Norwegian University
of Life Sciences

Master's Thesis 2017 30 ECTS

Faculty of Landscape and Society
Marius Grønning

Smart, Social & Sustainable?

Norwegian Smart Cities; means for social sustainability or expressions of a techno-economic race?

Axel Reuben Segovia Ødegaard
Urban and Regional Planning

I would like to thank everybody who has supported me during my education.

A special thank you goes out to my parents, Victoria and Dag, for their continuous care, financial or otherwise, and their partners Glenn and Angela, my aunt Liv and grandfather Nils, for always being supportive.

I would also like to extend my gratitude to many friends for not being too curious and inquisitive this last semester; Ulrik, Sondre, Anders and Øyvind.

Thank you Marius Grønning at NMBU for beers, good discussions and excellent guidance.

More than anyone, I would like to thank Alba and Matteo for distracting me when I needed it the most and helping me stay motivated and sound.

"The clock is not merely a means of keeping track of the hours, but of synchronizing the actions of men"

Lewis Mumford, Technics and Civilization, 1934

Abstract

Smart city technology has finally reached our shores. This technology is rich in promises, and is professed to be an unprecedented technological tool in addressing sustainable development in cities. There are as many definitions of smart cities as there are attempts of it, and in being a pertinent tool to spatial planning, this technology represents a novel strategic direction in land use management. Spatial planning and strategy has become recognized as an instrumental activity for achieving and expressing sustainability, and sustainable development has been absorbed into the Norwegian regulatory framework for land use management. Some researchers claim however, that the economic and environmental dimension of sustainability has received more than its share, leaving social sustainability behind. This thesis investigates the theoretical background for visions of technology as instrumental for progress and modernization, smart city´s promises and potential as a spatial planning tool, and juxtapositions this with Norwegian cities´ operationalization of smart city technology as a means for social sustainability.

I. Introduction

Urbanization is one of the most transformative trends this century. More people than ever before now resides in cities, which poses unprecedented sustainability challenges to land use and spatial development; “housing, infrastructure, basic services, food security, health, education, decent jobs, safety and natural resources, among others” (Habitat III, 2016; 3). In essence, these challenges involve meeting our own needs without compromising that of future generations in environmental, social and economic terms.

In countries such as Norway, spatial planning is recognized as instrumental in meeting these sustainability challenges, as spatial planning is considered to possess the capacity to physically express and mediate sustainability concerns in our built environments. By way of institutionalization, a mechanism that refers to the integration of practice into organizational and procedural custom, sustainability has become an established value and norm in Norwegian regulation, making sustainability a constitutional goal for spatial planning. The Norwegian regulatory framework encompassing spatial planning and land use activity does not discriminate against any sustainability dimension, and it expects built environment to express environmental, social and economic concerns proportionately. Historically however, the social dimension of sustainability has been given less attention than its counterparts, environmental and economic (Dempsey, 2008; Hofstad & Bergsli, 2017).

The latest fad and trend in spatial planning and sustainable practice is that of smart city technology. Its applications range from waste bin monitoring to cooperative planning. Utilising smart city technology is a strategic choice for spatial planning authorities, and cities all over the world are basking in this new technological innovation claiming to hold unsurpassed promises for sustainable practice and management of our urban futures. These relatively simple technological solutions developed by massive international corporations are utilised by cities in order to better manage resources, reduce environmental impact and improve quality of life for its citizens. But smart city technology is not only unproblematic, as it can be expensive and time consuming, largely provided by private companies, has yielded very few profits as of yet and its implications are still arguably unclear.

Smart city technology is the latest of technologies in a stream of technological innovations that have influenced our society. Technology is considered to be a driver for modernization,

and modernization essential for progress. Technology is also considered to be self-sustaining, meaning it carries with it seeds of new applications beyond our comprehension, and to some extent, control. Various techno-economic paradigms through time illustrates how technological innovations has had the capacity to completely restructure and appropriate society, and all of its sectors, by becoming new economic growth engines. From the invention of the steam engine to the invention of the microprocessor in the 1970s demonstrates how political, social and infrastructural climates have changed in the wake of new business cycles and technological innovations. Smart city technology, claimed by some to be riding this latest business cycle, can thus be understood to carry with it innate qualities and attributes, imagined or real as a technology and as a techno-economic system, disturbing our perception of it.

Norwegian cities are just starting to invest and experiment with smart city technology. The interest is widespread; big cities like Oslo to smaller cities like Bodø are currently enrolled in several smart city projects and strategies devised to address the sustainable challenges of our urban environments using this novel technology. But smart city strategies and projects are still fragmented, relatively small scale and pertaining certain sectors. As literature suggests, there exists an inherent tension between the seductive vision of technology as driver of progress and urban sustainability. Consolidating these two discourses is perhaps not as easy as one may imagine, as the inherent tension materialize in smart city technology; smart city technology can represent a duality between sustainability and a techno-economic race, as private companies capitalize on visions of technology´s inherent role in modernization and progress and smart city technology´s claimed capacity for sustainable practice, as well as the spatial planners regulatory requirements for sustainable development in strategies for land use management. Considering the identified historical neglect of social sustainability, this thesis will investigate how and if Norwegian spatial planners and city administrations are operationalising smart city technology to address urban social sustainability challenges.

Relevance for urban and regional planning

Smart city technology is a dominating discourse and strategy in the debates about the future urban and spatial planning (Hollands, 2008; Haarstad, 2016; Kitchin, 2014, Marvin et al. 2016). The task of this thesis is relevant for the planning profession, not only because technology is perceived to be, present and historically, a source of change and progress (Marvin et al. 2016; Lynne & Robey, 1988; Mumford, 1934; Perez, 2009), but because smart city, in some respect, claims to be able to address global issues facing our cities today (EU, 2014; Innovasjon Norge, 2016; Haarstad, 2016; Hollands, 2008; Our Common Future, 1987). Insight into potentials and problems concerning the discourse is necessarily crucial for appropriate spatial strategy and planning.

Research question

The intention of this thesis is to provide insight into Norwegian practice, optimistic or critical, and shed some light on the role of this technology, its promises and the expectations of the Norwegian institutional framework for spatial planning by seeking to answer the following question:

Is the development of Norwegians smart cities a means for social sustainability or an expression of a techno-economic race?

This research question addresses the crucial issue of whether Norwegian smart city strategies are operationalising smart city technology in a way that effectively and proportionately promotes social sustainability as its promises has it, or if Norwegian Smart City strategies are recklessly implementing technological innovations as a result of a market strategy in which developers in pursuit of profit force their products into built environment.

In order to compose a wholesome answer to this research question, I will have to elucidate some elements that are subsumed under it. Initially, I will ***map out the historical and***

theoretical context under which technology is depicted as a driver for change. This will position smart city technology in a larger historical framework where technological revolutions have been synonymous with progress, and furthermore how these technological innovations are perceived to have altering capacities on other societal sectors. This will elucidate smart city technologies qualities as technological tools and resource. I will follow by superposing this historical lineage on the backdrop of another historical process, namely ***how the sustainable development discourse is institutionalized in Norway.*** This will involve exploring sustainability´s rise to prominence, its various dimensions and how its attributes have been translated into constitutional principles for spatial planning and land use management in the Norwegian context to become established procedural norms and values. Furthermore, I will highlight the normative goals of spatial planning as of today, and what regulatory framework spatial planners operate under. As the utilization of smart city technology now prevails as a strategic choice within in spatial planning today, I will have to investigate ***what a smart city is, and what its technology is composed of****.* This will include looking at its various definitions, its claimed promises of sustainability and the actual technology and its supporting market. To elaborate on this, it will be interesting and telling to look at ***what the current uses and applications of smart city technology are****.* I will do this by drawing to concrete cases and empirically depicting how these cities go about operationalising smart city technology as spatial planning strategies. In light of smart city promises, institutionalized regulatory requirements and subsequent spatial implementation by way of smart city strategies, I will lastly discuss how ***social goals are expressed and achieved by way of smart city technology in vision and in practice in Norway****.* This will conjugate the two current drivers in spatial planning, sustainability and smart city technology, to produce an adequate fundament for evaluating the research question in terms of how smart city technology is used to address social sustainability.

Central discourses and elements

The structure of this thesis involves two discourses, and their point of tangency. That of sustainable development, which refers to meeting our own needs without compromising the needs of future generations with respect to natural resources, economic and social ecosystems. Sustainability has been applied to all sectors of society, which by and large are subsumed under the three dimensions discussed in this thesis; environmental, economic and social. A premise for the discussion in this thesis is the institutionalization of sustainable development into the Norwegian regulation for spatial planning. Secondly, the recent development of smart city technology, which in this thesis will be treated as an extension of a larger historical context under which technology is perceived as a driver for progress. These two discourses intersect in the spatial planning field, and the tension between the attributes pertaining each discourse materialize as smart city technology currently dominates strategic choices in planning. Elemental to reading this thesis is the understanding that smart city strategies has become a prevalent and dominant strategic choice of recent urban spatial planning. As a technological resource, smart city technology holds the seeming promise of sustainability, which has become a regulatory requirement for Norwegian spatial planners.

Thesis structure

This thesis is composed of four parts. The first chapter comprises a general introduction to the topic and the structure of this thesis. The second chapter creates an appropriate theoretical framework which is built up to put technology´s role in perspectives of society´s desire for progress and modernization. The theoretical chapter brings old trajectories of technology to relevance, which will shed some light on smart city concept´s innate qualities and attributes as a technology. In chapter three I will continue by presenting sustainable development and its institutionalization into Norwegian territorial governance and land use regulation. This will involve looking at the various passage points of the sustainable development discourse before being absorbed into state and regional regulation, as well as planning and strategic objectives on the level of Norwegian cities. Furthermore, I will introduce smart city technology and its

many promises, as sustainable practice and otherwise. I will do this by presenting and discussing some definitions of the concept, as well as its prospected returns, shortcomings and spatiality, among other aspects. This will culminate in an empirical presentation of current cases and uses and a performance review of smart city technology in light of the various sustainability dimensions. I will conclude this section with a synthesis. The last chapter is devoted to a discussion and reflection around the thesis research question, namely mechanisms affecting the relation between smart city technology and social sustainability, based upon perspectives and findings in previous chapters, followed by a conclusion.

Methodology

The reasoning in this thesis is abductive, as information is comprehensive, yet not complete, and conclusion is an attempt at best explaining empirical data. The conclusion is based on empirical observations made whilst conducting research, pointing to a likely tendency. Various methods are selected to obtain sufficient information to evaluate and discuss the research question. The theoretical framework behind the historical trajectory of technology is primarily based upon a literature review ranging within a range of themes concerning modernization, paradigm shifts and techno-economic systems, with the intention of creating an appropriate theoretical background in which to discuss empirical data. Although the literature coupled in this thesis is not necessarily referring to one another, I found it helpful and valuable to weave these together to create a context for which to place the emergence of smart city technology. For this I used Google Scholar and NMBU´s own search engine. The third part of this thesis is primarily based upon policy research, document and parliamentary white paper studies, as well as interviews and international and national case studies. This was necessary to obtain enough empirical data to superimpose upon the theoretical background construed above. The international case studies were chosen as examples of best practice, with the intention of comparing these to Norwegian cases. In relation to the thesis research question, this is expected to show how international cases perform in relation to social sustainability, what can be learned, and furthermore, how Norwegian cases follow suit, or potentially, fails to learn from what is considered best practice within the field. This section of the thesis is not complete or exhaustive of all policy research, but representative for the purpose of being able

to make an abductive reasoning. This policy literature review was obtained mostly from various sources on the internet; primarily developers, providers and city municipality websites. The interview was conducted with two employees of Cisco in their office space in Lysaker, Norway on October 12th 2017. I will superimpose the smart city practice observed in the second chapter on the theoretical background developed in the first chapter, and follow by make a reasonable, abductive inference based upon these findings.

Delimitations

In literature, there is a lot of talk about so-called greenfield cities; cities built from scratch using smart city technology. Masdar and Songdo are examples of such cities, and these have typically been developed in close relation with big tech companies such as IBM and Cisco. The latest example being Bill Gates´ newly acquired land in Belmont, Arizona, where the philanthropist will participate in designing a new city from its inception. I will refrain from discussing these types of cities. My personal opinion is that it is more fruitful to discuss strategies for retrofitting or incorporation of smart city technology into existing cities, as this lies closer to the nature of the justification for utilizing smart city technology for sustainability purposes. Secondly, I will avoid discussing problems concerning the digital divide and the use of smart technology in the health sector. Digital divide or digital literacy refers to the gap that exists between groups of people being able to use, or having access to internet or smart phones and those that do not. The divide is real, and certainly a problem, but the focus of this thesis is more on the governmental and municipal strategic level, and especially spatial strategies. As for the health sector, one could argue these initiatives are in fact proof of smart city technology used for social sustainability. As this may hold true, this thesis is more pre-occupied with the *city* aspect of smart technology; I find that smart technology used in the health sector falls outside the realm of spatial planning. Another obvious constraint of this thesis belies on the short timeframe in which smart city technology has been around. This has multiple implications, most of which clouds our judgement and knowledge concerning its prospected outcomes and return of investments. There are however observations that can be made as to how cities have chosen to structure and operationalize their current strategies.

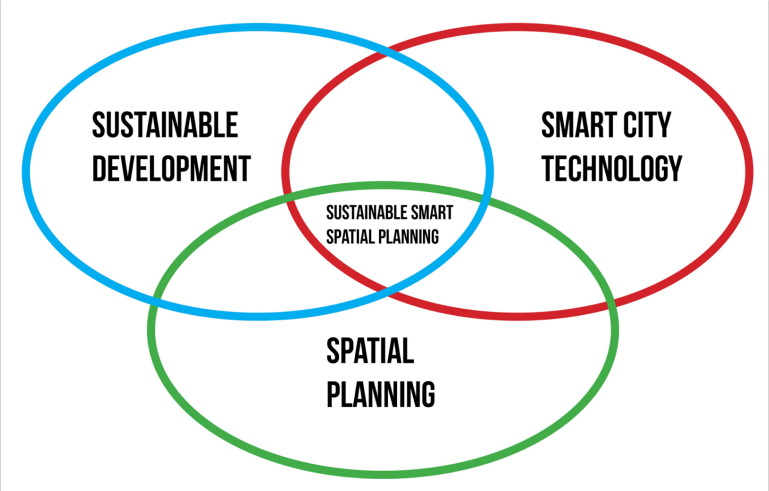
SUSTAINABLE
DEVELOPMENT
SMART CITY
TECHNOLOGY
SUSTAINABLE SMART
SPATIAL PLANNING
SPATIAL
PLANNING

Figure 1.

Definitions

Built environment
man-made environment which creates the basis for all human activity

Spatial planning/strategy
the act of expressing and translating environmental, economic and social goals into built environment

Sustainable development
development that seeks to meet current needs without compromising future generations´ ability to meet theirs; anthropocentric perspective on development

Sustainable practice
the act of actively and physically pursuing sustainable goals, in planning or strategy

Institutionalization
the process of incorporating norms into organizational and institutional norms and practice

Smart city
a strategic choice made by cities to pursue and enable technology to address sustainability challenges and sustainable practice

Smart city technology
technological tools and resources promoted under the smart city banner – new and traditional
cyber-physical systems able to link physical objects to digital platforms

Modernization
a conceptual western perception of progress – often given attributes such as industrialization, economic growth, social mobilization etc.

Paradigm
periods of time under which given theoretical perspectives has prevailed and gone unquestioned

Techno-economic system
a paradigm under which a specific technological innovation dominates the technological and economic industry in a given time

Socio-technical system
the extension of techno-economic system into social and cultural dimensions of society

Social sustainability/innovation
a sustainability dimension that is inherently social; in means and ends

II. Technological Lure, Cultural Lags and Sustainable Development

Modernization, technology and sustainable development

Smart city technology is being embraced and praised in cities around the globe as a way of devising and arming cities for urban challenges of the future. Technology as a driver for change and modernization is, however, not a new narrative, as history is full of examples of highly transformative technologies. Many are stressing that smart city technology "now appears as a new paradigm of intelligent urban development and sustainable socio-economic growth" (Neirotti et al., 2014; 3), and other professionals continue the reasoning by placing smart city technology into a wider historical framework; "discourses around smart urbanism are deeply rooted in seductive and normative visions of the future where technology stands as the primary driver for change" (Smart Urbanism, Marvin et al, 2016; 1). Assumptions concerning smart city technology and its capacities is ample, but its rise to prominence might not be unique in a historical context. As pointed out above, smart city technology is considered a paradigm with origins in ancient perspectives and visions of change and societal development with promises for being modern; the "smart city label (…) point to clever solutions allowing modern cities to thrive" (Caragliu et al.,2009; 46). The typical suppositions subsumed under the smart city technology discourse are plentiful, and exploring the innate assumptions and historical meanings behind these assumptions and justifications will elucidate the historical and contextual framework of the smart city discourse. Contextualising the smart city

technology discourse into this theoretical background will highlight its roots and origins within a greater historical and logical lineage, and understanding this theoretical background will provide a better comprehension of how smart city technology behaves as a technological innovation, its innate qualities as a technology and how it relates to the main topic of this thesis.

Modernization

The history of societies is long, and the study thereof is ever mounting. One aspect and genre of said study, is the study of how societies develop, and perhaps even progress and mature. The idea of modernization first became a topic of discussion in the post-war period (Bernstein, 1971; Tipps, 1973). The concept was introduced into a socio-institutional context of decolonization of eastern and southern world countries, and economic reconstruction of western world countries following the war. Albeit being vague, the popularity of the term can be attributed to its ability to wake "images which serve to summarize all the various transformations of social life attendant upon the rise of industrialization and the nation-state in the late eighteenth and nineteenth centuries" (Tipps, 1973; 199). Although being relatively new as a term, the concept and connotations was applied retrospectively to the industrialization of the west, which in turn saw the manifestation and emergence of capitalism. Despite being a novel term, modernization theory was developed and firmly placed within an old familiar concept of inquiry; developmentalism (Tipps, 1973; 199-200), a term that suggests a directional process. The traditional framework of developmentalism as a school of thought was again rooted in an analogy of biology and the biological growth of organisms. Within this school of thought and frame of logic, there can be found a native sense of progress or process of maturity into more supreme organisms through processes of acclimation and Darwinism. The application of all these concepts to the term and concept of modernization of societies, depicts a certain perspective of social and societal change in western experience; modernization as essential to progress and to the civilization process. One specific connotation evoked by modernization as process or state, is the dichotomy it generates as opposed to traditional. Within this sense, societies, or nations, are understood

to be either modernized or traditional; each concept rich with traits, imagined or actual. As the term, deriving from biological theory and social Darwinism, implies a certain positive progress, with "modern" being a desired state, the term has a reducing capacity when it comes to modernity's counterpart; traditional.

