Garden Bridge is a hybrid space defined by governance (*top-down*). Both examples also illustrate hardships, as the Garden Bridge project has received a lot of criticism, and the Neighbourhood University experiment ended in 2014. The reasons for the latter are unknown, but the development interestingly underlines the problems of participation-driven processes. As the projects are organised and executed by volunteers, there is no obligation to continue with the experiment, in case there is i.e. a lack of interest or economic resources.

3. Model of anticipatory hybrid governance

We define anticipatory hybrid governance as one that accounts for foresight-driven knowledge and allows for flexibility in the governance approaches to meet the best possible outcomes. Foresight provides a set of systematic tools to look at what may await for the cities of the future. It also prepares the ground to imagine and plan for alternative approaches. This way, the policy process can be shaped by opening up a diverse set up of actionable and contemporary approaches that hold a strategic long-term view. Whereas foresight produces knowledge; in governance, actions need to be taken to prepare for different possible futures – now. Both have to recognise a multi-level, multi-sectoral and dynamic nature of how society in reality works. Taking note of this complexity, anticipatory hybrid governance is prepared for a possibility of a mixture of solutions and even multi-stakeholder collaborations, when deemed suitable.

Along with a changing city, the governance has to change as well. Urban governance benefits from goals, targets and policies [32], indicators provide good checklists for monitoring and accountability – but having an overarching strategy is imperative. Planning discourse, theory and practice themselves have to be evaluated in the context of the transformation they can achieve in addition to supporting resilience [33]. Successful and proactive urban governance includes ecological and energy-related pressures, not only socio-technical issues when it anticipates the future of a city landscape. Preparing for alternative outcomes and known risks, escaping the rigidity of past policies and even allowing spontaneous behaviour such as piloting potential solutions can bring agility to policy-making that may improve the legitimacy of governance. Urban governance could benefit from a recognition of the potential of citizens as key change-makers, while public administration, the focus in typical policy studies, has resources that several innovative and nimble societal actors lack.

Our disposition towards anticipatory hybrid governance, as a lens of how to act, assumes a long-term view to reflect the alternatives in city space. Anticipatory hybrid governance needs to be responsible and align science, innovation and emerging technologies with short- and long-term social needs and goals [34]. All policy-making carries ethical, legal and social issues, just like values and ethics should influence technological and societal innovation already from the design phase [35]. The radical character and speed of technological change underscores these questions [36]. Meanwhile, in the absence of bolder policies, energy futures of cities will be unsustainable; by being more costly, unequitable, and with higher environmental pressures [22, 36]. Horizon scanning, including that of weak signals, can allow a proactive and positive governance response, as well as prepare the urban governance to

potentially scale up innovative solutions. When analyzing weak signals through an anticipatory lens of governance, the following questions are important: What implications will the occurrence of these weak signals have on urban governance? How should urban governance react to such changes?

It is often ignored that the present constraints for urban governance are an outcome of a series of past choices, technologies and design principles. Roads in cities were constructed to fit people, animals, bicycles, and with modernisation, cars and novel modes of public transport. In hindsight, an integrative perspective has shown that congestion leads to a loss of productivity, air pollution carries health costs, and carbon emissions induces climate change. Certain “lock-in” effects and path dependencies are slowing down attempts to reverse the choices made in the recent decades. Psychologically, it may be difficult to let go of sunk costs into built infrastructure [37]. Had this been anticipated a hundred years ago, perhaps the choices now available would be less constrained.

In the light of this, urban governance has to prepare for emerging ecological, socio-cultural, techno-economic and political changes. This has to take place early when such management is still possible. Like with technology, if you act late, it may be too late to re-design it [35]. As shown by our Neo-Carbon Energy research [38], the lowering costs of solar and wind can be supported by an enabling policy and market environment. Cities can be highly relevant actors towards renewable energy powered peer-to-peer urban futures [36], but some present problems must be overcome. These may range from difficulties to retrofit solar panels on building rooftops, or even prohibiting citizens to produce their own energy in some countries. In these two examples, such issues could be strategically met with appropriate policies that address building standards, or by re-considering the arrangements with public utilities and county electricity companies. Such bottlenecks are often discovered when taking a holistic view to analyse the urban energy transition as a societal issue *and* the often siloed and field-specific ways of governance. Multi-level solutions that involve several actors may be needed to make the most of an emerging technology – in a socially just manner [39].