The conceptualization of modernization has over time become an integral part of western understanding and thought, and by being a broad, general concept, its characteristics have readily been applied to and "personified/materialized" in various societal developments, such as "industrialization, economic growth, rationalization, structural differentiation, political development, social mobilization and/or secularization" (Tipps, 1973; 202), and more recently to the utilisation of smart city technology (Caragliu et al., 2009). A common understanding of a modern society is thus that of an industrialized one, or one that is prosperous and politically progressive.

Technology as modern

If one is to couple the above outlined understanding of modernization and civilization with the French philosopher Jacques Ellul´s work on *The Technological Society* (1964) one can extend the argument further. By advancing the argument of developmentalism, and furthermore modernization, into a world of (or with) technics and technology, Ellul´s insights share some valuable lessons, here illustrated by Lynne & Robey; "Ellul argued that technology creates social change far beyond its original applications" (1988; 592). Within the western experience of modernization, subsuming, among many other aspects of society, industrialization (Tipps, 1973; Bernstein, 1971; Hohenberg & Lees, 1985), Ellul´s argument makes for a dialectical relationship between society and the technologies developed within it. In addition, the technologies of Ellul fosters more technology, as it is self-sustaining, technologies "carry in themselves seeds of new applications" (Lynne & Robey, 1988; 592). As the aforementioned technologies evolve, society evolves responsively with it. The argument can be extended by referring to the surrounding infrastructures that allows for technologies to "institutionalize and perpetuate the technologies they were originally created to support" (Lynne & Robey, 1988; 592).

The institutionalization, and even internalization, of technics and technologies is something that was studied by the American philosopher of technology, Lewis Mumford already in 1934, and although *Technics and Civilization* predates the emergence of the term and formulation of *modernization* (Bernstein, 1971; Tipps, 1973), the discourse inherited by the term is present and distinguishable in Mumford´s argument. Mumford distinguishes between tools, machines and "the machine"; the latter referring to the more intangible disposition of societies and societies capacity to institutionalize technology. The idea behind "the machine", in Mumford´s literature (1934) can be recognized in Ellul´s theories under the more general technology. In accordance with Ellul´s technology, Mumford´s "the machine" (1934) has the capacity to alter our habits and our routines, and effectively change society through the process of institutionalization and internalization. A key aspect behind these processes is how these occupy our consciousness and become unquestionable truths, false consciousness´ so to speak; we ignore their altering abilities and subsume ourselves to its self-perpetuating nature. Mumford´s (1934) famous depiction of the development of the clock and subsequent timekeeping eloquently illustrates this notion; "the clock is not merely a means of keeping track of the hours, but of synchronizing the actions of men" (Mumford, 1934; 14); life and society is mechanized. Applying this to the emergence and implementation of smart city technology can understandably provoke some grave implications. Yet, technology, or "the machine", does not exist outside human culture, and it only develops within it, despite it being slave to objective science. Thus, modernization of society, through processes such as industrialization, economic growth, political development, advancements in technology and social mobilization, is perceived as integral to progress and instrumental for development (Tipps, 1973; Bernstein, 1971; Hohenberg & Lees, 1985; Mumford, 1934; Ellul via Lynne & Robey, 1988).

Paradigms

Whilst some suggest progress and modernization happen through processes reminiscent of biological maturity (Tipps, 1973), or that progress and development is attributable to

advancements within sectors such as industrialization, rationalization, science, capitalism and political development (Bernstein, 1971; Hohenberg & Lees, 1985) or even due to our somewhat subconscious capacity to internalize technologies and technics (Ellul via Lynne & Robey, 1988; Mumford, 1934), some scholars have philosophized around the actual progress of science or thought. In 1962, the American science philosopher Thomas Kuhn proposed a new theory about how science and thought progressed and evolved through time (Thomas Kuhn, Wikipedia). As opposed to the idea prevalent in his days, being that science progressed in accumulative manner, Kuhn proposed that the history of science was characterized by abrupt revolutions wherein the normal understanding of science and its inquiry swiftly changed. This happens as enough abnormalities within the reigning paradigm builds up, eventually leading to a crisis (of faith), which spurs a new science, "which subsumes the old results along with the anomalous results into one (new) framework" (Wikipedia, Thomas Kuhn). Nigel Taylor (1998) explains paradigms as

> "long periods in which a given theoretical perspective – or "paradigm" – has prevailed and been accepted by members of a scientific research premised upon the prevailing paradigm, and empirical observations are interpreted in terms of it" (Taylor, 1998; 157).

These prevailing theoretical perspectives are then overthrown as evidence piles up that challenges the current framework. Examples of such revolutions are the change from perceiving the earth as the centre of the universe, to orbiting the sun; the earth not being in the centrum of the universe replaced the previous perspective as the new norm and standard.

Although Kuhn initially intended to give descriptive perspectives on the development of science, this progression model has been somewhat universally accepted as applicable to other fields of inquiry as well. Kuhn´s paradigm shifts does not refute the theories proposed by Mumford (1934) or Ellul (Lynne & Robey, 1988) about technology and technics, and it does not ignore perspectives on social inquiry proposed by Tipps (1973) or Bernstein (1971). In contrast, Kuhn´s ideas regarding the progress of science, and if transferred to progress of thought within any field, rather seeks to explain how each of these sectors of inquiry amass unquestionable truths, and how these truths are eventually overturned. For instance, when applied to modernization, the ideas of paradigm shifts can explain how modernization, as a

frame of thought, accrues acceptance and becomes a framework for further investigation. Or, if applied to Mumford (1934) and Ellul (Lynne & Robey, 1988), how society subsumes itself to certain technologies and technics without critical reflection around its implications and institutionalization; this is too the case for smart city technology. Paradigms are normative ways of thinking within given periods, clouding and inhibiting us from perceiving its prevalent ideas as anything but truths, and thus accepting abnormalities as deviations. Applying this logical lineage to the current smart city technology trend, may explain why the technology has risen to such relevance.

Techno-economic systems

One that successfully applied Kuhn´s concept of paradigms to another field of inquiry was Carlota Perez; she contextualises it into the world of innovation and economy, calling them technological revolutions or techno-economic paradigms (Perez, 2009; 189). Perez has been quite influential in identifying key elements and components of such techno-economic paradigms. Where Kuhn´s paradigms shift when the current set of ideas and theoretical framework are sufficiently challenged by science and experiments (Taylor, 1998; 157), Perez´ paradigms shift with the introduction of new innovative technologies, which again spur whole new business cycles; “cluster of clusters, or a system of systems” (Perez, 2009; 189). Much like the description of self-sustaining technologies by Ellul (Lynne & Robey, 1988) and technologies´ capacity to institutionalize by Mumford (1934). Perez (2009) distinguishes a technological revolution from a random innovation system by pointing at two central components; “the interdependence of the participating systems in their technology and markets” and “the capacity to transform profoundly the rest of the economy (and eventually society)” (Perez, 2009; 189). Further on, Perez (2009) notes how these techno-economic paradigms changes society so profoundly, that their new industries become the new economic growth engine for extended periods of time. To illustrate this, Perez (2009) draws parallels to the various technological revolutions and business cycles in the past and their attributes. The steam engine revolution, for instance, spurred a multitude of industries directly or indirectly connected to the actual invention. The age of oil is one revolution that falls closer to home (Norway). The age of oil provoked the rise of industries such as the automobile and mass

production, and infiltrated whole societies with new norms and new political ambitions. The current revolution is characterized as the age of information and communication, caused, according to Perez (2009), by the invention of the microprocessor in Santa Barbara in the 1970s. Using Perez´ logic, one can easily trace most of today´s prominent smart city technologies back to this invention. Interestingly, one can also notice the retreat of previous revolutions, as their norms and ideals are outdated and replaced, what remains of their systems and infrastructure is being silently being watered-out or infiltrated with techno-economic ideals of the new revolution. As stated in the introduction to this chapter, smart city technology is by some perceived as such a paradigm.

Socio-technical systems

In light of what Perez (2009) refers to as the latest innovation cycle, the age of information and telecommunication, spurred by the invention of the microprocessor, one can comprehend how ideas and technologies concerning smart city technology has come to be such a prominent discourse today. Following years of perfecting the technologies, introducing these into the public discourse and political and economic ambitions, "the new TEP (techno-economic paradigms) becomes the shared, established and unquestioned "common sense" both in the economy and in the socio-institutional framework creating a clearly biased context in favour of the trajectories of the technologies of the revolution" (Perez, 2009; 199); considering smart city technology belongs to infrastructures of the latest techno-economic paradigm sheds some light on its dominance today. In accordance with Ellul (Lynne & Robey, 1988) and Mumford (1934), Frank Geels (2004) substantiates our understanding of how technology infiltrates society, and how the business cycles or systems of innovation (Perez, 2009) permeates our habits and routines of daily life (Mumford, 1934; Lynne & Robey, 1988). Geels (2004) refers to this as socio-technical systems, and founds the idea upon the knowledge that "these technologies are not only neutral instruments, but also shape our perceptions, behavioural patterns and activities" (Geels, 2004; 903).

Perez´ (2009) business cycles and innovation systems as generators for techno-economic paradigms and Geels´ (2004) theories about socio-technical systems fits well into Risto

Heiskala´s (Pol & Ville, 2009) logical framework of technological, economic, regulative, normative and cultural innovation. According to Heiskala´s (via Pol & Ville, 2009) analysis, innovation can be dissected into five separate sectors, under two umbrellas. The *techno-economic innovation* refers to economic innovation being the process of producing a surplus value using technological innovations. The contrasting sphere of innovation is *social innovation*, consisting of regulative innovation, referring to changing regulation and the way they are sanctioned; normative innovation, being changes and challenges to value and morals and the way these are manifested in communities, and lastly, cultural innovations, which seeks to innovate and transform the way reality is perceived through habits of interpretation, frames of logic and mental paradigms. According to some, the term social innovation is quite new, although what it represents is not (EU, 2010). Where Heiskala´s (Pol & Ville, 2009) social innovation is an umbrella concept, others describe social innovation rather simple, in that it is "innovations that are both social in their ends and in their means" (EU, 2010; 9).

The previous theoretical framework is construed in order to place smart city technology into a larger framework of inquiry. As has been illustrated above, technology and its pertaining "business cycles" or industries, has been perceived as quite influential, and in fact, instrumental in societal progress. Applying theories of modernization and paradigms, and the complementary ideas of techno-economic and socio-technical systems, to the current dominance of smart city technology in spatial strategy discourses, may hint at certain traits and infrastructural dominance. For one, smart city technology, like with any technology, is part of a seductive trajectory in which technology is perceived as integral to progress. Furthermore, this recent technology takes advantage of infrastructural system of systems generated by what Perez (2009) refers to as the age of information and communication. According to Geels (2004), normative values and ideals of the techno-economic revolution, pertaining to for example smart city technology, has the capacity to create profound changes within the social realm of society.

The three dimensions of Sustainable Development

In their report, the Brundtland Commission (1987) systematically breaks down the gravest ills of the world of their day; environmental degradation, poverty, consumption, and economic instability, and in turn proposes solutions and advice for a sustainable future. The definition of *sustainable development* formulated in the report, is echoed in the world of politics, economic and culture ever since, and stands out as a pillar definition of the concept; "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (*Our Common Future; 1987;* Chapter 2, pt. 1). Within its scope, this definition alludes to a directional discourse of constant change, reminiscent of earlier perceptions of modernization (Tipps, 1973; Bernstein, 1971, Hohenberg & Lees, 1985), such as developmentalism and the biological organism analogy.

Sustainable development is a central tendency and political ambition today; a trend toward rationalization and political development, advancements often attributed to the more general modernization (Tipps, 1973). Expressed by the UN (Our Common Future, 1987; 2017), sustainability rests primarily on three dimensions; economic, environmental and social. By definition, sustainable development is not entirely sustainable unless all three dimensions are proportionally considered and addressed. According to Our Common Future (1987; 16) the dimensions are intrinsically interrelated, as "limitations (to sustainable development) are imposed by present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities". Meaning technology and the social organisation surrounding it, can improve resource management, and secure economic growth (Our Common Future, 1987; Hofstad & Bergsli, 2017). In being interrelated, this necessitates a balancing act in spatial strategy and planning, as these three sectors overlap and synergise in the physical city (Hofstad & Bergsli, 2017). According to Dempsey et al. (2009; 289), this overlap is characterized by tension. Yet, over the course of the 30 years since the sustainability discourse became mainstream, the social dimension of sustainability has been given way less attention than its counterparts, economic and environmental (Dempsey et al., 2009; Hofstad & Bergsli, 2017).

Although the three dimensions overlap and are interdependent of each other in material life, they do promote different things. Environmental sustainability deals with our management of natural resources, and us not exhausting or depleting them, whilst economic sustainability refers to sound and prosperous economic growth. Social sustainability refers to ensuring fundamental human needs, equity, social justice, evenly distributing wealth and safety for all (Hofstad & Bergsli, 2017; 24). Although Our Common Future (1987) discusses sustainability on behalf of externalities, i.e. the environment, it is doing so with the "satisfaction of human needs and aspirations" (pt. 42) as its central objective. This meaning, the purpose of sustainable development, is for no one else but us, humans. Conversely, however, our technological innovations and social organization are understood to impact nature and its capacity to support us and our needs. Sustainable development is thus an anthropocentric perspective of evolution or development (Hofstad & Bergsli, 2017).

One of the reasons for social sustainability´s lack of momentum, might be its somewhat elusive conceptual definition which is hard to transfer into physical manifestation. Dempsey et al. (2009) argues that although issues of social sustainability are present in the sustainability discourse, it appears in multi-dimensional concepts, such as "social capital, social cohesion, social inclusion and social exclusion" (290), and the list of non-physical factors of social sustainability is twice as long as physical factors. Whereas the non-physical list is comprised of issues such as social justice, residential stability and quality of life, physical factors deals with accessibility, pedestrian-friendly and attractive public realm (pg. 291).

Spatial planning and sustainability practice

It might be fruitful to specify what is meant by spatial planning in the context of this thesis. Spatial planning refers to practices of interfering, manipulating and coordinating activities in physical space.

> "Regional/spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is at the same time a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed toward a balanced regional development and the physical organisation of space according to an overall strategy" (European Regional/Spatial Planning Charter via Wikipedia, 2017)

As the definition explains, the core task of planners is to express policies in built environment. Putting this into the context of this thesis, this involves translating political and normative ideas about sustainability into spatial form and built environment utilising smart city technology; spatial planning objectives can thus be understood to embody and pursue sustainability in practice. Spatial planning and sustainability are two different phenomena, but as will be illustrated in the next chapter, sustainability has been institutionalized as a goal by regulation under which spatial planners operate. Smart city strategies are strategic choices in which spatial planners operationalise smart city technology in built environment to achieve this goal.

Continuing the reasoning above, transferring abstract ideas about sustainability into physical and spatial initiatives is hard to execute. How do we see political and social ambitions manifested in the physical fabric of the city? What does smart city initiatives look like and how do they behave as a spatial component? This link is important to establish and investigate in order for smart city strategies and initiatives to withhold its relevance within spatial planning. Already in 1964, Donald Foley sought to explain the various passage points of ideas from being abstract and elusive values, to visible spatial structure. Foley (1964) referred to this as building a bridge between aspatial and spatial arrangements of urban planning, and asks the important question as to how a planner may know "whether the physical environment scheme he is proposing facilitates or impedes the achievement of stated values" (pg. 22-23). According to

the author and his diagrammatic framework, values and physical requirements operate within three respects; normative, functional organization and physical, all three with an aspatial and a spatial dimension. In proposing various chain of events, Foley (1964) highlights the bridging between aspatial to spatial in the step he calls the *functional organization* as the most common crossing. This identifies at which level spatial concerns becomes relevant and prevalent in planning and municipal execution. Foley (1964) recognizes that this relational progression between value formation to physical structure is sometimes challenged by changes that originates in other areas in this sequence, and he highlights changes in the functional organization in the spatial dimension as a typical one (pg. 28). These changes, or let's call them revolutions, can have ripple-effects, altering the normative and value aspect that is supposed to influence it. The author refers to this as a "cultural lag", and attributes "major changes in functional organization (to) include population growth and redistribution, technological innovations, violent swings in the business cycle, war and income redistribution" (pg. 29). Forces for societal change that in various respects has been identified earlier in this study by Perez (2009), Mumford (1963), Ellul (1964). For the purpose of this thesis, smart city technology, which situated into the diagrammatic framework of Foley (1964) obtains a spatial dimension, is elemental to place and justify this topic into a spatial planning context and employment.

Tension between technology as driver and sustainable development

Understanding what drives and motivates societies for change is instrumental for placing the research question into a larger contextual framework. As emphasised by both Tipps (1973) and Bernstein (1971), although the term modernization emerged relatively late, its attributes was retrospectively applied to an old trajectory of desired societal development. As opposed to traditional or antique societies, modernized societies enjoyed advancements in "industrialization, economic growth, rationalization, structural differentiation, political development, social mobilization and/or secularization" (Tipps, 1973; 202). Following the subsequent reasoning of Ellul (via Lynne & Robey, 1988), Mumford (1934), Perez (2009) and Geels (2002), the individual sectoral advancements all pertaining to Tipps´ (1973) and Bernstein´s (1971) modernity, are interwoven in an intricate and interrelated chain of events. New technologies and innovations stimulates business-cycles, techno-economic systems (Perez, 2009) and socio-technical systems (Geels, 2002), defining how technological and economic innovations (Heiskala via Pol & Ville, 2009) effectively, or potentially, leads to social and institutional innovation ("cultural lag"; Foley, 1964).

As discussed above, sustainable development has risen to become one of our generations greatest political and social quests, and it has been absorbed as a practice and goal into spatial planning and strategy. Just as how technological, economic and social innovation are described as interconnected in earlier sections, explained through processes attributable to Tipps (1973), Bernstein (1971), Ellul (1964), Perez (2009), Geels (2002), Heiskala (via Pol & Ville, 2009) and the likes, the three dimensions of sustainability are described as equally interlinked and interdependent (Our Common Future, 1987). Wherein the previous passage explains how these systems of innovation influences each other, a central belief expressed in Our Common Future (1987) is rather that the various sectors can inhibit and limit one another; "limitations (to sustainable development) are imposed by present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities" (Our Common Future, 1987; 16); this is especially interesting

for smart city technology as it, together with the social organisation of it, is suggested to be able to pose limitations of sustainability.

Foley (1964) gives these processes spatiality by illustrating how and when ideas and values are materialized into built environment. In describing the various passage points these values experience from formation in aspatial normative stages, to crystallization into built environment in spatial functional organizational or physical stages, Foley (1964) also mentions the process of “cultural lag”, describing how technological innovations in later spatial stages of this sequence of events, may retrospectively influence the normative aspatial stages, i.e. where values and ideas are formed. This process is recognizable in perspectives discussed by Ellul (via Lynne & Robey, 1988), Mumford (1934), Perez (2009) and Geels (2002), as they all describe processes whereby technology, or innovation thereof, influences other sectors of society; sectors that were initially supposed to influence and define innovation and technology.

The profession of spatial planning deals with political, cultural, ecological, economic and social ambitions and will on one hand, and expressing these in geographical and physical terms (Spatial planning, Wikipedia) on the other. Transforming sustainable development, as a normative idea, into built environment has become common practice for spatial planners. At some point, smart city technology managed to ride the sustainability discourse as a parasite, by promoting its own relevance as an applicable spatial strategy response and instrument to be used by spatial planners to mediate and deal with current global issues such as climate change, urban resilience, sustainable economic growth and socially inclusive societies (Marvin et al. 2016). Identifying and highlighting the inherent tension and dissonance between perspectives on technology as a driver for change and modernization, which within the context of this thesis is smart city technology, and anthropocentric perspectives on sustainable development, and as limited by technology and social organisation, is important to maintain a critical viewpoint on the performance of said technology in relation to social sustainability.

III. The Emperor´s New Smart City Technology at the Sustainable theme party

Institutionalization of Sustainable Development

The institutionalization of the sustainable development discourse into international politics and Norwegian spatial planning can be largely accredited to the emergence of the term and concept following Our Common Future (1987) and the debates and conventions that followed. Institutionalization refers to a naturalization of the concept, meaning that an effort is made to manifest the ethics and morals of, for instance sustainable development, into the regulatory framework, political and organizational practice and society as a whole (Institutionalization, Wikipedia). As opposed to previously used term internalization, institutionalization is a more conscious process of implementing concepts into organizational and political systems.

The United Nations is incremental and instrumental in institutionalizing sustainability goals into the public and political discourse. Sustainable development entails development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Our Common Future, 1987; 16). Multiple highly influential international treaties and conventions has furthered and proved the importance of the discourse, such as The Rio Convention of 1992. Through the formulation of UN´s 17 sustainability goals, and their subsequent regimentation, its member nations are obliged to implement and prove their commitment to achieving these goals (UN, 2030 Agenda, 2015). The 17 sustainability goals range in scope within a variety of sectors, but can in short be said to be especially prominent within three sectors; environmental, economic and social.

What follows is a non-exhaustive, chronological list of white papers illustrating the adoption and institutionalization of sustainable development in the Norwegian context.

St. meld. 58 (1996-1997): Issued in order to map progress and results since the initial two papers. The follow-up white paper states as its purpose to only examine the ecological perspective. Although the white paper claims this aspect is closely related and interdependent on other perspectives, especially the economic perspective, it effectively illuminates the claims made by Hofstad & Bergsli (2017) and Dempsey et al. (2009) that the social perspective has received less attention than its counterparts.

St. meld. 23 (2001-2002): Sustainability re-emerges in this white paper from 2001, this time in the setting of booming cities and towns. Through this white paper, the government encourages municipalities to ensure that physical intervention in cities canalize sustainability, as it is more or less irreversible. In discussing the actual physical expansion and planning of cities and towns, the government recognizes the effects and consequences this intervention has for the social, economic and environmental quality of communities. This white paper was an important contribution for the revision of the planning and building act of 2008, and is the first white paper to highlight social sustainability as a goal of its own in spatial planning, and in doing this, also acknowledging the vitality of sustaining quality of life in cities and communities.

St. meld. 23 (2003-2004): In this white paper, the governments vision and ambition for housing is expressed, and in that, the government articulate that everybody has the right to a place to live. In addition, the government express that as many citizens as possible should be able to afford their own place, with their own salary. Through means to control the housing market and assistance for the ones in need, the government claims their strategies for a sustainable housing policies has been a success.

St. meld. 34 (2006-2007): A white paper that by and large discusses Norway´s commitment to reducing its carbon footprint in reference to UN goals.

St. meld. 31 (2006-2007): This brief focuses on Oslo, and its challenges and opportunities as a big city, as well as the capitol region of Norway. Through this brief, the government announces a desire to develop the Oslo-region as an open, safe and innovative region, for the benefit of its inhabitants and Norway's population at large. The government states the need for social, economic and environmentally sustainable development.

St. meld. 20 (2006-2007): Although quality of life and health is generally good, there are fundamental differences in Norway, and these tend to correspond with the economic differences. With this brief, the government announces the initiation of a long-term strategy to combat socially and economic layered differences in health and quality of life.

St. meld. 7 (2008-2009): A brief constituting the government's policies concerning innovation, and innovations role in societal development. As the governments first brief on innovation, it holds innovation and change as keys to meeting the needs of our generation without compromising the needs of future generations. This brief marks the institutionalization of the acknowledgment of innovations positive impact on development, and several facets of innovation are emphasised and mentioned as tools for a more sustainable future; innovation in the public sector, innovation of services and service design and green innovation, in addition to stressing innovative societies, innovative people and innovative companies as important prerequisites for sustainable innovation.

St. meld. 14 (2010-2011): This brief interlinks the ecological perspective with the economic perspective. Both equally pressing, climate change and poverty are issues that can be addressed simultaneously, according to this brief. We need to ensure economic progress and equal distribution of wealth without compromising the environment. This is the first brief that discusses two of the perspectives.

St. meld. 10 (2011-2012): About culture, inclusion and participation, this brief comment on the importance for individuals to be able to express themselves and be creative, as well as feel included. As a planning principle and ambition, the government wishes to eliminate economic and social differences, and thus generate a more inclusive society.

St. meld. 45 (2016-2017): The first brief to mention circular economy. The white paper presents waste management and its potential role in a circular economy.

St. meld. 27 (2016-2017): A brief presenting the current challenges of Norway´s industry, and the government's policies to address these within a sustainable framework. Climate change, an ageing population, globalization and decrease in demand for oil are changing the horizon for Norwegian industry. At the same time, technology, automation and digitalization are unveiling new possibilities and industries.

St. meld. 24 (2016-2017): Another brief reflecting on Norway´s commitment to sustainable development, through its engagement with UN and the world community. Although this brief primarily discusses Norway´s, and the UN´s commitment to eliminate poverty, the introductory chapter discusses the necessity to perceive the three dimensions of sustainability as closely interlinked, and that they must be equally addressed in order to successfully overcome current challenges.

St. meld. 18 (2016-2017): A brief commenting on the governments suggestions and recommendations for sustainable development in cities and regions, by focusing on the three dimensions of sustainability. To substantiate social sustainability, the government emboldens the importance of spatial planning by claiming that the physical environment plays a significant role in citizens quality of life. This brief substantiates the coupling of social sustainability and spatial planning, which subsequently proves the institutionalization of the concept into organizational practice. The brief also encourages innovative solutions in municipalities, in order for them to correctly address the challenges.

Source: Meldingar til Stortinget, *Regjeringen.no,* 2017

The Norwegian government was swift and systematic to adopt the sustainable development discourse, something that can be discerned should one examine the white papers in the textbox above. Directly following the publication of Our Common Future (1987) and the Rio Convention of 1992, two separate Norwegian parliamentary white papers (St. meld. nr. 46 (1988-1989); St. meld. nr. 13(1992-1993)) were issued discussing its consequences and how to adopt its implications into a Norwegian context – unfortunately, these specific papers are not made available online, but a multitude of succeeding white papers refer retrospectively to these, and continue to manifest and illustrate the impact made by Our Common Future (1987) and the Rio Convention (1992). Shortly after Our Common Future (1987), the government expressed ambitions to tackle and address the issues voiced in the report seriously. Directly following these events, the environmental and the economic perspectives seem to prevail, especially when it comes to material suggestions and physical interventions being encouraged. St. meld 58 (1996-1997) specifies that it will focus on the environmental dimension, although it claims its dialectical relationship with the economic dimension. The social dimension is discussed merely as being affected by climate change, through poor air quality and reduced accessibility to green areas. This exemplifies the dichotomy, and or tension, between techno-economic innovation systems and social innovation systems, as elaborated in the theoretical chapter of this thesis. As late as in 2001 (St. meld 23 (2001-2002), the government first voices concern for the sustainability of cities and towns. In this brief, social, economic and environmental concerns seem to be equally weighed, and spatial strategy and planning is recognized as being proportionately implicative for either dimension.

Various factors may have influenced why Norway was so swift and thorough in their implementation of sustainable development. One central factor, however, is that Gro Harlem Brundtland, the head of the committee that made Our Common Future (1987), was the Norwegian prime minister before and after making the report (Gro Harlem Brundtland, Wikipedia). Necessarily, this brought about certain sensations of ownership and leadership of the report, and acting accordingly became a required commitment. By manifesting the term, and its principles, into the Norwegian constitution, the government has actively sought to institutionalize, and thus implement, the concept into the Norwegian regulation. Already in 1992, sustainable development was adopted into the Norwegian Constitution, spearheaded

by the Act 112, claiming all citizens have the right to a healthy ("helsesamt") and sustainable environment ("der produksjonsevna og mangfaldet blir haldne ved lag", *Kongeriket Noregs Grunlov,* Lovdata, 2017). The introduction of this law as early as 1992, exemplifies Norway's swift and sincere commitment to sustainable development.

The report Habitat III (2016), devised and declared by the United Nations Conference on Housing and Sustainable Urban Development, seconds the claims made in Our Common Future (1987) and follows the fundamental principles of the 17 sustainability goals (UN, 2030 Agenda, 2015), and proceeds to encourage and embrace the institutionalization of these principles and guidelines in city administrations;

> *"2. By 2050, the world´s urban population is expected to nearly double, making urbanization one of the twenty-first century´s most transformative trends. Populations, economic activities, social and cultural interactions, as well as environmental and humanitarian impacts, are increasingly concentrated in cities, and this poses massive sustainability challenges in terms of housing, infrastructure, basic services, food security, health, education, decent jobs, safety and natural resources, among others" (Habitat III, 2016; 3).*

The European Union too has embraced and further institutionalized this discourse in the realm of spatial strategy and planning, acknowledging that "major urbanization requires new and innovative ways to manage the complexity of urban living" (Mapping Smart Cities in the EU, 2014; 9), as being such a momentous societal trend, urbanization poses "tremendous challenges for city economies in terms of resource efficiency and social sustainability" (Angelidou, 2015; 100). The EU report recognises the urgent need for cities to balance cities´ "increase(d) strains on energy, transportation, water, buildings and public spaces" with cities´ potential for "generating economic prosperity and social wellbeing" (EU, 2014; 9). In accordance with Our Common Future (1987) and UN (2015), EU (2014) perceives sustainable development not only as essential in order to remedy the pressing ills of our time, but also as an opportunity for cities to reinvent themselves.

In order to ensure that the constitutional principles of sustainable development adopted by regulation are being followed, the Norwegian government has continuously issued a set of

regulations and guidelines for municipalities to adhere to in spatial planning, for instance Rikspolitiske retningslinjer for samordnet areal- og transportplanlegging in 1993, which developed into the more recent Statlige Planretningslinjer for Samordnet bolig-, areal- og transportplanlegging (Regjeringen.no, 2017). The purpose behind these guidelines is stated in the opening phrases, being to obtain coordinated and effective spatial planning processes nationwide, and promote sound resource management, quality of life and stimulate economic growth and innovation; ensure sustainable practice. It´s area of application is to all planning with implications for built environment and land use in the kingdom. The goal of the guidelines is to ensure spatial planning practice is sustainable through sound resource management, facilitation of innovation and economic entrepreneurship, sustainable cities and regions and to promote health, environment and quality of life – principles echoed from international institutions such as the UN (1987; 2015; 2016) and EU (2014).

The government issued National Expectations Regarding Regional and Municipal Planning (2015) is an officially issued document expressing the governments expectations toward regional and municipal planning in Norway. The municipalities possess most of the local planning authority, but through the same regulatory framework delegating municipalities the rights and obligation to plan, the government have ensured their influence and power, and through that, the influence and priority of international conventions and treaties. Municipalities are obliged to consider and meet the expectations expressed in the document National Expectations Regarding Regional and Municipal Planning (2015). Institutionalized by law, national expectations shall form the fundament for regional and municipal planning. It is expressed expectations within multiple sectors in this document; from a commitment to reducing carbon-emissions, to improve health and well-being, and economic stability and innovation; all subjugated to the rationalization and political ambition of sustainable development. The document even expresses the use and implementation of information and Communications technology (ICT) solutions as a priority, in order to standardise “planning processes as well as facilitating greater transparency and public participation for the population” (Regjeringen, 2015).

The Norwegian planning and building act of 2008 states in its purpose-of-the-act paragraph that “the act shall promote sustainable development in the best interest of individuals, society

and future generations" and that "planning and administrative decisions shall ensure transparency, predictability and public participation for all affected interests and authorities. There shall be emphasis on long-term solutions, and environmental and social impacts shall be described" (Regjerningen, 2008). This regulation subjects all spatial initiatives to emphasise and promote sustainable development. Chapter 3-1a of the same act specifies that all plans subjugated under this law is to establish goals for physical, environmental, economic, social and cultural developments, and identify social needs.

"Chapter 3. Planning functions and authority
Section 3-1. Planning functions and considerations pursuant to this Act

Within the framework of section 1-1, plans pursuant to this Act shall:

(a) establish goals for the *physical, environmental, economic, social and cultural development* of municipalities and regions, *identify social needs and functions*, and state how these functions can be discharged
(b) *safeguard land resources*, landscape qualities and the conservation of valuable landscapes and cultural environments
(c) protect the natural basis for Sami culture, economic activity and social life
(d) *facilitate value creation* and *industrial and commercial development*
(e) *facilitate* the good design of developed surroundings, *good housing environments and good childhood environments and living standards* in all parts of the country
(f) *promote public health* and *counteract social inequalities in health*, and help to prevent crime
(g) take the climate into account in energy supply and transport solutions
(h) promote societal safety by preventing the risk of loss of life, injury to health, and damage to the environment and important infrastructure, material assets, etc.

Planning shall *promote coherence by ensuring that sectors, functions and interests in an area are seen in an overall context through coordination of and collaboration* on the discharge of functions between sector authorities and between central government, regional and municipal bodies, private organisations and institutions, and the public at large.

Planning shall be based on financial and other resource-related prerequisites for implementation and *shall not be more exhaustive than necessary*.

Plans shall *contribute to the implementation of international conventions* and treaties within the scope of the Act.

> Adopted plans shall serve as a common basis for municipal, regional, central government and private-sector activity in the field of planning."
> (Planning and Building Act of 2008, Regjeringen, 2015)

The Norwegian Planning and Building act of 2008 regulates and judicially commits all land use and building activity in Norway, and a direct connection is made to "contribute to the implementation of international conventions" under which Norway is required to commit to. This includes Norway's commitment to UN´s 17 sustainability goals due to Norway's commitment to the UN. There are multiple elements from this section substantiating the institutionalization of sustainability, and in various forms, all three of the established dimensions of sustainability are discussed. Environmental considerations are ensured through a, b, g and h. Economic sustainability through a and d, and social sustainability through a, e, f and h. In addition, chapter 3-1 of the Planning and Building Act of 2008 requires all plans to promote coherence in planning, which translates to strategies to be planned and implemented holistically and cohesively. National and regional interests are further manifested and institutionalized through Section 11-1, which states that the "municipal master plan shall promote municipal, regional and national goals, interests and functions" (Regjeringen, 2015).

Chapter 8 of Our Common Future (1987), *Producing more with less*, emphasises the need to expand on technology, innovation and policy in order to better meet the challenges of the future.

> *"Technology will continue to change the social, cultural, and economic fabric of nations and the world community. With careful management, new and emerging technologies offer enormous opportunities for raising productivity and living standards, for improving health, and for conserving the natural resource base. Many will also bring new hazards, requiring an improved capacity for risk assessment and risk management." (Our Common Future*; Chapter 8.3.39).

The commission behind the report understands and underlines the importance of harvesting the benefits of new technologies, as they may bring solutions to the issues raised in the report, although the report acknowledges that said technologies are not void of risk.

A separate, recent set of parliamentary white papers seem to pave the way for implementing

and embedding new technologies and digitalisation into the Norwegian institutional framework. Digital Agenda for Norway in Brief (Meld. St. 27(2015-2016)), promotes and prioritises, and thus institutionalises, the use of digital technology. The brief rationalises this enabling by claiming information and communications technology´s (ICT) potential for reducing emissions, stimulating inclusion and value creation. As we will see in later sections of this thesis, parliamentary white papers, as well as several municipal plans, are currently engaged in the use of digitalization and smart city technology in spatial strategies and planning, justifying this by smart city technology´s apparent capacity to address sustainability challenges. This creates an explicit link between regulatory commitment to sustainable practice, and the perception of smart city technology as an enabler of sustainability in spatial strategies.

Considering the persistent and regimented implementation of sustainable development into Norwegian institutional practice, in all of its dimensions, and the recent appearance of smart city technology into the same institutional framework, the tension between the sustainability discourse and technology as a driver for change and progress, as described in the previous chapter, becomes visible in a Norwegian context. If we are to follow the outlined logical framework of smart city technology enforcing the current techno-economic paradigm, and all of its complimentary facets, and couple this with the recent emergence of visions of smart city technology as a remedy for sustainable development, the tension of sustainability dimensions characterized by Dempsey (2009), Hofstad & Bergsli (2017) and Our Common Future (1987) crystalizes in spatial strategies by way of smart city technology. This tension will have certain implications for how international and Norwegian spatial strategies perform as sustainable practice, as they are using technological instruments pertaining a techno-economic paradigm; a techno-economic paradigm that contains its own set of attributes, biases and self-sustaining nature.

Smart city technology, its driving forces and promises

The introductory chapter to Bas Boorsma´s recent book *A New Digital Deal (*2017) opens with the bald statement; "a central premise of this book is that digitalization holds an unprecedented promise for our communities." (pg. 8). This very much reflects the sentiment in most of the literature praising the recent emergence of the smart city discourse. This section will investigate various definitions, the attractiveness and expected potential of the contentious smart city technology.

Angelidou (2015) claims there has been two distinct forces mobilizing smart city technology; a technology push and a demand pull. She contrasts these forces as the technology push is "driven by supply, regardless of the expressed needs of society", and the demand pull as "solutions/products being developed and commercialized as a result of scientific research responding to the demand side of society" (pg. 99). The difference is subtle, but its implications might be grave; one force imposes technology upon society, whilst the other responds to needs in society. Out of these two contradictory driving forces, Angelidou (2015) claims "smart city solutions have been steadily more supply-driven rather than demand-driven" (pg. 101), a tendency which is based upon "an entire stream of visioning and thinking about technology-led urban development" (pg. 104); a stream that can be traced back to visions about technology´s instrumental drive for progress and modernization discussed in the previous chapter.

The promise of smart city technology alludes to those traditionally pertaining the spatial planner, those of combatting and overcoming the global and urban challenges we face today, such as climate change, urbanization, overcrowding and financial, social and political

instability (Our Common Future, 1987; Habitat III, 2016; EU, 2014), a problem to which many find smart city technology to hold the solution (Shelton, Zook & Wiig, 2014; Neirotti et al., 2014; Nam & Pardo, 2011; Innovation Norway, 2016; Boorsma, 2017; Haarstad, 2016).