New challenges set new targets, while old goals too must still be met. Based on our study, we propose the following conceptual model of anticipatory hybrid governance for cities. This reinvented governance 1) understands the ever-shifting urban environment proactively through systemic and holistic foresight process, 2) opens up beyond its strict traditional boundaries, reaching out to citizens, new partnerships, and fourth sector, and thus 3) leads the way toward fully utilising the potential of digitalisation to create a versatile, inclusive, and liveable urban environment. This has to take into account the context of 4) ecological limits and 5) a pressure to increase the amount of renewable energy, also in urban settings.

This provides a future-oriented, knowledge-based co-creative approach to urban governance. We recognise that at some point, this model, too, can become outdated and has to be further adapted. We hope that these considerations are of use today, even if no model can remove the social, institutional and cognitive limitations to real life decision-making. The question now is what will be the new role of urban governance deriving from these shifts: Will it be a coach for a team of citizens and other stakeholders? Or a judge and diplomat solving new conflicts rather than being a party of a conflict? Or will it resemble, and act as, a jazz orchestra conductor?

4. Conclusions

This paper has presented findings on the transformation towards a renewable energy based future as well as towards the liveability and economic viability of city centres, based on two futures research projects (ENCORE and Neo-Carbon Energy). The horizon scanning phases of these foresight projects focused on futures images, emerging issues, and weak signals, illustrative of approaches of peer-to-peer, renewable energy and/or ecological awareness. Described then as case studies, those of ENCORE were organized around three core themes that influence the liveability of an urban environment: 1) meaningful environment, 2) grassroots approaches, and 3) hybrid spaces. Many cases could have fitted more than one of these three intertwining themes. These cases were discussed with four Neo-Carbon Energy scenarios. To conclude, a conceptual model of anticipatory hybrid governance was presented with a view to potential benefits, limitations, and outlined certain open questions.

Our four transformative scenarios, of the Neo-Carbon Energy project, contribute to the reinvented peer-to-peer based urban planning system of the future, as a matrix to examine real-life initiatives against future narratives. DIY

libraries illustrate a shifting context of public services; whereas Singapore's Smart Nation initiative and Garden Bridge in London are top-down-driven approaches that in spite of well-intended plans and potential meet resistance and imply certain threats. ZOKU is a good fit into the scenario world of radical startups; while de Ceuvél in Netherlands inspires towards a circular economy and for further radical collaborations. Neighbourhood University represents a platform-type of approach that enables ecologically-motivated collaboration; and Restaurant Day merits for its massive scaling-up and institutionalization of a DIY initiative. This allows us to assess how transformative these initiatives are by design principle and how impactful in terms of outreach. They also illustrate the shortfalls in the novel initiatives of governments, cities and citizens to improve cities, and makes visible how and where complementarities and division of work might harness even more out of such innovations. How to make urban governance even more transformative, and responsive to leveraging such best practices may warrant further research.

Systemic use of holistic foresight knowledge is critical for understanding emerging urban futures. The scanning of weak signals allows a detection of early signs of possible changes that may carry even long-term impacts for urban transition. Even if future-oriented planning will always have 'unknown unknowns' as an ultimate aim to explore, it is worthy to be aware of the 'known knowns' and 'known unknowns', too. A research topic can also be positioned into the crossroads of foresight exercises. In this case, cross-fertilisation between the two different foresight efforts was needed for many reasons. Firstly, the systemic and holistic observation of the possible futures of any phenomena is interconnected to a complex set of other systems. Thus discussing the preliminary results of the two projects allows an extensive and wider framework to consider the validity of both projects. The weak signals detected in the ENCORE project have given evidence for the emergence of different aspects of all the four Neo-Carbon Energy scenarios. Signals that support these four scenarios are found in the examples. On the other hand, Neo-Carbon Energy provides a framework of a renewable-based peer-to-peer society against which to observe the urban development. Almost all of the weak signals from ENCORE indicate the increasing of peer-to-peer approaches.