But what does it mean to be a smart city? What does the term entail and mean for spatial planning? There has yet to be established a true definition of smart city. There are as many definitions as there are versions or attempts of it. Examples from around the world show there is a wide variety of approaches to developing smarter cities. Innovation Norway (Innovation Norway, 2016) boils the concept down to two essential elements in their report *Smarte Samfunn* (2016); 1) digital technologies and 2) geographically isolated developmental areas (Innovation Norway, 2016; 9); i.e. technological tools used in a confined socio-spatial area, which effectively makes it a land use activity. The report also highlighted a three-fold profit; economic, environmental and social (Innovation Norway, 2016; 2). Digital technologies thus enable smart solutions within cities or districts. The implementation of said technologies has strong financial motives and incentives, as it in turn yields environmental and social profits. However, what these smart solutions look like, what incentives and motives authorities pursue and within what societal sectors, is highly initiative specific, as we will see in later sections.

The parliamentary white paper issued by the Ministry of Local Government and Modernisation (KMD) Digital Agenda for Norge (Meld.St. 27 (2015-2016)) claims smart city technology has the capacity to mediate many of the current urban challenges of today, and furthers that digitalization will play a vital role in making cities sustainable and attractive in the future (pg. 109). The report has its own working definition of smart cities, that roughly translates to:

> "A smart city uses smart technologies to improve liveability in cities. Smart city initiatives seek to improve public services and its citizens quality of life, optimize the cities resources, improve the city´s productivity, whilst also reducing the carbon footprint and other environmental issues in the city"

On accord with Innovation Norway (2016), *digital technologies* are central also to KMD´s working definition of smart cities. KMD´s definition differ from Innovation Norway (2016) in

that *digital technologies* are merely tools to obtain an objective, an objective that is defined as rather social; “improve liveability in cities”, and better use of resources, higher productivity and so forth. KMD´s definition places technologies, not as a goal in itself, but rather as a means to an end.

The EU devised report *Mapping smart cities in the EU* (European Parliament, 2014) has a slightly less technocratic working definition of smart cities: “a smart city is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership” (EU, 2014: 9). Central to this definition as well, is the presence of digital technologies, here referred to as ICT. EU contributes to the definition by referring to stakeholders and partakers as integral to the definition, but with municipality as owner of the project.

The collective internet encyclopaedia Wikipedia offers its own definition on what a smart city is: “an urban development vision to integrate information and communication technology (ICT) and Internet of Things (IoT) technology in a secure fashion to manage a city´s assets” (Smart City, Wikipedia). The definition found on Wikipedia contrasts to that of the EU report due to integrating technology seems to be treated as a goal in its own right. It also ignores any components considering stakeholders or partakers to the definition, but it is the first to include any mentioning of Internet of Things (IoT) as a separate feature.

> ”*We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with wise management of natural resources, through participatory governance”* (Caragliu, A., Del Bo, C., & Nijkamp, P., 2011; 70).

Contrary to Innovation Norway (2016), EU (2014) and Wikipedia, *digital technologies* is not necessarily a prerequisite for smart cities according to Caragliu et al. (2011). If one is to follow their reasoning, a city is smart when it invests in social capital ***and*** infrastructure (transport and digital technologies), producing economic prosperity and improved quality of life, whilst also administering the city’s assets wisely and encouraging and generating citizen co-creating and participation. Here, the terminological assumption behind *smart* refers to an automation

of governance, rather than technology used for governance, and social capital and smart city technology, here "modern communication infrastructure", are both considered equally important to the definition. Interesting to this definition is the referral to "modern communication infrastructure" in relation to a city being smart, connoting attributes discussed in the previous chapter.

Albino, Berardi & Dangelico (2015) removes technology out of the definition all together, whilst also contextualising the understanding of the concept into an urban and spatial planning context, and effectively ads sustainable development as basic justification for the utilisation of smart city technology.

> "In the urban planning field, the term "smart city" is often treated as an ideological dimension according to which being smarter entails strategic directions. Governments and public agencies at all levels are embracing the notion of smartness to distinguish their policies and programs for targeting sustainable development, economic growth, better quality of life for their citizens, and creating happiness" (Albino et al., 2015; 5).

In this definition, the utilisation of smart city technology is reduced rather cleverly. Albino, Berardi & Dangelico (2015) specifies with their definition that the operationalisation of smart city technology is a strategic, directional and thus, ideological choice made by government, as a way of addressing sustainable development in spatial planning.

In making comparative studies on the multiple strategic ICT enabled city visions, Estevez et al. (2016), makes a clarifying distinction between various city strategies. As can be discerned from their chart, smart city incorporates social and human concerns as a central tenet.

Table 5: Comparing Digital City, Intelligent City, Smart City and Eco-City Models			
DIGITAL CITY	INTELLIGENT CITY	SMART CITY	ECO-CITY
○ Informatics (communication) ○ City portals for online information services	○ Intelligent systems (functionality) ○ Online web-based e-learning systems integrated and interoperable with other city platforms	○ Social and human concerns (quality of life) ○ Ecological systems (sustainability) ○ e-Learning platform and knowledge management ○ Advanced visualization and simulation tools ○ Benchmarking requirements	○ Natural eco-systems ○ Economic development while protecting the environment

(Figure 2, retrieved from Estevez et al., 2016: pg. 11)

It seems pretty evident that ICT and digital technologies can alter cities discourses physically, socially and environmentally, but Hollands (2008) claims there is a terminological trap in utilizing the *smart city* term. Hollands (2008) asks whether the term alludes to a totally new model of urban form, or if it simply distracts from the actual purpose behind the concept. It is the dissonance between the ambitions and the physical intervention Hollands (2008) highlights when he discusses the issues concerning claiming the smart city-term. This dissonance is also what sets so-called smart cities apart (Hollands, 2008; 305). Interpreted somewhat loosely, according to Hollands (2008), a city is smart only when goals, ambitions and policies are successfully translated into (successful) physical interventions. Interpreted in light of this thesis, this translates to a city being smart when smart city technology is successfully appropriated spatially to achieve sustainability.

Despite differences in definitions and formulations, there are some elements that tend to reappear in defining what a smart city is. Generally, some definitions discuss smart city as a strategic choice or direction (Albino et al., 2015), in which the technological aspects are implied as a resource, or a means to an end. Most of the definitions treat digital technologies, or ICT, in some way or another; even if these are integral to obtaining a goal (KMD, 2016), or if integrating these is a goal in its own right (IN, 2016; EU, 2014). Either way, the technology is, more often than not, referred to and perceived as an instrumental and modern tool in promoting sustainable development (Shelton, Zook & Wiig, 2014; Neirotti et al., 2014; Nam & Pardo, 2011; Innovation Norway, 2016; Boorsma, 2017; Albino et al., 2015; Caragliu et al.,

2011). Other promises that are often discussed in talking about smart cities, as opposed to other ICT enabled city strategies, are some sort of geographically defined area, be it a city or any confined area (Innovation Norway, 2016; Digital Agenda for Norway, 2015-2016). Social concerns appear in various forms as well, either engrained in the concept liveability, as a proportionately important dimension to invest in or as in multi-stakeholder perspective (Estevez et al., 2016; Caragliu et al., 2011).

The second part of the smart city term should receive its share of the definitional focus as well, as it too adheres to conceptions and connotations. The word city originates in the latin word *civitas*. The etymological origin of *civitas* refers to citizenship or community (*Civitas*, Wikipedia). Etymologically, this suggests that a smart city holds great promise. By combining the earlier mentioned definitions of smart cities with the etymological definition and origin of city, the social dimension can be said to be given substantial weight. As smart, in short, refers to sustainable development by the enabling of ICT devises and digitalization of societal functions, and city refers to citizenship or community, distinct social phenomena, a smart city implicates sustainable ICT enabled communities. Spatial strategy then, in light of smart city, quite noticeably should reflect this expression in the managing of our physical and geographical commons. Logically and etymologically, this demands a clear focus on the anthropocentric dimension.

Strategies, models and generations

In order to categorize and make sense of the myriad of various attempts and approaches to smart cities, it might make sense to clarify and highlight some suggestions as to how some advocates framework these various strategies, and not necessarily just its dimensions or axes (Innovation Norge, 2016; Cohen, 2014).

Boyd Cohen is a profiled American urbanist, who according to himself, has been preoccupied with understanding and studying the smart city movement. In addition to having published a yearly review of smart cities, with an elaborate set of dimensions factoring into a city´s “smartness”, Cohen suggests that, over the time he has studied the phenomena, he has

witnessed cities mature through three distinct generational stages (Cohen, 2015) Each stage is differentiated by various players and distinct missions, so to speak.

Smart City 1.0: Technology driven is characterized by the centrality and presence of big international tech companies. The development of some of these coincides with the emergence of IBM and Cisco as big data management infrastructure and technology, and the vision for these sites or cities, thus, reflect mainly these companies´ vision of the future city. Examples of these cities or areas are spots such as Songdo, Seoul and Masdar, UAE; so-called "green field developments" (Kitchin, 2014; Shelton, Shook & Wiig, 2014).

Smart City 2.0: Technology enabled, city-led is still the biggest cohort, wherein most cities engaged in the phenomena finds themselves, and can be considered as somewhat top-down managing. According to Cohen, these generations cities are characterized by "forward-thinking mayors and city administrations – (taking) the lead in helping determine what the future of their city is and what the role is for the deployment of smart technologies and other innovations" (Cohen, 2015). A good poster example for this generational approach is Rio de Janeiro´s IBM Central Operations Center, which is a centrally located monitoring control room in Rio, designed to predict and respond to any kind of disaster in the city.

Smart City 3.0: Citizen co-creation is, according to Cohen (Fast Company, 2015), the next-level generation. Some cities seem to have matured into this generation, at least if one is to judge by some of its latest initiatives and projects. Where Smart City 1.0 was tech driven, and Smart City 2.0 was city driven, Smart City 3.0 is sought to be citizen-led and driven. Although few to almost no cities have all-together embraced generation 3.0, a few pioneering cities have initiated several projects certainly in the 3.0 landscape. Among the many projects Vienna, Barcelona and Amsterdam proclaim, many of these integrate and involve citizens as decision-makers and creators of urban space and policy. What these projects share, in terms of technological structure, is often an online platform and infrastructure that allows for any party to participate and communicate. Many projects also seek to give information back to the citizen, information that previously was exclusive for city councils and policy makers. This generational maturity seems to have encouraged a push toward issues concerning social equity and inclusion (See Barcelona and Vienna), and some cities seem to be coupling these

incentives with citizen empowerment start-up labs (See Amsterdam). This is substantiated by Saskia Sassen (LSECities, *Urbanising technology, n.d.*), who argues for an open-sourced urbanism that is heuristic, meaning it learns and evolves from its own experiences. Thus, in this generation, cities acknowledge the value of technologies provided by big international tech companies, but controls market demand rather than being controlled by the commanding, closed-system nature of technologies (Sennett, LSECities, *the stupefying smart city,* n.d.).

Angelidou (2014) tries not to define smart cities in her approach, but rather to distinguish between four "strategic choices with a spatial reference" (pg. 3) that fundamentally affect how smart city policies are designed. This relates to the strategic make spatial planners make in operationalizing smart city technology as a resource and tool.

National vs. local strategies is the first of the approaches, and relates to the scope of the strategy; whether it is national, or whether it focuses more on smaller areas and districts, such as cities, neighbourhoods and so forth. Angelidou (2014) claims local strategies are way more typical because it is a more effort-effective scale, and less economically risky. It is also easier to more efficiently address local problems and issues, and yield results, in smaller areas.

New vs. existing cities relates to the stage of the city which is being developed. Whether the strategy relates to developing a "green field city" (Angelidou, 2014; Kitchin, 2014), such as Masdar or Songdo, or retrofitting existing cities. The latter one is the more typical one.

Hard vs. soft infrastructure oriented strategies deals with the nature of the strategies, and the projects under them. Hard infrastructure strategies typically refer to the advancement of transportation, building structure, water and waste infrastructure, and energy distribution. Soft infrastructure refers to people and policies, typically social innovation, human capital, participation, health, which are "indispensable characteristics of the smart city, and therefore smart cities should put technology truly at the service of their inhabitants and not vica versa" (Angelidou, 2014; 55).

The last categorical strategic approach to smart cities is **the reference area: economic sector-based vs. geographically based**. These strategies are typically differentiated by being either geographically focused, i.e. on a specific area or cluster, or a socio-economic sector such as business, governance, buildings and so forth (such as the categories developed by EU, 2014; Innovasjon Norge, 2016; Cohen, 2015).

Letaifa (2015) developed the SMART framework to illuminate how the three cities she studied (Montreal, London and Stockholm) designed their smart city strategies. The title is an acronym for Strategy, Multidisciplinary, Appropriation, Roadmap and Technology, and is also a reflection of the elements chronological order in the design/implementation process. According to Letaifa (2015), these steps take place on different conceptual levels; wherein strategy and multidisciplinary takes places on the macro level, appropriation and roadmap on the mezzo level and technology on the micro level.

Strategy refers to the step where the initial vision is shaped and a direction is pursued. The strategy is supposed to address specific objectives that reflect the local contextual issues or challenges. In relation to this thesis, this is ideally where social sustainability should be formulated as a normative value and goal in smart city strategies.

Multidisciplinary means that the process of shaping the smart city strategy should include a wide variety of disciplines and stakeholders. This in turn yields better and more wholesome results, as more issues, insights and perceived outcomes can be imagined.

Appropriation is the step where the vision and strategy is accepted and adopted by the community of stakeholders and involved actors. These stakeholders and actors need to themselves become ambassadors of the vision and strategy.

Roadmap is in essence a “how-to” implement the strategy into the physical structure; a working manual.

Technology is lastly required to transform and enable the envisioned strategy. Letaifa (2015) here notes that technology is a great tool to "improve liveability, but technology should not be a goal" (Letaifa, 2015; 1418).

The actual technology, its applications and its market

Having somewhat sought to examine how smart city is understood, and its expected economic, environmental and social potential, it is also important to review just what smart city technologies actually refer to, in terms of tangible objects and systems, how do these materialize in the spatial dimension and its market. Despite its myriad of definitions and approaches, there seem to be a set of key technologies and practices that needs to be present.

According to Shelton et al. (2014), the technology can be summarized into executing three actions, "monitor, measure and manage" (pg. 13). It is basically about coordinating resources, anticipating problems and making better and more precise decisions based on computational data and quantitative methods. This approach and scientific ambition is not new, however, as spatial planners and geographers have sought to use "sophisticated quantitative and computational methods to understand cities since at least the 1950s" (Shelton et al, 2014; 15).

Critical to any smart city is the integration of "cyber-physical systems" and Internet of Things (IoT). This is generally defined as "the connection and virtual representation of physical devices to the internet" (Rodger Lea, 2017; 6). Whereas earlier monitoring practice of a city´s asset, such as traffic and sewers, has been executed on an individual single-sector or silo-basis, this technology has the capacity of critically breaking down this barrier, and thus optimize resource management. With "cyber-physical systems", referring to cameras, recorders or sensors and so forth, connected to the same IoT-grid, all service information collected will be made available real-time within the same software platform, improving the administration of said services and resources.

The production of a significant amount of data is an inevitable consequence of IoT and "cyber-physical systems". The management and analysis of all this data is generally referred to as big

data. Big data can, “if managed and analysed well, offer insights and economic value that cities and city stakeholders can use to improve efficiency and lead to innovate new services that improve the lives of citizens” (Rodger Lea, 2017; 9).

Another trend of smart cities around the world has been to make as much of the significant big data analysis results accessible for the public, this is generally referred to as open data. Made with easy software, processed big data is presented to the public on open data portals. “Its primary goal is transparency, but a significant subsidiary goal is to make information available to third parties that can be exploited to improve city services and foster innovation” (Rodger Lea, 2017; 8). This application is closely related to a movement toward promoting citizen engagement and inclusion; i.e. third generation smart cities. Although citizen engagement isn´t a technological innovation, it is considered a “complementary aspect of smart cities” (pg. 9), as it “aims to harness technology in support of greater engagement with citizens, partly in attempt to “tap into the collective intelligence”” (Rodger Lea, 2017; 9) of cities. Estevez et al. (2016) substantiates this by claiming “a real promise of smart city initiatives is that digital technologies can be used to enhance equity and fairness and to promote citizen participation and social inclusion in the urban space” (pg. 37).

Another central and common prerequisite of creating a successful smart city strategy is public-private partnerships (Deloitte, 2015; Innovation Norway, 2016). This will enforce a system wherein private companies can finance or develop innovative projects that cities or municipalities could not otherwise afford (Kendra Smith, *Scientific American*, 2017); as funding is “by far the biggest challenge of cities” (Estevez et al., 2016; 60) seeking to devise smart city technology. It is also a prerequisite for remaining responsive, dynamic and flexible toward new challenges and innovation. Conversely, it illustrates the dual opportunity that is smart city technology, as private companies get involved for profit and market share, whilst city administrations and spatial planning authorities use it for its prospected sustainability benefits.

The growing smart city market is projected to be worth somewhere between US$ 400 billion to US$ 1,5 trillion by 2020 (Deloitte, 2015; Roland Berger, 2017). IBM and Cisco are two of the biggest actors and suppliers of smart city solutions and systems, and considering the market

potential, one can understand their engagement. IBM offer a range of solutions for the "future of cities" (IBM, 2017), and has become an essential proponent and obligatory "passage point" for smart cities (Wiig, 2015). Within the three sectors planning and management, people and infrastructure, IBM promotes IoT and big data for the benefit of the public administration and its citizens. From their acclaimed Operations Center in Rio, referenced in Cohens (2015) second generation smart city, using sensors and surveillance equipment to correctly asses and address urgent and real-time incidents, to educational platforms that personalizes the learning experience to the student´s capacities (IBM, 2017), IBM uses the availability of real-time data and information to customize software and platforms for cities and companies.

Willem Van Winden (2016) looks closer at what happens when smart city initiatives materialize into the spatial and physical dimension of planning, and points out that most projects and initiatives cease to exist after the initial piloting phase. Where there is a great spectre of pilot projects, "set up to offer inspiration, demonstrating a future possibility or solution without claiming immediate business sustainability" (pg. 4), almost none are rolled out or scaled up for wider impact. Winden (2016) argues that most pilot projects are experiments within controlled environments, financially and regulatory, whilst the multitude of failures can be attributed to flop of "technology, feasibility, a lack of demand/interest or otherwise, and scaling in whatever form makes no sense" (pg. 4). The lack of scaling or continuing and further implementing pilot projects is a problem recognized by most, illustrated by EU´s commitment to "ensure that solutions can be scaled and replicated" (*Analysing the potential or wide scale roll-out of integrated SCC solutions*, European Commission, 2016; 13). The consulting company Deloitte addresses this deficiency too; "the ability to transition from pilot tests to larger scale is distinctly absent globally" (*Smart Cities, not just the sum of its parts*, Deloitte, 2015; 8). Without the ability of scaling smart city projects for wider impact, its investments and subsidies falls redundant, wasteful and discriminatory, at least if seen from a governance or municipal perspective. Materialize this by taking urban displacement and gentrification as an example; without satisfactory research and comprehension of local needs, and with the sudden public investment in modern infrastructure (digital infrastructure for example), spatial strategies may risk attracting more affluent citizens and push out the less affluent ones, as was the case with the San Francisco transit-induced gentrification (Kendra Smith, *Scientific American,* 2017).

“For most city leaders, the question isn´t to embark on a digital transformation, but how” (Digital Cities: Building the new public infrastructure, Cisco, 2017; 3). Like IBM, Cisco offers a wide range of solutions for public administrations seeking to optimize their services, but the company highlights that at its foundation, a smart city must show political will and flexibility in order to be successful in its endeavour (Personal Interview, Cisco, 12.10.2017, Lysaker).

With the correct political will, budget and flexibility, any city could enable and integrate a full scale technological network making it into a smart city as professed by Cisco and IBM (Personal Interview, Cisco, 12.10.2017, Lysaker). Many cities were early adopters of the smart city dream, as sold by IBM and Cisco, without knowing what would come from it (Wiig, 2015); as the outcomes of smart city strategies rarely reflected their promotional material. This strongly resonates with Cohens (2015) depiction of first, and to some degree second, generation smart cities, as well as Angelidou´s (2015) description of smart city technology as being part of a technology push trend, rather than technology being applied in response to concrete needs in society. A connection can also be drawn to Letaifa´s (2015) SMART implementation process, which emphasises that the implementation of technology should be the last step of a smart city spatial strategy, and not a goal in its own rights.

As Angelidou (2015) describes, the smart city technology push is embedded in an “entire stream of visioning and thinking about technology-led urban development” and “often results in smart city strategies that are disconnected from their social context and fail to tackle a city´s problems in a cohesive way” (pg. 104). Considering too that the “smart city model is a tool for city modernization and social mobilization driven by a set of urban development goals” (Estevez et al., 2016; 38), further suggests that cities´ and spatial planners devising said technology might not be as unbiased as one may think, albeit unconsciously, as the desire to rely on technology for progress is based upon implications and connotations somehow unrelated to sustainable practice; this stream of visioning and strive for modernization is part of the seductive promise of technology for progress, as discussed in earlier chapters. As this section highlights too, private companies pertaining the current business cycle and techno-economic paradigm are perceived as central partakers in successful smart city strategies. This again illustrates the tension between the two discourses of technology-driven progress and

sustainable development, and in this specific instance, the two-faced nature of smart city technology; a great business opportunity for private tech-companies, and an innovative way of adequately addressing sustainable development for spatial planners and city administrations.

In analysing smart cities all over the world, the German consultancy firm Roland Berger found that many smart cities were overly invested in certain sectors, whilst neglecting others. The most successful ones, however, were the cities that had managed to generate end-to-end, comprehensive strategies invested in all sectors of the city. Based upon their research they identified 10 key characteristics of successful smart cities.

1. **Re-evaluate he role of the city and it´s administration**: this novel technology offers a unique chance to reconsider what and how the city should offer in terms of services.
2. **Involve citizens and other stakeholders**: Before developing a strategy, one must understand the target group.
3. **Avoid isolated solutions – look beyond e-government and actively apply best practices:** make sure there is a digital interface between different service sectors in the city in order to foster cross-sector activities and control.
4. **Encourage initiatives, self-sustaining business models and other contributors from the private sector:** establish healthy public-private partnerships, as long as private businesses are willing to engage in the local community.
5. **Create a comprehensive data strategy and data platforms:** Understand the data the city, and link data sets to each other using common data platforms. Make these available to the public.
6. **Set up innovation labs to foster an inspiring ecosystem:** Encourage innovation and entrepreneurship, and ensure these have enough regulatory room to expand. Provide technical and financial support to where needed.
7. **Ensure data security:** Data security is an increasing problematic area. Ensure the protection of private and sensitive data, public and private.
8. **Involve infrastructure operators in designing, financing and implementing initiatives:** as most major cities own and operate their infrastructure via intermediary companies, these companies have important saying in designing, financing and implementing smart city concepts.
9. **Gain political backing and integrate public feedback:** This is important to ensure alignment over goals and actions. This could involve the use of digital participation platforms.
10. **Establish a coordinating body and a dedicated planning system:** A central governing body is essential to formulate clear, realistic goals, timeframes and budgets.

(Source: Roland Berger, 2017; 12-13).

The notion that smart city technology is supply-driven, and that, as a result, smart city strategies fails to consider or contribute positively to its social context elaborates on the tension presented by Dempsey (2008), Hofstad & Bergsli (2017) and Our Common Future (1987) between the sustainability dimensions, or if anything, it compliments their observations about social sustainability's unproportioned attention, all in the new arena that is smart city strategy; as technology, and the social organisation of it, poses limitations on sustainability. Considering the established regulatory obligation to all sustainability dimensions of Norwegian spatial strategies, and the above-mentioned social promises professed by smart city advocates, smart city practice may in fact suffer from performance issues. In order to claim the smart city title, as Hollands (2008) claims, the city must be successful in closing the gap between intention and successful spatial strategy. In literature and practice however, there are cities that are perceived as successful in overcoming this dissonance.

Smart city case studies

Looking for best practices and experiences to learn from and draw inspiration from is important in development. The parliamentary white paper Digital Agenda for Norway (St. meld. nr. 27 (2015-2016)) emphasises this, and states that it is highly necessary to look to cities with identical characteristics and challenges to obtain a better fundament for smart city spatial strategies in Norway (pg. 112). This allows for the transfer of knowledge and experience, and will further reduce the financial and social risk of implementing initiatives.

The following section will present some of the cities that are considered to be the “smartest” cities of today. Albeit subtle, inherent in the idea of “smartest” cities, suggestions are made to values of progress and modernization. In becoming pioneering cities, the following examples have become pinnacles of what it means to be a modern city; something to strive for. By having integrated technology being a parameter for which modernity is measured and idealized, the trajectory discussed in previous chapters again become visible.

One city that repeatedly tops international rankings and lists as a pioneer within the smart city discourse, is Amsterdam. Spearheaded by the collaborative organization Amsterdam Smart City, the region of Amsterdam is a hotbed of ongoing smart city projects. The organization is comprised of companies, governmental actors and academia. The organizations own slogan is; *we organize impact on urban innovation*, which subtly implies the organizations role as a coordinator, encourager and portal to the cities smart city development.

More so than being an instigator, the organization seeks to become a facilitator. Although the organization claims it is continuously challenging industry and government to come up with innovative solutions for a smarter city, the organization prides itself on being more of a portal and connector of people so that good ideas and projects are initiated. The organizations mantra, that it will work with any one or any company, be it private or public, community or individual, who has a good idea, reflects the organizations values when it comes to the urban challenges our cities face.

The organization curates a multitude of projects; projects still in the initial phases as well as plans that have been implemented and completed. The range of projects have been categorized into six various categories; infrastructure & technology, energy, water and waste, mobility, circular city, governance & education, citizens& living.

Infrastructure & Technology revolves around big data, connectedness and using technology as an infrastructure. It introduces and presents a series of projects that aim at improving smart city initiatives as infrastructures. ***Energy, water and waste*** is Amsterdam Smart City´s effort to channel all projects aiming at assisting Amsterdam in reaching its potential and ambition to become greener city. The ***Mobility*** section seeks to promote and highlight projects that aim to improve the city´s accessibility and mobility, from new car sharing models to improved batteries. The ***Governance & Education*** segment deals with research and developing and sharing valuable lessons and knowledge concerning the smart city. It is mainly comprised of various start-up labs and seminars, where companies and organizations can share their knowledge. ***Circular City*** is a segment that seeks to promote reusing, recycling and reducing waste and pollution. It promotes the jump from linear to circular economy. It is about redesigning the material value chain.
Citizens & Living is the citizen-centric segment of the six. It promotes inclusion, social issues and the general well-being of all the citizens. The organization acknowledges that in order to keep the city liveable in the future, initiatives that promote liveability is required.
(Amsterdam Smart City, 2017).

CITY OF COPENHAGEN

According to State of Green (2014), Denmark´s collaborative effort to educate and share results, Copenhagen has the "world´s best smart city project" (State of Green, 2014). The mayor of technical and environmental affairs of the Danish capitol was presented the prize on the annual Smart City EXPO in Barcelona in 2014. The reason was, according to the jury, that Copenhagen has the most comprehensive plan for collecting data, and using said data for generating a greener city, a higher quality of life, a sounder business climate and to achieve the city´s goals in terms of reducing congestion and CO2 emissions, and improving air quality. Copenhagen has also devised a clever implementation plan. The programme has been named Connecting Copenhagen, and is a collaborative, transversal effort, between the city of Copenhagen, several universities and Rambøll.

Connecting Copenhagen states that the use of technology is a clever and relatively cheap way of resolving the issues modern cities face today, and that the digital infrastructure the city aims to implement will be open and available for anyone to use (Connecting Copenhagen).

Copenhagen is implementing an extensive smart city grid, with sensors (RFID-units) that collects information about the real-time flow in the city, on everything from traffic to sewers. This information is valuable for the authorities as it allows for them to precisely assess when and where assistance is needed. A successful smart grid RFID-unit based pilot project was conducted at the Copenhagen Airport, where signals from smart phones where used to triangulate and deduct people's movements and behaviours. This information can be viewed in real-time, or one can study historical data and thus learn valuable information about how people move in instances of crisis, for example.

Copenhagen claims, through the other similar projects, that city expenditures can be reduced by up to 45% in certain sectors. Not only are expenditures reduced, these projects have a significant effect on the reduction of emissions and consumption.

As a repercussion of granting everyone access to the big data base, the city of Copenhagen promotes and encourages cleantech-businesses to exploit and use this as a resource in developing new models and innovations that can further Copenhagen's ambitions toward becoming a smart city. This will attract investments and create jobs, and thus ensure wealth and economic sustainability.

Connecting Copenhagen are using this technology to substantiate the regional plan developed by the city of Copenhagen. It is specifically stated, that the technology is perceived as a tool that can be utilized in reaching the goals and aims of the regional plans, such as their bicycle strategy or the parking strategy. (Connecting Copenhagen, n.d.).

Another contender of the title as champion in the smart city race, is the capitol of Catalonia, Barcelona. As the city regularly ranks at the top in rankings, it is perhaps no surprise that the world's biggest smart city conference, Smart City Expo, is held in Barcelona each year. A conference that seeks to be at the forefront of smart technology, and serve as an exposition of clever and smart solutions and infrastructure.

The Barcelona City Council states that they aim to go beyond the traditional smart city, and "take full advantage of opportunities brought about by highly transformational data-driven technologies" (Ajuntament de Barcelona, 2017). The city is committed to looking beyond what they consider to be the technocratic approach, where information and infrastructure, "all too often,… (are) being managed by big foreign corporations". The city states that they perceive this new technology as a valuable asset in creating more engaging and inclusive communities.

At their official smart city website, the city of Barcelona lists at least 39 projects within a wide range of sectors. The city itself has chosen to divide the sectors into three axes, naming them "digital transformation", "digital innovation" and "digital empowerment" (Ajuntament de Barcelona, 2017).

The ***Digital transformation*** *(DT)* axe of development consists of projects and plans that seek to use the technology and the big data systems available to provide better services for the citizen. The city has devised plans to completely digitalize government, allowing for full transparency as well as enabling participation. The axe also includes comprehensive ambitions that seeks to provide internet access for all, in order to eliminate the digital divide and ensure inclusion for all (*Digital transformation*, Ajuntament de Barcelona, 2017).
The ***Digital innovation*** *(DI)* branch of the digital agenda focuses on supporting entrepreneurship and inclusion in the digital economy. It seeks to address urban social challenges using this technology, as well as promoting circular and sharing economic models. (*Digital innovation*, Ajuntament de Barcelona, 2017).
The ***Digital empowerment*** *(DE)* axe of Barcelona´s efforts focus on ensuring citizen´s rights while promoting digital technologies. The city states they will "harness digital technologies in order to create good jobs in communities across the city and fight inequality", as well as "promote participatory democracy" (*Digital empowerment,* Ajuntament de Barcelona, 2017).

Barcelona´s ambitions and statements concerning their smart city goals are overwhelmingly oriented toward empowering the citizen and using digital technologies as an enabler for democracy and social inclusion. Any project coordinated by the Barcelona City Council is justified by referring to its social and economic benefits, very few projects claim to be driven by the desire to reduce CO2 emissions or combat climate change, although this is likely a necessary side effect of many of the efforts.

City of Vienna

The city of Vienna is perhaps not the first to come to mind when it comes to progressive smart city policies, but looks can be deceiving. Vienna is, according to Roland Berger (2017) the smartest city in the world. The city council has endorsed an impressive and comprehensive framework strategy that runs until 2050. Similarly, with the city of Amsterdam, the city of Vienna has its own umbrella organization coordinating all official smart city projects called Smart City Wien. This organization is currently in charge of about 100 projects, ranging in a wide range of areas they have decided to name; education, digital, energy, buildings, health, infrastructure, innovation, mobility, social affairs, urban development, and environment. All categories with their own individually formulated goals and aims. The secret to Vienna´s success is the coherency and comprehensiveness in their strategy; instead of investing and improving one sector more, Vienna is aspiring to improve all sectors a little less (Roland Berger, 2017).

Smart City Wien defines their role as instrumental in translating the larger international and European goals of sustainability into distinct actions for the city, that will assist the city in meeting these goals. The city itself has highlighted a three-folded goal; a future city that will radically protect the resources, without compromising the quality of life and while promoting innovation and a sound economy. The statement also emphasises the importance of planning holistically, or comprehensively.

According to the *Smart City Wien Framework Strategy* (2014), this three-fold goal makes up what they city council of Vienna has chosen to call the “three dimensions of Smart City Wien” (Smart City Wien Framework Strategy, 2014; 28). Under each dimension, the framework strategy has formulated multiple sub-dimensions that are supposed to substantiate or support the objective of the main dimension. Under quality of life, we find social inclusion, healthcare and environment, under resources we find energy, mobility, buildings and infrastructure. Finally, under innovation, we find education, research, technology and economy. Under each dimension, and even sub-dimension, the city council has clear defined goals and aims called objectives. For instance, under resources, the city council has as an objective to reduce the per-capita emission of greenhouse gases by 80% by 2015 (pg. 32). The objective under the innovation dimension is for the capitol to become an innovation leader “due to top-end research, a strong economy and education” (pg. 35). In terms of quality of life, Vienna has the ambitious goal of being the city with the highest quality of life in 2050.

Norwegian cases

The Norwegian government too has committed to promote smart city spatial strategies in order to promote digitalization in society´s best interest. The parliamentary white paper Digital Agenda for Norway (Meld. St. 27 (2015-2016)) illustrates this ambition, and reasons the objectives with various rationales, amongst them the fact that the technological development alters the structure of public service design, coupled with the notion that this technology will help us achieve our national and international climate goals (pg. 13-14), and further emphasises the importance of learning from best practice. The Ministry of Local Government and Modernisation, the ministry that was responsible for the white paper above, issued in 2015 funds for projects pertaining housing, area and transport planning for sustainable and attractive urban development. Smart city technology and digitalization is perceived as central to these grants, and several of the projects that received funding was in fact smart city projects (Meld. St. 27 (2015-2016); 111).

Although many Norwegian towns and cities have proclaimed the smart label, no Norwegian region has come very far compared to its European counterparts when it comes to smart city initiatives. Most smart city strategies remain in planning stages, and it is still very fragmented. There are however some municipality-led initiatives worth mentioning, and this section will present some comparable Norwegian smart city strategies.

It is worth noting the differences in scope, internally and compared to international examples. Whereas many cities tend to be mostly a compilation of projects and initiatives, few cities have devised whole smart city strategies. Projects and initiatives are smaller in grasp, and tend to address singular issues, whereas strategies are more comprehensive and tend to include a multi-dimensional approach.

Bergen

There is no comprehensive smart city strategy in Bergen as of yet. There has however been established a public-private smart city-network, working toward becoming an innovation hub and meeting place for smart city initiatives and projects. The city administration presented a green strategy for how the city is to become fossil free by 2030 (Innovation Norway, 2016). The strategy emphasises the facilitation of innovation and entrepreneurship, for instance:

- Inspired by Helsinki, Bergen wishes to stimulate innovation within municipal services, for example mobility
- Smart Care; municipality-led initiative to modernize the health sector
- Participates in The Norwegian EU Network on Smart Cities and Communities, financed by the Research Council of Norway

(Innovation Norway, 2016; Smartcitybergen, 2017; Municipality of Bergen, n. d.)

Bodø

Bodø has high ambitions for becoming a smart city, and aims for being one out of 100 European cities to obtain the smart city lighthouse status (Bodø Kommune, 2015). The municipality is currently developing a smart city strategy for Bodø, using the newly attributed airport area as a point of departure. Incorporated into this strategy is a commitment to improving the welfare, using technology, as well as introducing new innovative ways of including the public in decision making and participatory exercises concerning the planning process. Several factors contribute to Bodø´s success and advancement in Smart planning, according to themselves; firstly, the opportunity to plan a whole new district from scratch ("Ny by – ny flyplass" plan, Bodø Kommune, 2015). Secondly, the sheer size of the city makes it perfect for testing out new technologies and solutions before rolling out. Thirdly, Bodø has a big university community.

- In cooperation with numerous research organizations and universities, Bodø is a national test-bed for autonomous door-to-door transport solutions.
- Bodø is trying out new methods for participatory governance using digital technology

(Innovation Norway, 2016; Municipality of Bodø, 2015).

Stavanger

Probably the most progressive Norwegian municipality when it comes to smart city initiatives. The municipality ruled in 2016 that they would devise a smart city strategy for Stavanger. Overall, the strategy will aim to improve citizen services, generate innovation and economic growth and greater welfare. The city of Stavanger is part of several innovation clusters and programmes, which exemplifies their commitment to the strategy. Through Stavanger's involvement with these programmes, smart city solutions are tested and experiences shared between involved cities, for later being implemented in other cities. Stavanger has initiated and participated in various activities, such as:

- Participation in Triangulum, a city network programme, which in cooperation with technology innovation clusters use their own cities as test beds for innovative solutions.
- Parts of the city has sensors in waste containers in order to make sanitation services more efficient.
- KMD-project – Cityplanner: Online platform for citizen dialogue concerning urban development plans.
- On-going project seeking to make municipality data available and open to the public.
- Stavanger is a partner in the Nordic Edge Expo.

(Innovation Norway, 2016; Municipality of Stavanger, 2016).

Oslo

Oslo has just recently begun to devise an overall strategy, coordinating its on-going projects under one larger comprehensive strategy. Being the capitol, Oslo has expressed the need to devise a collaborative strategy across sectors and institutions, national and international. The municipality plan from 2015 states as one of its goals that Oslo shall be a pioneer in adapting to and utilising new technologies (Oslo municipality plan, 2015; 19). From before, Oslo is facilitating and monitoring several on-going projects such as zero-emission construction sites and the future built, an innovation hub with the mandate to plan for a smarter future. In addition, Oslo has initiated;

- An app for citizens to report about faulty infrastructure, such as street light and pavement repairs.
- Parking sensors
- Climate dashboard, which compiles all data collected from sensors and presents this online.
- Driver-less cars

(Innovation Norway, 2016; Municipality of Oslo, 2017).