Anticipation requires future-orientation, with a capacity to act. So far, when urban governance has anticipated trends and variables, it has struggled in designing for the future to mitigate potential conflicts. Our model opens aspirational alternatives and aids urban governance to reinvent itself. What is more, foresight and governance can be aligned to visions of preferred, and even transformative urban futures. While the future is increasingly complex and societal change increasingly rapid, urban governance has to address issues of how the future can – and should unfold. Ecological pressures that manifest as weak signals before they evolve, may over time result in changes of radical magnitude. Emerging technologies today are manifold and can further converge. In renewable energy powered peer-to-peer urban futures, citizens' seek to make decisions, influence the public sphere, and have a stake in how novel technologies are adapted. All this will influence cities and urban governance must allow for flexibility and co-creative collaboration with citizens to address such developments. A plausible head start to address such challenges is given by ensuring that it has the appropriate mindset to make the most of them.

Acknowledgements

The authors gratefully acknowledge the public financing of Tekes, the Finnish Funding Agency for Innovation, for the 'Neo-Carbon Energy' project under the number 40101/14, as well as the Turku Urban Studies Programme for funding the ENCORE project. Ms. Merja Lang, Millennium Project Intern at Finland Futures Research Centre (FFRC) is also acknowledged for her contribution in finalising this work.

References

- [1] O.K. Flechtheim, *Futurologie: Der Kampf um die Zukunft*. Wissenschaft und Politik, Köln, 1970.
- [2] EU, European Union Research in Foresight. Luxembourg: Publications Office of the European Union. https://ec.europa.eu/research/social-sciences/pdf/project_synopses/research_in_foresight.pdf, 2014.
- [3] EFP, European Foresight Platform, <http://www.foresight-platform.eu/>, 2016.