How smart city strategies perform with respect to its promises and sustainability

Translating universal and global challenges and goals of sustainable development into concrete actions and projects is not an easy task. What does the sustainable smart city look like? What does the smart city with respect to each dimension of sustainability look like? What follows is a run-down of the motivational nature, with respect to each sustainability dimension, behind the observations of empirical data on smart city strategies made above.

Amsterdam, Copenhagen, Barcelona and Vienna are all examples of existing cities who has composed comprehensive strategies with clear-cut objectives in order to canalize and coordinate the multitude of smart city projects taking place, which is considered detrimental in achieving its goals of becoming smarter cities. This expresses a political will and ambition to steer the smart city technology development through either top-down or bottom-up, government-led, or at least coordinated, initiatives (Estevez et al., 2016). In addition to creating platforms for smart city experimentation and communication, the various administrations facilitate innovation through hubs and networks, yielding public-private partnerships as results. Among the success criteria displayed in Amsterdam, Copenhagen, Barcelona and Vienna, is having all-encompassing and comprehensive end-to-end strategy and public-private partnerships (Deloitte, 2015). Empowering citizens and integrating feedback into the decision-making process, and a supportive regulatory and judicial

framework that enables and encourages innovation are other observable facets (Rodger Lea, 2017; Deloitte, 2015; Roland Berger, 2017).

Any city or municipality can become smart tomorrow; the technology is readily available, and perpetually evolving (Personal interview, Cisco, 12.10.2017, Lysaker). Taking advantage of the technology is a matter of political will and budget. The urban challenges to which to apply the technological solutions reflects yet another stratum of aspirations and interest. The political will for investing in smart city technology in Norway is arguably present; the governments continuous referral to technology and digitalization as an enabler of sustainability in its parliamentary white papers and principle guidelines for planning (Regjeringen.no, 2017), proves this. As does the empirical cases above.

On accord with international conventions and expectations, the environment is a common justification for initiating smart city strategies and projects. According to Estevez et al. (2016) 21% of all reviewed smart cities focus on smart environment; basically technology-enabled solutions for reducing pollution. Another 9% focus explicitly on mobility solutions with similar objectives. This is observable in the empirical data in this thesis too; Bergen wishes to integrate smart city technology into its green strategy, Oslo is experimenting with zero-emission construction sites and electrical buses (Oslo Kommune, 2017), and Stavanger lists the reduction of CO2 emissions as a central goal for its smart city strategy (Veikart for Smartbyen Stavanger, 2016). Extensive monitoring with physically dispersed ICT devises improves resource management, whilst being more cost efficient, as exemplified by the waste bin sensors in Stavanger. Two centrally defined sectors of smart cities include smart transportation and smart buildings (EU, 2014; Innovation Norway, 2016); both seeking to cut emissions through optimizing energy use and/or switching to renewables. Amsterdam´s *Zero Emission City Logistics* project is currently being implemented, seeking to replace all freight and service logistic transportation with electrical vehicles (City of Amsterdam, 2017). Bodø is experimenting with something similar, as it has become the national test-bed for autonomous door-to-door transport solutions (Innovation Norway, 2016). *GridFriends* is another example from Amsterdam currently being implemented, creating a local energy grid distributing renewable energy as needed between houses within a vicinity (City of Amsterdam, 2017). Oslo is retrofitting buildings into “circle-based waste management and green energy systems”

(Oslo Kommune, 2017). Needless to say, there is an abundance of hard infrastructure (Angelidou, 2014) projects, nationally and internationally, seeking to reduce emission and develop green or circle-based energy using smart city technology. The environmental dimension seems to be proportionately represented in both strategies and outcomes.

The global market size of digital and smart city solutions is estimated to grow exponentially (Roland Berger, 2017; Deloitte, 2017; Saunders & Baeck, 2015). That governments and municipalities invest and promote such seemingly prosperous innovation is somewhat self-explanatory. Smart economy comprises 19% of initiatives, and another 9% focus on smart people; technology-enabled jobs (Estevez et al., 2016). Innovation Norway (2016) supports this perception, and continues the argument with the "realization of smart solutions in urban and societal development can assist in reaching more of UN sustainability goals" (pg. 2), one of which being economic and financial stability. Both Innovation Norway (2016) and the Norwegian government, via its parliamentary white papers emphasise the economic stress and decline of the oil industry, which the Norwegian economy is founded upon. In light of this industrial decline, finding new sectors of investments for economic prosperity and growth is essential for a sustainable economy. There are several government-led public-private, Norwegian and international, examples of projects and programmes aiming to generate innovation, experimentation and sharing knowledge in the field, from Bergen´s aspirations for stimulating innovation, to Stavanger´s participation in the Triangulum innovation clusters and hubs. In addition, smart technology and digitalization has the potential of releasing unrealised service design innovation between public administration and citizens, which can cut the cost of management and government expenditures, as is the estimated case with Copenhagen (Copenhagen Connecting, 2013). The economic dimension too seems to be proportionately represented in both strategy and outcome.

Which takes us to the third and last dimension of sustainability; interestingly, 25% of the cities reviewed by Estevez et al. (2016) (none of which were Norwegian cities) had smart living (incorporates technology designated for health sector) as their main focus, and in terms of rhetoric, this holds true in some Norwegian cases as well. Stavanger and Oslo both places its citizens at its core with visions about citizen involvement, citizen needs and quality of life (Municipality of Oslo, 2017; Municipality of Stavanger, 2016). Bodø and Bergen both seem

hesitant to make any social claims at all in visions and goals with smart city technology (Municipality of Bodø, *Smart Bodø* (PDF), n. d.; Municipality of Bergen, 2017). With respect to social sustainability, their smart city strategies are modest, and its results not really quantifiable. Are we to believe its advocates, smart city technology makes for a great possibility of reversing the unfortunate trend of underappreciating the social dimension in spatial planning (Demspey, 2009; Hofstad & Bergsli, 2017), as it redefines what spatial planning and decision making can be, and ultimately the role of the city and it´s administration (Roland Berger, 2017). Still, Norwegian smart city approaches are predominantly experimenting with relatively simple solutions concerning resource management, such as parking sensors and waste bin monitoring. Undoubtedly useful tools, but not responding to some of the fundamental social issues and human concerns of urban life (Hollands, 2008; Estevez et al., 2016), and certainly not employing smart city technology to its full potential and promise.

In the forefront of the social smart city dimension, depicting its capacity and potential for change, is Barcelona. As seen above, Barcelona´s strategy is overwhelmingly justified by its expected social, and to some extent socio-economic, merits. Most projects, within any of its three axes, seek to organizationally empower and include its urban citizens. *Decidim Barcelona* is an online, collaborative platform for the public administration and citizens of Barcelona. It allows citizens to suggest plans, complaint and see the progress of each plan; it devises a heuristic process between the governance body and its citizens. Another, relatively simple Barcelona initiative, materializing the social dimension of smart city technology, is its devising of an online map showing all registered vacant and lots and rentals "as part of its drive to improve the supply of affordable housing" (Tieman, Barcelona: smart city revolution in progress, *Financial Times,* 2017). This exemplifies a spatial planning initiative adequately applying digitalization and smart city technology to a pressing social urban problem; a smart city initiative with social means and social ends.

What is evident also, looking at current smart city initiatives and projects in Norway specifically, is that they are highly fragmented. They are also somewhat arbitrary, and "assembled piecemeal, integrated awkwardly into existing configuration of urban governance and built environment" (Shelton et al, 2014; 15). There is little to no strategic coordinative or

restructuring efforts in place, and if there is, it is still being developed and yet to be implemented, Stavanger being the most likely exception. With respect to smart city strategies, there is little observable evidence to support "coherence by ensuring that sectors, functions and interests in an area are seen in an overall context through coordination and collaboration" (Planning and Building Act of 2008, Regjeringen, 2017). An essential and instrumental dimension of smart cities, is its potential for creating a common platform or data pool, otherwise smart city projects will continue to reinforce the silos in which municipalities and governments operate today (Tieman, Barcelona: smart city revolution in progress, *Financial Times*, 2017); none of which is visible in the Norwegian smart city scape. Although projects and initiatives touch on a variety of topics and issues, there is still little to be said about the impact of Norwegian smart cities, and little to be said about its potential for being scaled up or rolled out (Winden, 2016). As a democratic tool, which by a stretch can be translated to social justice tool, smart city technology offers enormous potential when it comes to revolutionizing how administrations and municipalities engage with and empower its citizens; where public administration historically has been a one-way communication, digital technology makes a dialogue possible (Saunders & Baeck, 2015). Stavanger and Bodø seems to be the only cities experimenting with anything resembling this, albeit they have not come very far.

As many smart city pilot projects have failed to deliver on their preliminary promises (Hollands, 2008; Saunders & Baeck, 2015), and been dismantled after its short-lived trial period (Winden, 2016), it becomes quite evident that being pre-emptive and knowledgeable about how to spend public money is a moral obligation for spatial planners. In Norway, it is also a regulated obligation, as being cautionary is a regulatory principle, and the Planning and Building Act of 2008 states that plans shall promote coherence and cohesiveness, and shall not be more exhaustive than necessary (Regjeringen, 2017). This translates to not being wasteful with public funds. As smart city investment and funding, as of yet, is the biggest obstacle and little to no returns in any societal sector or sustainability dimension, one can question the legitimacy of this engagement, especially considering this in turn has, in some cases, negatively affected precisely social conditions (Saunders & Baeck, 2015; Angelidou, 2015; Kendra Smith, 2017; Estevez et al., 2016). "Smart city strategies provide a unique opportunity to reconsidering what exactly the city should offer in terms of services" (Roland

Berger, 2017; 12). In order to do so, like any service supplier, policy makers and city administrations need to comprehensively understand the present need of their citizens, how to meet them and how to implement without compromising other social conditions of urban life. Without this knowledge and understanding, smart city technology may inversely reinforce "institutional privileges and protections as well as exclusionary practices" as "smart cities will not be utopian societies that, by the sheer presence of technology, make everything better" (Kendra Smith, *Scientific American,* 2017*).* In essence, this means, if applied incorrectly or, even insufficiently, smart city strategies may end up doing the opposite of what it has the potential to do with respect to its social promises. By investing in social inclusion and citizen empowerment, local needs and intelligence is harnessed, which in turn has a better chance of yielding a more sustainable and adequate solution. In literature and policy, smart city technology is claimed to hold the capacity to mediate such problems by way of using the technology for citizen empowerment and public participation – social elements also ensured in Norwegian law.

In literature, social sustainability is evenly emphasised as an integral tenet of sustainability, alongside economic and environmental (UN, 1987, 2017). Opposite to economic and environmental however, social sustainability is more elusive, qualitative and soft (Angelidou, 2014). Evidence of any successfully implemented or instigated municipal-led smart city strategy with clear social sustainability objectives is hard to find in the Norwegian context. If spatial planners and city authorities chooses to pursue a smart city strategy (Albino et al., 2016), it effectively needs to find a way to address all urban challenges that spatial planning would otherwise have to address in order to claim the smart city title (Hollands, 2008; Batty et al, 2012), as the sustainability discourse is not divisible; sustainability is by definition environmental, economic and social (UN, 2017; Regjeringen, 2017); claiming this title is currently unfit. The same interdependence is transferred by Batty et al. (2012) into smart city context; "cities that are smart only with respect to their economy are not smart at all if they disregard the social conditions of their citizenry" (pg. 486). Despite good intentions, there can be revealed a deficiency in Norwegian cities´ operationalization of smart city technology to address social sustainability; i.e. the emperor's new smart city technology.

Synthesis

In smart city strategies, an innovation in technology and a political mobilization in the way we rationalize sustainable development, has coincided and converged. These two momentous societal transformations have both in equal rights had incredible influence on how we live our lives and lead our communities, and will continue to do so in the future. In this section, I will summarize the evolution of these two individual discourses and investigate their point of intersection or tangency.

Technology has historically had the capacity to revolutionize society in profound ways. Despite smart city technology being relatively new, its prominence is probably not by chance. Modernization is a multi-facetted phenomenon, and although it is sometimes used to describe progress and civilization in its own right, the concept is loaded with attributes often applied to and materialized in other sectoral advancements of society; “industrialization, economic growth, rationalization, structural differentiation, political development, social mobilization” (Tipps, 1973; 202) and so forth. Subsumed under the western experience of modernization is an understanding of progress or, much like the biological analogy which it is born out of, maturity into more supreme organisms with the above-mentioned advancements as vessels. The advancement of technology specifically, has been highlighted by some as especially detrimental to development and progress (Ellul, 1964; Mumford, 1934; Marvin et a., 2016). Ellul (via Lynne & Robey, 1988) and Mumford (1934) further poses that technology does not only generate progress, it also influences and colours progress in preferential ways for said technology, as technology “carry in themselves seeds of new applications” (Lynne & Robey, 1988; 592). This self-sustaining technological development makes for a dialectical relationship with society, as society has a tendency to subconsciously subsume itself to technology´s influence on cultural and moral values (Geels, 2004), as well as accepting its self-sustaining nature (Lynne & Robey, 1988; Mumford, 1934).

Technology, and supporting infrastructure, oscillates and takes on different forms as technological advancements takes place. Perez´ (2009) techno-economic paradigms and

business cycles applies this logic into the framework of innovation and economy. Every now and then, technological innovations emerge, with the ability to completely overturn the current paradigmatic techno-economic system, and totally replace its infrastructure or leave it obsolete. Just as how Ellul (via Lynne & Robey, 1988) and Mumford (1934) described technologies´ influential and self-sustaining power, Perez´ (2009) claims these new technological innovations generate whole new "system of systems" (pg. 189) which has the "capacity to transform profoundly the rest of the economy (and eventually society)" (pg. 189) so substantially that they become new economic growth engines. As these technological advancements take place, they permeate our habits and perspective in a subconscious manner, "as these technologies are not only neutral instruments, but also shape our perceptions, behavioural patterns and activities" (Geels, 2004; 903). Thus, in being an attribute of modernization, technology is in itself a self-sustaining driver of change, and its seductive nature of progress persistently infiltrates societal norms and values in a dialectical manner.

According to Perez (2009), the current techno-economic paradigm was instigated with the invention of the microprocessor in Santa Barbara in the 1970s; essentially what makes any digitalization or smart city technology possible. Overturning the age of oil (Perez, 2009), this innovation has spurred a series of techno-economic systems replacing the infrastructure supporting the oil industry, and greatly altering not only economic markets and political ambition, but stimulating regulative, normative and cultural innovation (Heiskala via Pol & Ville, 2009) in its wake. Inhabiting the inherent seductive capacity for modernization and progress, this new technological innovation has generated whole new industries and societal reformations; smart city technology being one of the latest.

The smart city technology industry that was born out of the age of information and communication (Perez, 2009) following the invention of the microprocessor, is estimated to be worth somewhere between US$ 400 billion and US$ 1,5 trillion by 2020 (Deloitte, 2015; Roland Berger, 2017). Needless to say, this is expected to grow exponentially in worth and become an enormously profitable market, and countries such as Norway, traditionally heavily reliant on industry pertaining to previous techno-economic paradigms (Perez, 2009; Innovation Norway, 2016) is wise to restructure its economy and invest in in this new sector.

For city leaders and municipalities, not necessarily seeking financial profit, “the question isn´t to embark on a digital transformation, but how” (Digital cities: building the new public infrastructure, Cisco, 2017; 3). The technology made available has the capacity to significantly reduce governmental expenditures (Connecting Copenhagen, 2016), as well as it is comprised of innovative solutions for public administrations to optimize their resource management and enhance public participation (Saunders & Baeck, 2015; Estevez, et al., 2016).

Despite its elusive definition and wide-ranging set of practices, smart city technology as a tool, and its surrounding system of systems, is said to hold big promises for the future, and its advocates argue that smart city technology, through proper spatial and structural implementation and operationalization, will adequately address and mediate the global and urban challenges of the future, such as climate change, urbanization, financial, political and social instability (Our Common Future, 1987; Habitat III, 2016; EU, 2014; Shelton, Zook & Wiig, 2014, Innovation Norway, 2016; Boorsma, 2017; Haarstad, 2016).

Parallel to this trajectory, albeit having started somewhat earlier, the emergence and absorption of sustainable development into political mobilization and social organization took place. The introduction of sustainable development into public discourse can largely be credited to the conceptualization of the issue in Our Common Future (1987), and the subsequent regimentation in the UN through the Rio Convention in 1992 and their formulation of 17 sustainability goals (UN, 2030 Agenda, 2015). As defined in Our Common Future (1987), sustainable development is development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (pg. 16). Although touching on a variety of topics, and ranging in scope, the discourse can be summarized in three dimensions; environmental, economic and social.

The UN devised Habitat III (2016) further contextualises and couples the sustainable development discourse into the urban sphere, which will according to predictions, undergo “one of the twenty-first century´s most transformative trends” (Habitat III, 2016; 3) as the urban population of the world is expected to nearly double within the next decades. This will cause enormous stress on cities capacity in terms of “energy, transportation, water, building and public spaces”, and its capacity to “generate economic prosperity and social wellbeing”

(EU, 2014; 9). This institutionalization and contextualization of sustainable development has led to increased focus on city organization and how we manage our geographical commons.

Exemplified by various instruments, the Norwegian judicial system proves the relevance and impact of the discourse. By swiftly incorporating sustainable principles into its constitution, Norwegian legislation has demonstrated its commitment to institutionalize the discourse. One of the most dominant example of Norway´s institutionalization of sustainable development, is the Planning and Building act of 2008. This act specifies its purpose to "promote sustainable development in the best interest of individuals, society and future generations" (Regjeringen, 2008). The act poses a series of requirements for all spatial or land-use planning activity, amongst them that coherence and coordination, contribution to the implementation of international conventions and treaties, as well as posing a requirement that planning shall promote coherence and not be more exhaustive than necessary (Planning and Building Act of 2008, 3-1, Regjeringen, 2008). Norwegian law, thus, draw direct connections to UN´s 17 sustainability principles, and compels planning agencies to adhere to its principles.

Built environment and spatial planning has become recognized as incremental to sustainable development, and thus instrumental in addressing its corresponding issues. Considering this, in addition to integrating sustainable development into its Constitution, the government has continuously issued a series of parliamentary white papers and guidelines documents legally binding municipal and city spatial planning authorities to sustainable practice in order to pursue national and international goals. Statlige Planretningslinjer for Samordnet bolig-, areal- og transportplanlegging (2017) is a legally binding document produced to ensure effective and coordinated spatial planning with sustainable principles. The 2015 issued National Expectations Regarding Regional and Municipal Planning (Translation from: Nasjonale forventninger til regional og kommunal planlegging) is another official document imposing governmental principles upon municipal spatial planning. Both these documents exclaim the urgency to reduce carbon-emissions, to improve health and well-being, as well as economic stability and encourage innovation with spatial planning as a tool.

The practice of spatial planning can be understood as an operational mechanism to geographically express economic, ecological and social policies and values (spatial planning,

Wikipedia). Thus, any policy that interferes or somehow manipulates spatial arrangements or behaviour, will necessarily be subjugated to spatial planning practice and its judicial framework. Spatial planners are thus required to crystallize and translate political and normative ideas into built environment by giving these an adequate and relational expression and physical form. The utilisation of smart city technology in spatial planning is perceived as an ideological and strategic direction to address and activate sustainable development efforts (Albino, Berardi & Dangelico, 2015; Boorsma, 2017; Innovation Norway, 2016; Estevez et al., 2016), which again is rooted in age-old trajectories elevating technology´s instrumental and incremental significance for modernization and progress (Marvin et al., 2016).

Being a regulated requirement, Norwegian plans with a spatial dimension or relevance for land use activity, are required to produce sustainable built environment and justify its outcomes in terms of all dimensions of sustainability; environmental, economic and social (Regjeringen, 2017). The integration of smart city technology and digitalization as a spatial planning tool to help mediate the issue of sustainable development is also an expressed political ambition (Digital Agenda for Norway, 2016; Regjeringen, 2017). This ambition is transferred and adopted by individual cities and regions, as exemplified by the Stavanger Smart City programme (Municipality of Stavanger, 2016). So, by analysing the current outcomes of smart city initiatives being played out in Norway, one can examine how values of environmental, economic and social sustainability are operationalized after being processed through the smart city technology churn.

Using Stavanger as an example, the following diagram illustrates the sequence of events institutionalizing sustainable development as normative values for spatial planning, and the operationalization of these using smart city technology.

Year	1987	1992	1988-2017	2015-2017	2015	2016
Level	International	National	National	National	Regional	Local
Strategic Sector	Political	Political	Political/Spatial	Spatial	Spatial	Spatial
Document	Our Common Future (1987)	Norwegian Constitution Act 112	Numerous Parliamentary White Papers	Statlige Planretningslinjer for Samordnet bolig-, areal- og transportplanlegging (2017), National Expectations Regarding Regional and Municipal Planning (2015)	The Municipal Plan for the Stavanger Region (2015)	Stavanger Smart City – roadmap and projects (2016)
Explanation	Sustainable development enters the public and political discourse. Its introduction can largely be credited the UN report Our Common Future (1987)	Norwegian legislation incorporates sustainability aspects into its constitution.	Multiple official white papers discuss Norway's commitment to sustainability, and its importance in spatial planning.	Official documents expressing expectations and principles for spatial planning emphasises sustainable practices in municipal spatial planning.	The fundament for the municipal plan for Stavanger is based upon sustainability principles, and makes direct reference to the three dimensions of sustainability; ecological, economic and social.	Justifies the utilisation of smart city technology with its capacity to mediate sustainability challenges.

Although the three dimensions of sustainability are institutionalized into the regulatory framework for Norwegian spatial planning and strategies and present in smart city strategies internationally, examining the empirical data on smart city strategies and outcomes in Norway to this day shows the results are not satisfactorily balanced. In accordance with retrospective observations done by Dempsey (2009) and Hofstad & Bergsli (2017) about social sustainability´s reduced attention in spatial planning, this tendency seems to hold true looking at smart city strategies and practice in Norway today as well. The operationalization of

sustainable development by way of smart city technology in spatial planning seems to have produced less social plans and results, than it has produced its counterparts environmental and economic, despite quality of life and citizen involvement often placed in the centre of vision statements (Municipality of Oslo, 2017; Municipality of Stavanger, 2016).

This has several implications as it may question the relevance of smart city technology in Norwegian socially sustainable spatial planning. This may suggest that Norwegian spatial planners and politicians do not sufficiently understand this technology, its consequences and heritage or that they are too invested in their own efforts that they fail to see other cities´ successes, and thus investing and incorporating smart city technology might be too early or redundant ("too exhaustive", Planning and Building Act of 2008). It might also prove that governments and municipalities have bought into a marketing scheme which does not deliver its promised outcomes (Wiig, 2015). It might propose a "cultural lag" (Foley, 1964), as smart city technological innovation in the spatial functional and physical organizational stages has either failed to sufficiently influence our normative values to the degree of us appropriately comprehending its potential and consequences, or reversely, that we have been overtaken by technology and not fittingly resisting, or at the very least be aware of, its modifying and internalizing capacity of our normative and cultural values (Lynne & Robey, 1988; Mumford, 1963). This may further suggest that the techno-economic paradigm (Perez, 2009) stimulated by smart city technology, and the consequent socio-technical system (Geels, 2004), has been made prime and susceptible for generating support for this technology beyond our control and comprehension.

IV. Smart, social and sustainable?

Discussion

Exploring the main research question of this thesis involved operationalizing multiple sub-research questions all intended to shed some light on elements explaining parts of the main research question. The major findings from exploring each sub-question creates the fundament to which to base the discussion and plausible conclusion of main research question on. In studying empirical data on social goals of Norwegian smart city strategies, this research found that there is little evidence to support the notion that Norwegian spatial planners are actively addressing social sustainability as a stand-alone sustainability dimension; cities´ engagements are often fragmented and non-coherent. Some of the cities studied, however, displayed both vision statements and on-going projects to support social sustainability, but these were outnumbered by simpler projects pertaining more environmental and economic motivation. Internationally, social sustainability is a more often occurring motivation for devising smart city technology. Barcelona, specifically, exemplifies a city justifying smart city strategies solely with its capacity to mediate social sustainability. Literature and promotional material proved that the actual technology and potential applications of smart city technology is multi-facetted; consisting of certain sets of technological devices, collaborative constellations and public participation. Its application holds high promises for a more sustainable management of social and urban resources, be it environmental, economic or social. By many institutions and advocates, utilizing the technology is considered instrumental in practicing sustainably in the future. Its appeal to Norwegian spatial planners and city administrations can largely be justified by this notion, as sustainable development has become an established and regulated normative value for Norwegian land-use management. As a political ambition, sustainability, in all its dimensions, has been actively institutionalized into Norwegian spatial planning practice. The very last sub-question seeks to illuminate seductive visions about technology´s instrumental purpose in progress and modernization, and places smart city technology into a larger historical context, with its own discourses and trajectories.

In response to the main research question, whether the development of Norwegian smart cities is a means for social sustainability or an expression of a techno-economic race, my

findings would lead me to argue that even though I find it hard to prove or claim that Norwegian smart cities are cynically enrolled in a techno-economic race, I find it even harder to prove they are actively utilizing smart city technology toward social sustainability. Within the framework of this thesis, the logical polarity would suggest Norwegian smart city strategies have been appropriated to, or by, a techno-economic race with smart city technology as a vessel, rather than this technology being consciously used as means for social sustainability.

Naturally, I would ask if Norwegian smart city strategies are not actively utilising smart city technology for social sustainability, why are they? There has been identified numerous mechanisms in this thesis that substantiates the fact that smart city strategies behave more as subjects in a techno-economic race than as means for social sustainability. It is integral to comprehend and being able to identify these mechanisms to be able to successfully exploit the benefits of smart city technology, and appropriate these successfully as a technological tool and as spatial strategies. Very telling is the lack of social objectives as proven by reviewing the empirical data on Norwegian examples, which is unfortunate considering the discussed potential this technology supposedly poses to reverse the historical trend of neglecting social sustainability in spatial strategies. This has several implications, for instance that Norwegian advocates of this technology do not sufficiently understand the capacities of smart city technology with respect to social sustainability. This may further suggest that Norwegian cities utilising smart city technology are too short sighted to learn and re-appropriate successful practices from internationally renowned smart city strategies. It also points to the fact that Norwegian spatial planners fail to recognize smart city strategies for what they are; spatial strategies, which will be subject to Norwegian regulation. Another vital mechanism that has been identified as possible hindrance, is the duality of smart city technology itself – as it represents and promotes itself as an instrumental tool in addressing sustainable development available to spatial planners, whilst also representing a gigantic market opportunity for private companies supplying the technology. Through the lenses of the theoretical chapter in this thesis, this duality can be traced further back in history to an inherent vision in technology as a driver for progress and modernization. Reapplying this to current usage of smart city, suggests that the employment of smart city technology is as double-natured; by its promise of modernity as a technology, as it is for its promises for sustainability.

I believe this duality represents the most interesting discussion in seeking to shed some light on why smart city strategies and technology behave more as expressions of a techno-economic race, than as means for social sustainability, as it may provide some insight into the nature of smart city technology and its surrounding infrastructure and give further implications for its appropriate area of application and use.

The discussion about the duality of smart city technology, as a tool for spatial planning and as a market opportunity for private companies, is well documented, but perhaps not equally formulated. The smart city technology market is expected to become a massive industry, and large international companies are already heavily invested, by producing technological solutions and software for city administrations and land-use management. The market is expected to be worth somewhere between US$ 400 billion and 1,5$ trillion by 2020, and according to promotional material, “the question isn´t to embark on a digital transformation, but how” (Cisco, 2017; 3). Big international companies such as IBM and Cisco have become obligatory passage points for cities wishing to utilize this novel technology. A factor that certainly does not alleviate the presence of this duality is the centrality of public-private collaborations in smart city strategies. Although perceived by some as an integral quality of a successful smart city, others condemn it; Barcelona, for instance, insists to be in control of its public infrastructure, modern or traditional. In many cases however, private companies have been given access to public digital, or modern, infrastructure as a way of overcoming the high costs of getting involved; funding being the biggest obstacle for smart city strategies. Looking at the Norwegian examples one can easily recognize these collaborations, as most cities are either a part of or are themselves instigators of various hubs and clusters comprised of public and private actors.

As identified by Angelidou (2015) in chapter three, smart city technology has been driven by two forces; a technology-push and a demand-pull. Whereas one implies technology comes before needs, the other suggests societal needs define what technology enters the market. Out of the two, it has been identified that technology-push has been the prevailing force, which has had crucial consequences for social environments, as generic technology is implemented to solve local and highly complex problems. The prevalent technology-push of smart city solutions into our spatial strategies and built environment is due to the fact that

“new solution/products is ushered into the market as a result of quickly advancing science and technology” (pg. 99). As discussed in the previous chapter, the current use of smart city technology in Norway is more reminiscent of earlier generations of smart cities, wherein private companies and technological innovations to some extent define strategies and agenda, as Norwegian city administrations are rather indiscriminatingly applying available technology, rather than identifying goals, clear objectives or cohesive strategies for addressing holistic issues. Just by acknowledging that the current application of smart city technology in Norway is primarily characterized by solving hard infrastructural problems with technological solutions already present in the market, rather than problems being defined for the purpose of finding technological solutions supports Norwegian smart city strategies as being more a market arena susceptible to a technology push. A side from its promoted and prospected benefits, smart city technology is also given other more elusive qualities, such as Norwegian parliamentary white papers claiming integrating such technologies is important for a city´s attractiveness in the future, and too that the “smart city model is a tool for city modernization” (Estevez et al., 2016; 38). The production of technological solutions, as being done by private international companies, is naturally based upon achieving the outcomes that yields the highest financial margins, but the production of seductive ideas concerning technology´s centrality in a city´s attractiveness and modernity stems from somewhere more instinctively.

The dominance of smart city technology in the market today is due to its pertinence to the current techno-economic system and paradigm. As discussed in the theoretical chapter of this thesis, the current techno-economic paradigm is said to have started with the microprocessor in the 1970s. This invention has completely infiltrated and restructured societal infrastructures far beyond just the economic sector, to the extent of having become the new economic growth engine. Smart city technology is a recent application of the microprocessor, a seed for a new application has grown into a full-blown industry, so it can be said to have been born into a techno-economic infrastructure supporting its existence. This is a huge advantage for smart city technology, as these infrastructures “institutionalize and perpetuate the technologies they were originally created to support” (Lynne & Robey, 1988; 592), but it can pose a danger of containment and control when taking into account the commanding and closed-nature of technology. Being characterized as a paradigm connotes certain attributes too, most importantly it gives it qualities which for extended periods of time goes

unquestioned, and becomes common sense, such as for instance smart city technology´s importance for a city´s attractiveness and modernity.

Discussed in depth in the theoretical chapter of this thesis, the vision of technology as integral and instrumental to modernization goes back to old perceptions of developmentalism and progress. Much like biological maturity, modernization is a goal western societies strive for, and certain sectoral advancements are characterized incremental for modernization; amongst these are technology, rationalization, political development and social mobilization. The attractiveness discussed in Norwegian parliamentary white papers is thus given a theoretical and conceptual background. But as stated above, technology as a sectoral advancement is not alone in being defined integral to modernization. Sustainable development has risen to become one of our times´ most dominant political mobilizations and social organizational developments, and is perceived, in some respect, as important to modernization and progress as technology. The duality presented earlier in this section is a reproduction of a much deeper tension, as smart city technology not only represents a two-faced nature between market opportunity for private companies and a tool for achieving common good for spatial planners – it also represents a duality on a more normative level, between perceptions of modernity by way of technology and by way of political mobilization and social organization.

Going back to the capacities of smart city technology and sustainability, there exists a distinction in literature and practice between the various sustainability dimensions that might need clarification for the sake of this discussion. As identified in chapter three, there is a dichotomy in spatial strategies consisting of hard and soft infrastructure; both inhabiting its own set of qualities and attributes. Most notably, is probably the tangibility of hard versus soft. Whereas hard infrastructure for the most part refers to physical stuff like energy grids, technology, transportation, buildings and so forth, soft infrastructure refers to social justice, social capital and issues more closely related to social sustainability. Smart city technology, according to this distinction being a hard application, may in fact not be entirely suitable for addressing social sustainability, as they belong to two different qualitative dimensions. Thus, in addressing issues pertaining the soft dimension using hard applications, results might be deemed to fail from the start. To some extent, this notion further problematizes the trajectory of technology´s instrumental role in modernization and progress, as it suggests that

technology and social sustainability, perceived as hard and soft, exists as two different qualities in society, questioning the impact of applying one to address the other. Yet, it is important to remember the interdependence and rank of one of the other, as technology does not exist outside of human culture and social organisation (Mumford, 1934).

This distinction has been identified in the world of innovation as well, under the two umbrella concepts techno-economic innovation and social innovation. The same characteristics from the above-mentioned distinction between hard and soft infrastructure is inherited in these two umbrella concepts, but rather than providing still-framed descriptions of them, the distinction in innovation seeks to explain interaction, dynamism and process. Whereas techno-economic innovation refers to producing economic surplus with technology, social innovation refers to more normative, regulatory and cultural progress. i.e. hard and soft. This also relates to Angelidou (2014) sectoral based strategic usage of smart city technology from chapter three. More importantly, however, it gives a temporal quality and dimension to two paralleling or interdependent trajectories; hard and soft; techno-economic and social.

These comparative lines across conceptual strata reveal a multi-level, multi-dimensional tension and possible misconception between two historical trajectories. Smart city technology, being an inherently hard infrastructural component perpetuated and sustained by infrastructure of the current techno-economic paradigm, with its seductiveness and attractiveness rooted in an age-old vision of technology´s instrumental value for modernization and progress, exists parallel to, or within, a rather soft trajectory of political mobilization and social organization. The two conceptual trajectories are interdependent, and interact and pose limitations to each other, but on a more institutional and normative level than what is suggested in smart city promotional material and strategy; this is to say, in order for hard applications to be consciously used for soft applications, the appropriate point of tangency in the normative dimension must be addressed, rather than in the physical dimension where smart city technology exists as a materialized extension and expression of the techno-economic trajectory. Cultural lag, as a theory by Foley (1964) problematizes the exchange in which techno-economic trajectory innovations are introduced in material life, causing ripple effects into the normative stages of soft applications.

Being one of our times greatest political mobilization and social organisational developments, sustainable development is an inherently anthropocentric perspective of development; the "satisfaction of human needs and aspirations" (Our Common Future, pt. 42) is the central objective. In being a social goal more so than techno-economic, it is reasonable to suggest sustainable development is a goal pertaining the soft trajectory.

This illustrates precisely the limitation to sustainability identified by Our Common Future (1987). Technology (and its infrastructure) and social organisation compose the biggest limitations to sustainable development. In uncritically or indiscriminately applying smart city technology without critically examining the social apparatus paralleling or encompassing it, one is activating one of these deeply-rooted trajectories without appropriating the other. It so happens that the activated trajectory in Norway today, is the techno-economic hard infrastructural trajectory containing smart city technology, and thus, in not appropriating the social organisation, sustainability suffers, especially prominent in the social dimension, as again, these represents two different qualities in material life; hard and soft; techno-economic and social. One could also make the case, in relation to Angelidou´s (2015) push-pull observations, that in order for the application of smart city technology to be successful, one needs to critically examine its relationship and role within the social trajectory supposedly organizing it. In being a commanding and closed-system, the prevalent techno-economic paradigm encompassing smart city technology is perhaps not adequately armed, or disarmed, to address sustainability by itself. In this regard, smart city technology´s failure to appropriately address social sustainability in Norwegian spatial strategy, is not due to a technological shortcoming, but rather our social organization of it, as it only exists in human culture and social organization, and not the other way around.

So how will planners know "whether the physical environment scheme he is proposing facilitates or impedes the achievement of stated values" (Foley, 1964; 22-23)? In thinking a tool with the qualities and inherent biases of one sectoral and historical trajectory, smart city technology as part of the current techno-economic paradigm, can be operationalized to meet challenges and goals pertaining other trajectories (sustainable development as political and social mobilization) without adequate appropriation and re-organization, sustainability will suffer; as has been the case with social sustainability for a long time; remember Dempsey

(2009) and Hofstad & Bergsli´s (2017) observations. Smart city technology is the latest fad in a series of highly transformative technologies in a stream of technologies promoting progress and modernization. Our acceptance of it has become second nature and common sense, yet as has been stated before, these are not neutral instruments. Not because the technology itself is biased, but because the infrastructure of the trajectory supporting it is, and by advancing it in a multi-trajectory, multi-qualitative physical environment, its scheme will impede values pertaining other trajectories; do not bring a sword to a gun fight.

In light of this discussion, it becomes clear that smart city technology, as a stand-alone technology, might not be sufficient to comprehensively address social sustainability, and it further substantiates why social and human concerns are "indispensable" (Angelidou, 2014; 55) in the smart city discourse and literature; the techno-economic trajectory alone is not sufficient, but by arming it with the infrastructural support of its social organization, a fuller sustainable development might be attainable. In the words of Our Common Future (1987), technology and social organisation limits, or as a logical polarity, facilitates sustainable development; in all of its dimensions. As identified by Cohen (2015), there seems to be a fundamental shift as to how we perceive and strategize our smart cities. This suggests that some cities utilising smart city technology has realized the inherent tension and implications of its application, as it insinuates its strategies are proportionally weighing the two trajectories into their utilization of smart city technology. It further suggests that these cities have gone as far as to comprehend smart city technology´s, and its parent techno-economic paradigm, innate qualities and its parallel or subordinate nature to social organisation and human culture, by manipulating its application in a normative level, i.e. how should this technology be used, not where can we apply it. This is promising stuff, but none of its character is observable in the empirical data from Norway as of yet.