- [4] J. P. Gavigan, F. Scapolo, M. Keenan, I. Miles, F. Farhi, D. Lecoq, M. Capriati, T. Di Bartolomeo, A Practical Guide to Regional Foresight, Seville, Spain. Manchester, United Kingdom. CEDEX, France. Rome, Italy: FOREN Network: Foresight for Regional Development <http://foresight.jrc.ec.europa.eu/documents/eur20128en.pdf>, 2001.
- [5] J. Glenn, E. Florescu, the Millennium Project Team, Future Work/Technology 2050 Real-Time Delphi Study: Excerpt from the 2015-16 State of the Future Report, Millennium Project, Washington D.C, 2016.
- [6] S. Heinonen, O. Kuusi, H. Salminen (Eds.), How Do We Explore Our Futures? *Acta Futura Fennica* 10, The Finnish Society for Futures Studies, Forthcoming.
- [7] R. Amara, The futures field: searching for definitions and boundaries. *The Futurist* 15, (1981) 25–29.
- [8] S. Heinonen, Neo-growth in future post-carbon cities, *Journal of Futures Studies* 18 (1) (2013) 13–40.
- [9] H. Girardet, *Creating Regenerative Cities*, Routledge, New York, 2015.
- [10] M. Raco, Governance, Urban, in *International Encyclopedia of Human Geography*, R. Kitchin and N. Thrift (Eds), Elsevier, Oxford, 2009, pp. 622-627.
- [11] A. Toffler, *The Third Wave*, William Morrow, New York, 1980.
- [12] H. M. Fattah, P2P: How Peer-to-Peer Technology is Revolutionizing the Way We Do Business, Chicago: Dearborn Trade Publishing, a Kaplan Professional Company, 2002.
- [13] Y. Benkler, Coase's Penguin, or Linux and the Nature of the Firm. *The Yale Law Journal* 112 (3) (2002) 429.
- [14] Y. Benkler, *The Wealth of Networks How Social Production Transforms Markets and Freedom*. London, Yale University Press, 2006.
- [15] IEA, *Energy and Climate Change: World Energy Outlook Special Report*. Paris: Organisation for Economic Co-operation and Development/International Energy Agency, 2015.
<https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>
- [16] P. Valkering, R. van der Brugge, A. Offermans, M. Haasnoot, H. Vreugdenhil, A Perspective-Based Simulation Game to Explore Future Pathways of a Water-Society System Under Climate Change, *Simulation & Gaming* 44 (2–3): (2013) 366–90.
- [17] C. Breyer, S. Heinonen and J. Ruotsalainen, A societal and energetic vision for rebalancing humankind within the limits of planet Earth, *Technological Forecasting and Social Change*, 2016 (forthcoming).
- [18] P. W. F. Van Notten, J. Rotmans, M. B.A. van Asselt, D. S. Rothman, An Updated Scenario Typology, *Futures* 35 (5): 423–43, 2003 doi:10.1016/S0016-3287(02)00090-3.
- [19] J. Dator, Alternative Futures at the Manoa School, *Journal of Futures Studies* 14 (2): (2009) 1–18.
- [20] B. Ralston, I. Wilston, *The Scenario-planning Handbook: A Practitioner's Guide to Developing and Using Scenarios to Direct Strategy in Today's Uncertain Times*. Thomson South-Western, 2006.
- [21] P. Malaska, A More Innovative Direction Has Been Ignored, in: *Understanding Neogrowth – An Invitation to Sustainable Productivity*. TeliaSonera Finland Plc. Helsinki, 2010, pp. 200-210,
http://www.sonera.fi/media/13069ab55806de22e8955bc2a3f1afeab17b28bd/Understanding_Neogrowth.pdf.
- [22] H. Lund, *Renewable Energy Systems, 2nd Edition: A Smart Energy Systems Approach to the Choice and Modeling of 100% Renewable Solutions*, 2nd Edition, 2014.
- [23] J Rifkin, *Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World*, New York, Palgrave MacMillan, 2011.
- [24] A. Naess, G. Sessions, *Basic Principles of Deep Ecology, Ecophilosophy*, 6 (1984)
- [25] S. Heinonen, E. Hiltunen, Creative Foresight Space and the Futures Window: Using Visual Weak Signals to Enhance Anticipation and Innovation. *Futures*, 44 (2012), 248–256.
- [26] E. Hiltunen, *Weak Signals in Organizational Futures Learning*, Doctoral dissertation, Helsinki: Aalto University School of Economics, 2010,
<http://epub.lib.aalto.fi/fi/diss/?cmd=show&dissid=400>.
- [27] N. Taleb, *The Black Swan. The Impact of the Highly Improbable*, Random House, 2007.
- [28] J. Glenn, E. Florescu, and The Millennium Project Team, 2015-16 State of the Future. Millennium Project, Washington D.C, 2015
<http://www.millennium-project.org/millennium/201516SOF.html>.
- [29] M. Parkkinen, S. Heinonen, Insights on urban tomorrows - Expert survey on futures of liveable cities, *Encore Working Paper*, Finland Futures Research Centre, Forthcoming.
- [30] S. Heinonen, J. Ruotsalainen, Toward the Age of Neo-Entrepreneurs, *World Future Review* 4:2 (2012) vol. 4, 123-133, doi: 10.1177/194675671200400216.
- [31] M. Batty, *New Science of Cities*, MIT Press, 2013.
- [32] P. Schmitt, *Managing Urban Change in Five European Urban Agglomerations: Key Policy Documents and Institutional Frameworks* (eds.) A. Eraydin and T. Tasan-Kok, *Resilience Thinking in Urban Planning*, GeoJournal Library 106, Springer New York, 109-130, 2013.
- [33] A. Eraydin and T. Tasan Kok (Eds.), *Resilience Thinking in Urban Planning*, GeoJournal Library 106, Springer New York, 2013.
- [34] S. Araldi, GL. Quaglio, M. Ladikas, H. O'Kane, T. Karapiperis, K. Ravi Srinivas, Y. Zhao, Responsible governance in science and technology policy: Reflections from Europe, China and India, *Technology in Society*, 42 (2015) 81-92.
- [35] D.H. Guston, Understanding Anticipatory Governance. *Social Studies of Science*, 44: 2 (2014) 218-242.
- [36] V. P. Mega, *Sustainable Cities for the Third Millennium: The Odyssey of Urban Excellence*. Springer; New York, 2010.
- [37] K. D. Arbutnott, B. Dolter, Escalation of commitment to fossil fuels, *Ecological Economics*, 89 (2013) 7–13
- [38] C. Breyer, D. Bogdanov, K. Komoto, T. Ehara, J. Song and N. Enebish, North-East Asian Super Grid: Renewable energy mix and economics, *Japanese Journal of Applied Physics*, 54 (2015) 08KJ01, <http://dx.doi.org/10.7567/JJAP.54.08KJ01>
- [39] M. Swilling, E. Annecke, *Just Transitions: Explorations of Sustainability in an Unfair World*, United Nations

University Press; Tokyo, 2012