Until Norwegian cities consciously internalize and redefine what smart means instead of out-sourcing this definition to the market, they will be caught in a sprint favouring technology's reckless application and techno-economic race, rather than comprehensively engage in addressing sustainability in all of its dimensions using smart city technology. Until the desire to use this technology consciously for what it's worth as a tool for social sustainability outweighs the desire to implement it for its attractiveness, Norwegian cities will remain

stagnant in the status quo. By simply buying into discourses pertaining technological products and solutions delivered by international companies, the dissonance between pursuing goals pertaining the soft trajectory using hard trajectory instruments is widened, and the prophecy of technology´s self-sustaining nature is fulfilled, as technological innovations and techno-economic systems, smart city technology in this instance, takes on a life on its own, and consequently permeates cultural, social and political dimensions of society, and continues to perpetuate and institutionalize its own significance in society. If this goes unnoticed or unrecognized by spatial planers, this may in turn lead to sequential problems, such as what was learned earlier; simply implementing technological or infrastructural solutions, without harvesting social and local intelligence or support from social organization, may reinforce institutional and social prejudices rather than mediating social problems in the urban sphere.

This discussion has not taken into the consideration the multiple regulative requirements to spatial strategies in Norwegian law. This source of regulative and normative requirements represents attempts at manipulating hard infrastructural trajectories using tools pertaining the soft trajectory; social innovation. Many of these regulations are deeply rooted in visions of rational, political and social mobilization pertinent to the social organization trajectory, and its influential capacity. But as the empirical evidence in this thesis demonstrates, little evidence suggests that Norwegian smart cities are means for social sustainability in any substantial manner. The previous discussion has sought to give a possible explanation on mechanisms inhibiting this.

The notion that smart city technology is a contentious tool in meeting social sustainability, or human and social concerns, has to some extent been discussed before. Also, the notion of smart city technology being primarily a marketing scheme is well established. This thesis contributes by suggesting new ways of perceiving possible mechanisms behind these shortcomings, connecting them into a bigger picture, as well as shedding some lights on the inherent tension in smart city technology. These pose general and specific considerations Norwegian spatial planners should take into account when developing smart city strategies; where the technology fails to support sustainable practice, maybe our organization of it can compensate.

Conclusion

In this thesis, I have tried to answer the following research question; are Norwegian smart cities an expression of a techno-economic race or social sustainability. The findings in this thesis are leading me to believe Norwegian smart city strategies are behaving more as expressions of a techno-economic race than means for social sustainability, as it fails to do so on several accounts. Norwegian smart cities are not very social as of yet, neither are they very smart, according to definitions. Taking account for the short amount of time smart city technology has been a part of the Norwegian agenda, the findings in this thesis still suggests Norwegian initiatives are primarily involved in a techno-economic race by indiscriminately applying available generic technology, or alternatively, not being ambitious enough with their vision for getting involved. Empirical data, promotional material and literature reviewed in this thesis shows there are practices and applications of smart city technology that has, or can be used for, socially sustainable qualities; Barcelona exhibiting the prime example. Coupled with the recognized notion that social sustainability has been the least appropriated sustainability dimension in spatial planning and strategy, I would argue it is irresponsible of Norwegian smart city strategies not to address these comprehensively. Furthermore, this thesis has sought to shed new light on an ancient tension by depicting potential mechanisms and driving forces manipulating smart cities performance in Norway, and otherwise, which postulates valuable insight for spatial planners seeking to operationalize smart city technology as means for social sustainability; the multi-level duality of smart city technology; a market opportunity and spatial strategy, and as a strive for modernization by way of technology and social and political mobilization.

Further research

In working with this thesis, multiple potential discourses and discussions have been revealed. I would encourage anyone interested in this subject to further investigate “cultural lag” with respect to smart city technology. As smart city technology is still quite novel, and literature suggests this technology is advancing quickly, the “cultural lag” phenomenon could be a point of departure in an explanation of some of the dynamism of the operationalisation of smart city technology in spatial strategies. Another interesting case study could seek to map out processes and actors under which smart city strategies are being shaped in Norway today. This could further highlight the role of actors and their influence on strategies and outcomes, and more interestingly it could further highlight or prove/disprove the suggested duality of smart city technology in Norway.

Personal Reflections

I have realized, working with this topic, that smart city is very new, and there is an overwhelming amount of literature, praising and criticizing, compared what there is to empirically study in Norway. Although there exist many discussions about the ideal usage of this technology, I am under the impression that most cities utilizing it go through many of the same stages. However, the benefit of being a late adopter should in most cases be that one could skip the failures, and rather adapt the successful practices. Another consideration I have had to account for is the very complex nature of smart city, itself. It is a strategic spatial vision, it is tangible technology, it part of a techno-economic paradigm, it is a market opportunity, it is sustainable; it is everything and nothing. I often found literature, promotional material and empirical data to pertain different dimensions and spectrums of this complexity, and weaving these together was challenging. This complexity may also have resulted in some considerations being left out, or that I should have been stricter with delimiting and picking theoretical framework and literature. For the research question, I set out to answer, the methodology worked well, as the purpose was to superimpose smart city practice with its proclaimed promises, within a theoretical backdrop as mechanism. Looking back at this thesis, I am content with my work and process, but I do think it would be interesting and educational

to have challenged myself with a more practical thesis, in terms of using traditional visual tools and software.

Bibliography

Ajuntament de Barcelona (n. d.) Barcelona Digital City. Retrieved from http://ajuntament.barcelona.cat/digital/en

Albino, V., Berardi, U., Dangelico, R. (2015) Smart Cities: Definitions, Dimensions, Performance, and Initiatives, Journal of Urban Technology, 22:1, 3-21, DOI: 10.1080/10630732.2014.942092

Amsterdam Smart City (n. d), Amsterdam Smart City: We organize impact on urban innovation. Available from https://amsterdamsmartcity.com/network/amsterdam-smart-city

Amsterdam Smart City (n. d), Projects, Retrieved from https://amsterdamsmartcity.com/projects

Angelidou, M. (2014). Smart cities : a spatial approach. *Cities,* 41, S3-S11. doi : 10.1016/j.cities.2014.06.007

Angelidou, M. (2015). Smart cities: a conjuncture of four forces. *Cities,* 47, 95-106. Available from http://dx.doi.org/10.1016/j.cities.2015.05.004

Barbier, J., Delaney, K., France, N. (2017). Digital cities: building the new public infrastructure. Cisco. Available from https://www.cisco.com/c/dam/en_us/solutions/industries/docs/scc/digital-cities-value-at-stake.pdf

Batty, M., Auxhasen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics*, 214, 481-518. doi: 10.1140/epjst/e2012-01703-3

Berger, Roland. (2017). Smart city, smart strategy. Available from https://www.rolandberger.com/en/Publications/pub_smart_city_smart_strategy.html

Bernstein, Henry (1971). Modernization Theory and the Sociological Study of Development. *Journal of Development Studies*, Vol. 7. Available from http://www.tandfonline.com/doi/citedby/10.1080/00220387108421356?scroll=top&needAccess=true

Boorsma, Bas (2017). *A New Digital Deal*. Rainmaking Publications, 1: 2017.

Caragliu, A., Del Bo, C., Nijkamp, P (2009). Smart cities in Europe. *3rd Central European Conference in Regional* Science – CERS, 2009. Available from http://www.tandfonline.com/doi/abs/10.1080/10630732.2011.601117?journalCode=cjut20

Cohen, Boyd (2014). Smart City Index Master Indicators Survey. Smart Cities Council. Available from https://smartcitiescouncil.com/resources/smart-city-index-master-indicators-survey

Cohen, Boyd (2015). The 3 generations of smart cities. Fast Company. Available from https://www.fastcompany.com/3047795/the-3-generations-of-smart-cities

Copenhagen Connecting (2013). Copenhagen Connecting. Retrieved from http://cc.cphsolutionslab.dk

Crawford, Gunnar (n. d.). Stavanger Smart City – roadmap and projects (PDF). Retrieved from http://www.rosenkilden.com/ShowFile.ashx?FileInstanceId=bd680d4e-dbe6-48c6-adfa-08cdc4e20397

Deloitte (2015). Smart cities, not just the sum of its parts (PDF). Retrieved from https://www2.deloitte.com/content/dam/Deloitte/xe/Documents/strategy/me_deloitte-monitor_smart-cities.pdf

Dempsey, N., Bramley, G., Power, S., Brown, C. (2009). The Social Dimension of Sustainable Development: Defining Urban Social Sustainability. *Sustainable Development*, 19, 289-300 : 2011. doi: 10.1002/sd.417

Estevez, E., Lopes, N., Janowski, T. (2016). Smart sustainable cities: reconnaissance study. Available from http://collections.unu.edu/view/UNU:5825#viewAttachments

European Commission (2016). Analysing the potential or wide scale roll-out of integrated SCC solutions. Available from https://ec.europa.eu/energy/sites/ener/files/documents/d2_final_report_v3.0_no_annex_iv.pdf

European Commission (2010). This is European Social Innovation (PDF). doi: 10.2769/825

European Parliament (2014): Mapping Smart Cities in the EU. Retrieved from http://www.europarl.europa.eu/studies

Foley, D. L. (1964). An approach to metropolitan spatial structure. In M. M. Webber, J. W. Dyckman, D. L. Foley, A. Z. Guttenberg, W. L. C. Wheaton, & C. B. Wurster (Eds.), *Explorations into urban structure* (pp. 21–78). Philadelphia, PA: University of Pennsylvania Press

Geels, Frank (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33 (2004), 897-920. doi:10.1016/j.respol.2004.01.015

Haarstad, Håvard. (2016) Who is driving the "Smart city" agenda? Assesing smartness as a governance strategy for cities in Europe. In A. Jones et al. (eds.), *Services and the Green Economy*, DOI 10.1057/978-1-137-52710-3_9

Hofstad, H.,& Bergsli, H (2017) Folkehelse og sosial bærekraft. NIBR 2017:15

Hohenberg, P., Lees, L (1995). *The making of Urban Europe, 1000-1994, Revised Edition.* ISBN-10: 0674543629

Hollands, Robert. (2008) Will the real smart city please stand up? City, 12:3, 303-320, doi: 10.1080/13604810802479126.

IBM (n. d.), Smarter Cities. Retrieved from https://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/

Innovation Norway (2016). Smarte Samfunn – Drømmeløftet 2016. Retrieved from http://www.innovasjonnorge.no/no/mulighetsomrader/smarte-samfunn-og-byer/report-on-smart-societies-and-cities/

Innovation Norway (n. d), Sustainability. Available from http://www.innovasjonnorge.no/en/start-page/our-services/sustainability/

Jakobsen, K. (November, 2014). "Connecting Copenhagen" is the world´s best smart city project. *State of Green.* Retrieved from https://stateofgreen.com/en/profiles/city-of-copenhagen/news/connecting-copenhagen-is-the-world-s-best-smart-city-project

Kitchin, Rob. (2014). Making sense of smart cities: addressing present shortcomings. *Cambridge Journal of Regions, Economy and Society*, 2015, 8, 131-136, DOI: 10.1093/cjres/rsu027

Lea, Rodger. (2017). Smart cities: An overview of the technology trends driving smart cities. IEEE, 2017. Available from https://www.ieee.org/publications_standards/publications/periodicals/ieee-smart-cities-trend-paper-2017.pdf

Letaifa, S. B. (2015). How to strategize smart cities : revealing the SMART model. Journal *of Business Research*, 68(7), 1414-1419. doi :10.1016/j.busres.2015.01.024

Lovdata (n. d.) Kongeriket Norges Grunnlov. Retrieved from https://lovdata.no/dokument/NL/lov/1814-05-17

Lynne, M., Robey, D (1988). Information technology and organizational change: causal structure in theory and research. *Management Science*, Vol. 34, No. 5. Retrieved from http://www.jstor.org/stable/2632080

Marvin, S., Luque-Ayala, Andrés., McFarlane, Colin (2016). Introduction. In Marvin, S., Luque-Ayala, Andrés., McFarlane, Colin (eds.), *Smart Urbanism – utopian vision of false dawn?* Routledge: 2016.

Mumford, Lewis (1934). *Technics and civilization.* First Harbinger Books, 1: 1963

Municipality of Bergen (n. d.), Grønn Strategi. Retrieved from https://www.bergen.kommune.no/hvaskjer/tema/gronn-strategi

Municipality of Bodø (n. d.), Smart Bodø – et smart city utviklingsprosjekt (PDF). Retrieved from https://www.nfk.no/_f/i9196a605-3f3b-42e0-b104-d753ec0c5e77/smart_bodoe_191115.pdf

Municipality of Bodø (n. d.), Smart Bodø. Retrieved from http://nyby.bodo.kommune.no/smart-bodo-prosjektet/category8329.html

Municipality of Oslo (n. d.). Smart Oslo. Retrieved from https://www.oslo.kommune.no/english/politics-and-administration/smart-oslo/#gref

Municipality of Stavanger (December, 2016). Veikart for Smartbyen Stavanger (PDF). Retrieved from https://www.stavanger.kommune.no/samfunnsutvikling/smartbyen-stavanger/veikart-for-smartbyen/

Nam, T., Pardo, T. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. *The Proceedings of the 12th Annual International Conference on Digital Government Research.* Available from https://www.ctg.albany.edu/publications/journals/dgo_2011_smartcity

P. Neirotti; A. De Marco; A.C. Cagliano; G. Mangano; F. Scorrano (2014). Current trends in Smart City initiatives: some stylised facts. In*: CITIES*, vol. 38, pp. 25-36. - doi: 10.1016/j.cities.2013.12.010

Perez, Carlota. (2009) Technological revolutions and techno-economic paradigms. *Cambridge Journal of Economics*, 2010, 34, 185-202. DOI :10.1093/cje/bep051
http://www.jstor.org/stable/178351

Pol, E., Ville, S (2009). Social Innovation: buzz word or enduring term? *Journal of Socio-Economics,* 38 (6), 878-885. Available at http://ro.uow.edu.au/commpapers/661/

Regjeringen (2015). Nasjonale forventninger til regional og kommunal planlegging. Available from https://www.regjeringen.no/no/dokumenter/nasjonale-forventninger-til-regional-og-kommunal-planlegging/id2416682/

Regjeringen (2017). Planning and building act of 2008. Retrieved from https://www.regjeringen.no/en/dokumenter/planning-building-act/id570450/

Regjeringen (2014). Statlige planretningslinjer for samordnet bolig-, areal- og transportplanlegging. Available from https://www.regjeringen.no/no/dokumenter/Statlige-planretningslinjer-for-samordnet-bolig--areal--og-transportplanlegging/id2001539/

Sassen, Saskia. Urbanising technology. LSE Cities. Retrieved August 21, 2017. Available from https://lsecities.net/media/objects/articles/urbanising-technology/en-gb/

Saunders, T., Baeck, P. (2015). Rethinking Smart Cities from the ground up. UNDP: Nesta, 2015. Available from
https://www.nesta.org.uk/sites/default/files/rethinking_smart_cities_from_the_ground_up_2015.pdf

Sennett, Richard. The stupefying smart city. LSE Cities. Retrieved August 21, 2017. Available from https://lsecities.net/media/objects/articles/the-stupefying-smart-city/en-gb/

Shelton, T., Zook., Wiig, A. (2015). The "actually existing smart city". *Cambridge Journal of Regions, Economy and Society*, 2015, 8, 13-25. Available from
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2477482

SmartCity Bergen (n. d.), SmartCity Bergen. Retrieved from http://smartcitybergen.no

Smith, Kendra (November, 2017). The inconvenient truth about Smart Cities. *Scientific American.* Retrieved from https://blogs.scientificamerican.com/observations/the-inconvenient-truth-about-smart-cities/?wt.mc=SA_Facebook-Share

Taylor, Nigel (1998). *Urban Planning Theory since 1945.* London: Sage.

Thomas Kuhn. In *Wikipedia.* Retrieved September 25, 2017, from https://en.wikipedia.org/wiki/Thomas_Kuhn

Tieman, Ross (October, 2017). Barcelona: smart city revolution in progress. *Financial Times.* Retrieved from https://amp.ft.com/content/6d2fe2a8-722c-11e7-93ff-99f383b09ff9

Tipps, Dean (1973). Modernization theory and the Comparative Study of Societies: A Critical Perspective. *Comparative Studies in Society and History*, vol. 15, No. 2, 1973. Available from

United Nations (2016). Habitat III: New Urban Agenda. Available from http://habitat3.org/the-new-urban-agenda/

United Nations (2015). Transforming our World: The 2030 Agenda for Sustainable Development. Available from https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

United Nations (1987). Our Common Future. World Commission on Environment and Development. Available from www.un-documents.net/our-common-future.pdf

Vienna City Administration (2014). Smart City Wien – Framework Strategy (PDF). Retrieved from https://smartcity.wien.gv.at/site/files/2016/12/SC_LF_Kern_ENG_2016_WEB_Einzel.pdf

Wiig, A. 2015 (in press). IBM's smart city as techno-utopian policy mobility. City: 1 *analysis of urban trends, culture, theory, policy, action. 19* (2) April. Available from http://www.tandfonline.com/doi/abs/10.1080/13604813.2015.1016275

Winden, W. van. (2016). Smart city pilot projects, scaling up or fading out? Experiences from Amsterdam (working paper). Retrieved from https://www.researchgate.net/publication/296431497

Personal Interview with Cisco representatives conducted in Lysaker, Norway, 12.10.2017.
Any retraceable material will be deleted and erased to preserve anonymity.

Parliamentary White Papers, all retrieved from
https://www.regjeringen.no/no/dokument/meldst/id1754/

St. meld. 58 (1996-1997)
St. meld. 23 (2001-2002)
St. meld. 23 (2003-2004)
St. meld. 20 (2006-2007)
St. meld. 31 (2006-2007)
St. meld. 34 (2006-2007)
St. meld. 7 (2008-2009)
St. meld. 14 (2010-2011)
St. meld. 10 (2011-2012)
St. meld. 27 (2015-2016)
St. meld. 24 (2016-2017)
St. meld. 18 (2016-2017)
St. meld. 27 (2016-2017)
St. meld. 45 (2016-2017)

Civitas. In *Wiktionary*. Retrieved November 7, 2017.
https://en.wiktionary.org/wiki/civitas#Latin

Gro Harlem Brundtland. In *Wikipedia.* Retrieved December 10, 2017.
https://en.wikipedia.org/wiki/Gro_Harlem_Brundtland

Institutionalization. In *Wikipedia.* Retrieved December 3, 2017.
https://en.wikipedia.org/wiki/Institutionalisation

Spatial Planning. In *Wikipedia.* Retrieved October 23, 2017.
https://en.wikipedia.org/wiki/Spatial_planning

Figure 1; produced by me
Figure 2; Estevez et al., 2016: pg. 11

Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitskapelege universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway