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Keys to the Smart City:
Civic & Political Participation

The Copenhagen Case Study

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Submitted by
BEATRIZ MIKHAILA ALDABA
1048692
bmaldaba@gmail.com
Teglholmen Østkaj 45 st mf, Copenhagen 2450, Denmark

Internal Supervisor: Iwona Windekilde
Secondary Supervisor: Josef Trappel

Department of Communication Studies

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Supervisor: Iwona Windekilde
Secondary Supervisor: Josef Trappel

Project group no.: DCLead

Members:
Mikhaila Aldaba

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Aalborg University Copenhagen
A.C. Meyers Vænge 15
2450 København SV

Secretary: Maiken Keller

Abstract:
According to the UN, 60% of the world will be living in cities by 2030. People migrate to urban areas because they want a better life. To address the continuously growing pains of rapid urbanization, people have turned to the "smart city" movement. However, the smart city has also been criticized to prioritize technology over humans which can have a negative effect on democracy. This has led to a shift in thinking from top-down to bottom-up to middle-out in smart city planning.

Using a mixed methodology including thematic analysis, this research has found that participation frameworks must be updated in the new context of the smart city. Multiple power gaps still exist and that people can be motivated by more than financial reasons. This study finds promising partnerships and grassroots tech movements in Copenhagen.

Keywords:
Smart City, Civic Participation, Copenhagen, Denmark

Keys to the Smart City: Civic & Political Participation

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“First we shape the cities,
then they shape us.”

— JAN GEHL

“What is the city but the people?”

— SHAKESPEARE

“Forget the damned ~~motor car~~ smart city
and build the city for lovers and friends”

— ~~LEWIS MUMFORD~~ MIKA ALDABA

Executive Summary

This study sought further understand on how civic participation is taking place in the smart city of Copenhagen, with the definition of participation being one that is tied to power. How can existing participation frameworks be augmented by new methods of participation? What are the motivations for people who participate and what are the power gaps that exist in the smart city?

In ancient cities, citizens were equal and active in making civic decisions. Alexandria is closer to today's modern city which has a representative democracy. The ideal city concept has evolved over time from Howard's Garden City, Corbusier's Radiant City to Jane Jacobs and new urbanism. Today, the original polis would be unrecognizable. The evolution of cities and technologies are interconnected and smart cities aren't an entirely new concept. However with the ubiquity of the internet, smart cities have captured the public's imagination.

Polemicists like Poole and Morozov warn against giving big tech companies too much control over our cities. This continues the trend of technology used massively and mindlessly, exacerbating problems that have been there before. There are issues of the lack of accountability, privacy, transparency and consent that have arisen. Continued outsourcing of city tasks and decisions to technology without analyzing the risks involved can possibly lead to the end of democracy. Can the reintroduction of more civic participation from the city's residents save it from this threat? First, it must be clarified what civic participation actually entails. It is an act of that goes beyond mere ability to access and interact with the city and its governance.

In order to reclaim the smart city, Morozov, Bria and Green present different strategies including alternative data ownership, open source, cooperative models and more ethical procurement. They all mention the importance of democratic values. This calls back to Lefebvre's 'Right to the City,' whose concept has been further developed from the citizen's right to occupation and public life to the right to democratizing the city from the privileged elite to including those who are marginalized to have the same rights. These are rights that smart city projects might intentionally or unintentionally take away. Adding to the discussion of inclusion in the city, the study calls for new terminology. The use of "smart citizens" excludes other people who dwell, work and visit in the city. These are the ones whose rights are the most threatened.

Civic participation in the age of social media has not gone unnoticed by academia. Zuckerman proposes that traditional metrics no longer illuminate the full picture of participation. Some examples around the world include social media, blogging, digital e-participation platforms, open street mapping and participatory budgeting.

The three part methodology is undertaken through data collection, thematic analysis, and synthesis. Data is collected through unstructured interviews, gathering smart city and participation projects and fourteen semi-structured interviews. The thematic analysis method was selected in this study due to the exploratory nature of its research questions. The study utilises the thematic analysis described by Braun et al. which has an analytical input and output model. Through synthesis, the civic participation frameworks from Ekman &

Amnå, Linders and Carpentier are brought together and used to frame the results of the study. The limitations of the study due to the scope of the topic and potential interview biases include reproducibility and generalisability.

Copenhagen is a leading world capital and frequently features on 'best of' lists and rankings. However, like any other city, it faces the same problems that rapid urbanization brings about such as rising inequality. Just as Ethan Zuckerman described in chapter 3, traditional metrics of civic participation such as party membership are falling while volunteering is rising. As a member of the European Union, Copenhagen is subject to the EU's Urban Agenda. This is a good deal for smart cities because the EU offers funding for many smart city related projects as long as it aligns with their strategies and standards. Denmark ranks near the top in terms of digital infrastructure and usage. All these factors combined lead to a solid foundation on which the smart city can be developed on.

Overall, the first reading of the data has resulted into a wide array of insights. Most smart city project goals are aligned with Copenhagen's brand of being a sustainable green city. Others highlighted the importance of building communities, networks and ecosystem. A concept that is expected to become more mainstream is the minimal interoperability and standardization of data and upcoming technologies. The involvement of people ranges across the whole spectrum of participation from access to information to consultation, co-creation and bottom-up self organization. Metrics and measurement also vary depending on the size, effort required and relevance of the project. Recruitment of people is either closed and invitation only or open. Inclusion is not registered as a concern by most of the interviewees.

Motivations for starting a smart city initiative by the public sector are financial and political. On the other hand, people starting their own community projects are more likely doing so out of a sense of social responsibility. Perceived motivations of participants were mostly out of self-interest. Further research is required in this topic. Current and emerging tech ranges from very new and complex artificial intelligence and IoT sensor to more established and accessible tech like the internet and social media. Some of the initiatives reported being technology agnostic or technology neutral. Interviewees were not all able to point out potential issues with the technologies. Those that were mentioned include knowledge gaps, overreliance on technology and lack of inclusion. The external and internal evaluation of public sector has been mostly negative. The positive reviews come from the private sector who are interdependent with them. Areas for improvement are managing bureaucracy, budget optimization, technology training, internal knowledge sharing, standardization and openness for collaboration.

The exploratory nature of the analytical input has led to a rich qualitative dataset where several patterns have been discovered. Until now data ownership issues remain unresolved. Data solutionism still exists but this is a problem if the data is not trustworthy or if it contains biases. Data access is a design problem because of the sheer amount of information and lack of awareness and literacy for the general public.

Openness is another theme. Open data is open data. Misuse of open data in itself is not a crime, it is the crime committed using open data that will be charged. Personal data is excluded in open data. However, it is possible with some types of open data, given enough of it, that it can be de-anonymized. There are also situations where you would want authorities to know your personal data such as in accidents so that you can

be rescued. Open source is frequently brought up as a principle used to avoid big tech from having too much power and as a tool for better collaboration.

The pragmatic reality of cities is that resources are limited. Therefore, the public sector is budget conscious and likely to make decisions for financial reasons. The same goes for city dwellers who use their spare time to spearhead or volunteer in grassroots tech-related initiatives. There are simply too many decisions in the city to make. Another resource is the physical infrastructure of the city. Interviewees stress that connecting smart city initiatives to physical places and meeting physically help people understand them more and feel more involved. As Poole suggested in 2.3, the smart city is about who holds power in society. Both high ranking officials in the public sector and big tech companies are at the top. The public sector has the power to prioritize agendas whose budgets will get approved. Smart cities that are dependent on too many services provided by big tech companies are also at risk. Should this continue and tip the scale towards the private sector, it could become problematic because the private sector has different aims. Interviewees suggest people learning to produce data themselves as a first step, projects that democratize the planning process and access to technologies and quadruple helix and equal partnerships.

Information asymmetry and knowledge gaps exist in all the sectors of the pentahelix. The average city resident would not know how to handle open data or work with an IoT network. Public sector and civil society employees are also challenged by new and emerging technologies. Fab labs are a good initiative that makes new technologies more accessible to the general public. The public sector is so huge that it is unaware of its own overlapping projects, doubling the work done and wasting the people's tax money. The information gap that needs to be closed is if smart city developers are actually developing it based on what people want versus what they *assume* people want. In order to address these, education has been suggested as necessary for the future of the city. It is not only tech skills such as handling data but also thinking critically about its connection to power and democracy. Finally, there must be a clear delineation of roles in order to clear up confusion among sectors and drive people to action.

The smart city ecosystem in Copenhagen and Denmark in general continues to evolve with more formal partnerships and informal connections across the helices being made. To create a new framework of participation, typologies of Ekman & Amnå and Linders are fused with Carpentier's definition of participation. There is evidence of all participation types in the new framework present in Copenhagen. Multiple power hierarchies still exist in the city.

1 Foreword and Introduction

Before writing this thesis, I had a somewhat limited view of what participation in the smart city meant. I thought with my data driven and design background that I could just build some nice dashboards and call it a day. Through my research, I've managed to widen my horizons outside the usual confines of tech. The inspiration for my topic came from visiting and living in several cities. By chance, I heard Jan Gehl's keynote speech at the World Design Summit in Montreal. He talked about designing cities with the human scale and presented his work on making Copenhagen pedestrian and bike friendly. Thanks to his efforts and many other like-minded people, Copenhagen has become one of the most liveable cities in the world. My interest was shifting from the technology in cities to a more personal perspective.

Life in Copenhagen is a truly eye-opening experience for a girl who grew up in the car-worshipping conservative gated communities of Manila. The biggest culture shock for me was the buildings where addicts can safely consume their drugs and get help if they want to quit. The Philippines is currently undergoing a self-induced drug war where you can be shot if you are at the wrong place at the wrong time. Whether you were involved in the drug trade or not doesn't matter to the police. That is not to say that Copenhagen is smarter than Manila. I don't think it's fair to compare two completely different places. My peers in the Philippines are coming up with innovations that I don't think could be developed here. The important thing is finding common ground because thanks to the internet, cities are connected now. How can we learn from each other?

Cities should be for everyone. The rise of new technologies can help facilitate that or make the 1% richer. Through my research I want to understand better the current state of our smart city. To begin, I first narrate a brief history of the city from the beginnings of Western civilization to the development of competing visions of the smart city in chapter 2. At first, the concept is embraced but now is seen as past its peak in the Gartner cycle. Just as technology has exacerbated the existing problems around the world, it is doing the same in cities. I turn to civic participation as a way to take back control from big tech. The latest research in the topic sees the smart city critics proposing alternative methods for using technology in the cities in chapter 3. We are reminded of the democratic values, who has the right to the smart city. In these times of nationalism and border crises, we should be mindful of the terminology that we use to describe the people who make use of the city. Civic participation mediated by technology is leading us to a time of post-representative democracy.

There are numerous frameworks with which to undertake this study that are outlined in chapter 4. An underlying theme is seeing the city as a network of different links between city actors. Due to the explosion of smart city research, there are many ways of looking at smart cities. There has also been a lot of research in civic participation. In this research, a framework to join the two concepts is needed. The methodology is described in chapter 5. It involves three parts, data collection, thematic analysis and synthesis. Before discussing the results, the important facts and figures about Copenhagen as a smart city are discussed in chapter 6. The output of the thematic analysis is split into chapters 7 and 8. Using the joint framework of smart cities and participation, the results are synthesized in chapter 9 and the whole study is summarized in chapter 10.

1.1 Research Question

How is civic participation taking place in the context of the smart city in Copenhagen?

- How can existing participation frameworks be augmented by new methods of participation?
- What are the perceived motivations of participation by project leaders?
- What power gaps exist in the smart city?

1.2 Relevance of the Study

In 2016, CNBC reported that as much as $41 trillion will be spent over the next 20 years for smart city technology (Pattani 2016). Bill Gates, the co-founder of Microsoft, bought 24,800 acres of land outside Phoenix, Arizona for $80 million, with the plan to develop it into a smart city (Ong 2017). 66% of US cities are investing in smart city technology (Maddox 2017). Google's plans to turn 800 acres of lakefront Toronto into an internet city laboratory called "Quayside" as the "world's first neighborhood built from the internet up" (Hawkins 2017) is currently being challenged by Toronto activists for being untransparent. The question is if these technological solutions that these big corporations are developing aligned with the actual problems that local governments around the world are trying to solve.

Referring to the United Nations Habitat III The New Urban Agenda (2017), the new challenges of urbanization involve closing the inequality gap with more job creation, livelihood opportunities, and improved quality of life. Urban planners and local governments around the world envision the city as "safe, healthy, accessible, affordable, resilient and sustainable" with equal rights for all (United Nations 2017, p. 5). Cities should aim for adequate housing for everyone without discrimination, civic engagement, belonging and ownership, gender equality, sustainable economic development, safe and accessible urban mobility, disaster risk reduction and management and the conservation of ecosystems (United Nations Habitat III 2017). Because of the urgency of the situation, experts are also calling for new urban science development (Townsend 2015). Research into the shifting roles of the different members of society is needed to help public sector understand their constituents better. The results of this study can also serve as a guide in forming creative and comparative framework for private sector and non-profit designers and consultants.

Although Copenhagen is frequently looked upon as a model for sustainability and smart city solutions, there are still plenty of opportunities for improvement. New smart districts such as Nordhavn and Lynetteholmen are being developed. The innovation district in Copenhagen, Ørestad has been criticized by architects and planners to be a market-driven ghost town with wide windy avenues and designer luxury flats but devoid of street life (Gehl cited by O'Sullivan 2016).

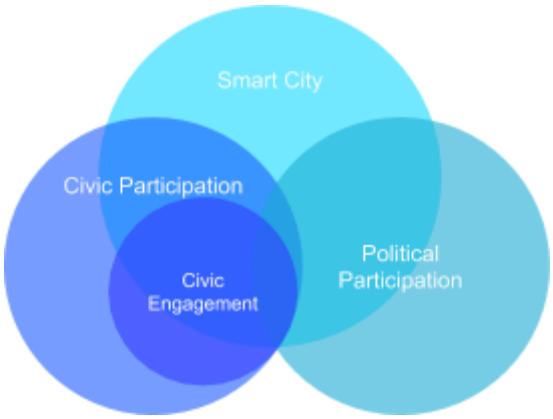
As 80% of the world's population will be living in urban areas, following the dream of better jobs, education, and health care by 2030 (United Nations 2017), this study is ultimately at its heart, about how we as humans live and move in our daily lives. We need to understand if new technologies will enable civic participation for us who want to take back control of our city. For those who still believe in democracy, we need to know if there are technologies that threaten it.

1.3 Definitions

As some of the terms that are in this report are frequently misused interchangeably, this section serves as a guide to reduce confusion.

- Civic Engagement
    - the creation, or existence, of a social connection of individuals or groups with a broader political community, which is aimed at protecting or improving it (Carpentier 2016)
    - Although related, it is frequently confused with participation but is different
- Participation
    - the equalisation of power relations between privileged and non-privileged actors in formal or informal decision-making processes (Carpentier 2011)
    - Different from *access* and *interaction*
- Civic Participation
    - Social involvement - attention and awareness of the importance of politics and societal issues
    - Civic Engagement - actions for the betterment of society, informal methods of political participation (e.g. discussing the news with friends, volunteering)
- Political Participation
    - Involve formal methods of political participations (e.g. voting, joining a political party, etc.) and legal and illegal forms of activism
- eParticipation
    - ICT-supported participation in processes involved in government and governance

Figure 1. Diagram of Participation and Engagement in the Smart City (Author)



- Smart City
    - A city where its residents and visitors use digital technology to participate in it

In order to be more inclusive, I refrain from using the term *smart citizen* as the term excludes many people who have the right to the city and instead refer to:

- Smart Resident
    - A person whose primary residence is in the smart city regardless of legal status
- Smart Visitor
    - A person who is visiting a smart city for any purpose, but without having primary residence there (e.g. tourists, business travelers, seasonal workers, family visitors)

2 Background

The chapter begins with a short narration of how the city came to eventually become the smart city in 2.1. In 2.2 the discussion about the people who live and visit the city is launched while 2.3 embarks on the politics behind the smart city, asking if Big Tech is really in power. Then in 2.4, the topic of civic participation is introduced and how it can be used to take back control of the city.

2.1 A Brief History of the Smart City

In four sections, the story of the smart city is narrated. 2.1.1 goes through the timeline from Alexandria, to the Garden City, to Le Corbusier and to Jane Jacobs. 2.1.2 tracks the rise of the smart city amongst other city visions. 2.1.3 dives further into the smart city's corporate nature and 2.1.4 briefly touches upon the critiques.

2.1.1 The Western City

> *"The power of architecture even in its traditional format as a discipline concerned with the design of buildings - to influence the reality of our urban condition."*
> *(Aureli 2013, p. 15)*

Before the smart city is defined, first the story of the city must be told. The Oxford dictionary meaning of the city is simply a large town although legal definitions based on metrics such as population and density are complicated depending on the country and the philosophical definition looks into the topic of its identity. Understanding how cities came about in history can help develop a better understanding of how to make smart cities. In Earliest Cities, Michael Smith writes that cities did not exist until the last five thousand years. Before that, people were staying in temporary campsite dwellings and small village areas. Life back then was much simpler than how it is now (Smith 2002).

In historian Lewis Mumford's study, he narrates that one of the first cities that has inspired the modern world is the legendary Alexandria. Built by Alexander the Great and designed by the architect Dinocrates, inspired by the plans of Hippodamus, a Greek architect and philosopher, regarded as the "father of city planning" by Aristotle. In the classic ideal city, the center contains the agora as its heart. The agora was the

public market where citizens gathered not just to buy and trade goods but also to share ideas. This was where civic life occurred (Mumford 1961).

The Guardian correspondent Jack Shenker writes that in ancient life, the polis is where citizens were equal, autonomous and had a right to decision making. This did not include women, foreigners and slaves. Whereas, the original intention of Hellenistic towns was to be a polis, Alexandria was the foundation of the modern city or urban absolutism. The strict grid and plan was ordered by higher powers, instead of being voted upon by citizens in a democracy (Shenker 2016). “What was left of the old urban drama was a mere spectacle. In the old polis every citizen had an active part to play: in the new municipality, the citizen took orders and did what he was told” (Mumford 1961 cited by Shenker 2016). Mumford contrasted the neat aesthetics of Alexandria with the loss of the messy freedom that cities stand for (Shenker 2016).

After the fall of the Roman Empire, the focus of the cities were on survival and security, hence the need for walls and fortification and then shifted back to spiritual well-being during the medieval times and the enlightenment age according to urbanist author Charles Montgomery (2013). Fast-forwarding to the beginning of the 20th century, new urban planning paradigms were proposed because the industrialization of cities were starting to spread disease and pollution. Ebenezer Howard created the Garden City movement in 1898 which drew inspiration from countryside settlements built by industry for workers. What these dwelling communities did was to draw away factories from city centers to depollute them while providing livable homes for the workers. It was a way to live close to nature again, but it was a life for people with no plans of their own (Jacobs 1961).

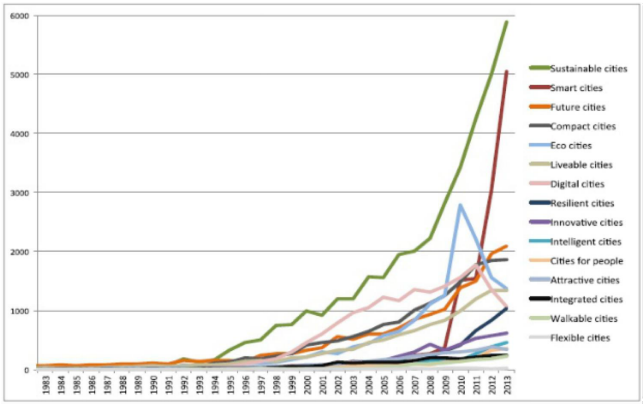
In this vein, the paradigm of City Beautiful by Daniel Burnham also sought to improve society through aesthetics, tearing down poverty stricken areas and replacing them with grand avenues and aesthetically pleasing buildings (Montgomery 2013). Another famous architect, Le Corbusier, had his own ideas on the best urban planning paradigm, the Radiant City. It was composed of tall skyscrapers within a park with elevated motorways interwoven around it (Jacobs 1961). "Human happiness already exists expressed in terms of numbers of mathematics of properly calculated designs, plans in which the cities can already been seen" (Le Corbusier 1933, p. 93). For him, happiness was derived from a rigid form.

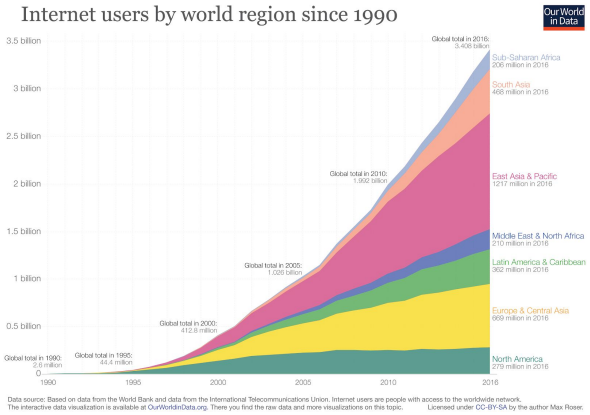
The prominent urban critic Jane Jacobs decried these paradigms as egoistic (Jacobs 1961). Her work became the basis of contemporary urban planning which focused more on behavioral psychology, sustainability and collaboration.

2.1.2 Competing Visions of the Smart City

There have been many definitions of the smart city. The confusion and lack of unity over a clear definition leads to a lack of clear objectives. Hence, a lot of projects have been doomed to fail.

Figure 2. Google Search over time (Calzada 2016). Figure 3. Global Internet Adoption Rate (Murphy & Roser 2016)





The story of the smart city was not the first of its kind. It has been preceded by the future city, the virtual city and the digital city. Why is it that "smart city" was the term to capture the imagination of the public? Perhaps it coincided with the ubiquity of the Internet as shown in the graphs above. Or perhaps it was the new possibilities brought about by another broadly defined buzzword "Internet of Things".

Table 1. City Terms (Author)

Category	**Framework**	**Author**	**Year**
Technological	Smarter Cities	IBM	2009
	Digital City	Yovanof, G. S. & Hazapis, G. N.	2009
	Virtual City	Judith Stefania Donath	1997
	Information City	ME Hepworth	1987
	Intelligent City	Komninos and Sefertzi	2009
	Ubiquitous City	Anthopoulos, L., & Fitsilis, P.	2009
	Cognitive Smart City	Mostashari, A, Arnold, F., Mansouri, M., Finger, M.	2011
	Digital Twin	Glaessgen & Stargel	2012
	Hackable City	Martijn de Waal, Michiel de Lange & Bouw	2017
	Open and Agile City	Martin Brynskov	2015
Human	Creative City	Bartlett, L.	2005
	Humane City	Glaeser, E. L., & Berry, C. R,	2005
	Knowledge City	Dirks, S., Gurdgiev, C., & Keeling, M.	2010

	Learning City	Moser, M. A.	2001
	Conscious City	Moshe Bar	2015
Environment and Society	Participatory City	Yasminah Beebeejaun	2016
	Sharing Cities	Duncan McLaren and Julian Agyeman	2015
	Eco-city	Richard Register	1987
	Sustainable City	Dennis Church	1980
	Green City	Moisei Ginzburg and Mikhail Barsch	1930
Economic	Global City	Saskia Sassen	1991

Smart cities are also combined with one or several other imaginaries such as the knowledge city and the sustainable city.

2.1.3 Building the Smart City from Tech Down: a Corporate Utopia with Neoliberal Values

Whenever you hear the word "smart," beware, because that is somebody who wants to sell as many millions as possible of some new gimmick. - Jan Gehl

The smart city was born in a corporate environment rather than from an urban planning approach (Greenfield cited by Poole 2014). It has continued to be a corporate project in its first couple of years (Townsend 2013) and despite the proliferation of small technology start-ups (Hartley & Kuecker 2018). One can just look at buzzword-laden corporate brochures that proclaim smart cities as the "cities of the future" and "the city's nervous system" (Huawei 2017) selling smart power grid and sensor infrastructures that collect all sorts of data. IBM sells their smarter cities vision as "new cognitive approaches to long-standing challenges" (2009). The implication of this is that if you don't buy these services, your city isn't smart. Smart city is a status that can be achieved by procurement. Mayors have been the target of these tech corporations because they bought into the smart city: it would make them a smart mayor (Koolhaas 2014). Many smart city proposals have assumed the public sector as the consumer without considering the actual city residents and visitors (Boorsma 2017). For a time, smart city infrastructure was too expensive for smaller communities until cloud services made it more affordable (2017). This could lead to a simplification of business models and an overreliance on public sector budgets (2017).

In reality, these tech corporations focused more on selling small fixes to existing systems than challenging the status quo and city norms although their advertising promises something bigger (Townsend 2013). The early smart city ambitions were too limited and did not consider the urban concerns of today (2013). On the other hand, in the next couple of years, smart cities have been built from the ground up as "model smart cities" like Songdo in South Korea, which some critics consider to be a failed project because of the low occupancy rates, bland lifestyles and lack of history.

"Technology has always been *smart*" argued Camilla Siggaard from Gehl Architects. "The development of information technology and the advances of human society have always been connected; as our world gets more complicated, we invent means to control, govern and interact with the underlying systems." (Siggaard 2015) From the carrier pigeon, to the internet to ubiquitous computing, smart cities are "just a natural extension of the infrastructural system that has developed since the beginning of our civilisation." According to her, the soft infrastructure of smart cities will bring benefits but also threaten to do the same as the hard infrastructure of railways and roads developed trade between cities, they also damaged homes and neighbourhoods. (2015)

> *Whenever that's done right, it will increase the soft power of the more alert and ambitious towns and make the mayors look more electable.*
>
> *When it's done wrong, it'll much resemble the ragged downsides of the previous waves of urban innovation, such as railways, electrification, freeways, and oil pipelines.*
> *(Sterling 2018)*

Anthony Townsend defined a smart city in his book, Smart Cities: Big Data, Civic Hackers and the Quest for the New Utopia, as "a community that is using new digital technologies to address these timeless problems like fighting crime, reducing traffic, or disposing of waste" or "a city that employs digital technology to improve municipal management, governance, or long-range design and planning" (Townsend 2013). This is a multi-stakeholder activity where actors from the government, businesses, and civic sector participate. However, he also notes that by this standard almost every city on Earth can be considered 'smart' (Townsend 2013).

With the explosion of data, artificial intelligence or AI is being seen by cities as the only way to cope with the changes. (Ted Ross, chief information of the City of Los Angeles, quoted by Smart Cities World 2017). AI could help with climate change, energy and hunger by using algorithms for urban planning (Bartlett 2018). Harvard and MIT scientists are using Facebook volunteers and work at home moms for their research determining whether an area of a city looks less dangerous and more appealing using images from Google Street View. This data is then fed into an AI model which can predict why some districts can decay and others can thrive. (Greene 2017) The researchers saw that population density and residents' education level are better indicators of neighborhood improvement, than median income levels, housing prices, and rental costs. (Poon 2017) Attractive neighborhood perceived as safer were more likely to see improvements and less safe ones would go past a tipping point and sharply decline. They also proved the spillover effect where neighborhood transformation is correlated with closeness to central business districts and other attractive neighborhoods (Poon 2017).

In Redwood City, California, sensors were used to tackle the parking problem, where people have a difficulty finding parking despite the garages being only half full. (McCauley 2016) And this is only the beginning for

the city, as they look to expand the system with smart lighting and water. “Adoption of this sort of technology is the future for city infrastructure." says Hammock. “In order for us to build connected vehicles," Hammadou said, "it is critical for us to build a very smart infrastructure." (McCauley 2016)

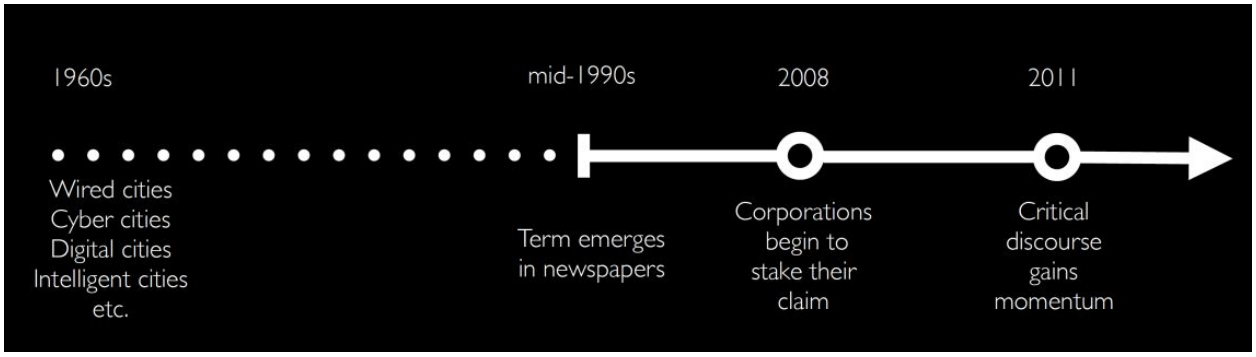
The advancements in the algorithms make them an unstoppable force. It would be almost too stupid for the public sector not to use them and save a lot of costs. For instance, why hire experience designers to make observations on how people use streets when machine learning can simulate them on computers instead (Aschwanden et al. 2011)?

To counter that argument, Siggaard suggests that a smart city “should aim to strengthen local infrastructures, to reconnect internal links and it should empower communities with the tools to shape their own neighbourhoods and lives.” (2015) She insists that new technologies would enable the public to do good. It is important to integrate local infrastructures. “The key is that you need the human assessment. This is not a circumstance in which you just set the algorithm and say, ‘Go design a city,’” says Kominers. “You're designing a city for people, and with people, but the tool makes it possible to work at a much finer resolution and larger scale than you could ever do with just people alone” (Poon 2017). Like in Medellin which was retransformed by connecting the favelas, their shanties, to the city with new transit options (Koppikar 2015).

2.1.4 Critics Strike Back: The Smart City is an Informatic Dystopia

In Figure 4 below, a brief history of the smart city as a term is illustrated.

Figure 4. Smart City Term Evolution (Kitchin 2016)



The technology polemicist, Evgeny Morozov says that while they may be trying to do some good in the world, they still rely too much on technology as the solution (2011). He also stated that “clinging to Internet-centrism—that pernicious tendency to place Internet technologies before the environment in which they operate” is also symptomatic of government workers, giving them a false sense of security (Morozov 2011, p. 111). The journalist Andrew Keen also stated that the boards of big tech try to come up with solutions on society’s problems without necessarily aligning with the general public (Keen 2015). “They appointed themselves as the emancipators of the people without bothering to check with them first” (Keen 2015, p. 141). Another symptom is solutionism is when smart city objectives use the solution itself as the objective rather than a means to an end (Boorsma 2017). This technosolutionism is one of the ills of the people developing smart city technology as well as their customers buying their products.

This has originated in the engineering focus of the tech industry which values efficiency as making something better. It is not necessarily a bad thing. However, when applied in the context of cities, efficiency is not the only outcome that is desired (Boorsma 2017). Tech goggles can skew perspectives. Trying to fix a city with a tech industry mindset alone is problematic. Although having good intentions, some technologists look to direct democracy as the peak achievement of civic engagement. They seem to think that the problem is that the "New England town meeting" where people gather to discuss and debate decisions has difficulties in scaling hence why we have our current representative government now (Green 2019). But to reduce it to a mere problem of scale is not correct. "Direct democracies in its purest form are simply not feasible for larger communities" (Schiener cited by Green 2019). Cities don't exist merely for perfect efficiency, optimization and predictability. Cities provide contradiction, a space in which experiences from random and coincidence can arise. It is a melting pot of cultures and ideas, not a sanitized panopticon (Poole 2014).

Adam Greenfield, another urban polemicist, was one of those Songdo critics who said "Cities are rather products of specific geographies, social milieus and inhabitants. We do not live urban informatic lives divorced from the physicality of the city and ourselves; instead that other 'smart' technology, the smartphones, has smushed physicality and data-presence together by its ubiquity and regular reporting of data to the network" (Greenfield 2013, p. 9). However, he only critiqued the smart cities in their purest ideologies, he did not address pre-existing cities that were incrementally updating and retrofitting themselves to be smart.

> *What's more, if an entire city has an "operating system", what happens when it goes wrong?*
> *The one thing that is certain about software is that it crashes.*
> *The smart city, according to Hollis, is really just a "perpetual beta city".*
> *We can be sure that accidents will happen – driverless cars will crash;*
> *bugs will take down whole transport subsystems or the electricity grid;*
> *drones could hit passenger aircraft.*
>
> *How smart will the architects of the smart city look then?*
> *(Poole 2014)*

Another critic, Shannon Mattern (2017) recently published argument against the use of cities as 'living labs'. She criticized the New Cities Lab initiative by the startup accelerator Y Combinator and argued against the questions they asked like: "How should we measure the effectiveness of a city (what are its KPIs)?" KPIs or Key Performance Indicators are business intelligence terms that is not used in everyday language. She thinks that we should ask more questions like "How do cities function, and how can they function better?" although she admitted that they did ask "How can cities help more of their residents be happy and reach their potential?" (Mattern 2017).

Other criticisms of the smart city involve technology myopia, where a technology demonstration becomes the end itself without a plan for scaling (Boorsma 2017). There are also problems with communication

because of silos in the government, IT departments taking control of digitalization, and failure to address reluctant stakeholders, failure to include civic engagement (Boorsma 2017). Legacy networks and closed architectures are also large roadblocks in smart cities (Boorsma 2017).

London ranks highly in corporate funded smart city lists . But if it's so great then why does it have so many empty skyscrapers, too many CCTV cameras, sewers with fatbergs? "Better to reimagine the forthcoming urban future as a mirror of Rome, that "Eternal City," where nothing much ever gets tech-fixed, but everything changes constantly so that everything can remain the same." (Sterling 2018)

2.2 Where are the humans in the smart city?

> *"The smart city was the wrong idea pitched in the wrong way to the wrong people... How is it tangibly, materially going to affect the way people live, work, and play?" (Hill cited by Poole 2014)*

For most of its existence, smart cities have focused on the technology and digital side with no regard towards strong urban planning and design principles. These include the prioritization of shared mobility over single occupancy vehicles, public spaces over large roads for cars, and public services for access to jobs and secure aging (Dowd cited by Maddox 2017). Isn't a city, a place for all people to "play, work, socialize, buy goods and services, educate themselves, raise families, and access arts, sports, entertainment and culture in its many forms and in close proximity to each other" (Karjalainen 2017). People working with smart cities must focus on those and not just tech.

Finding a solution between humans and technology is not a new question. In the 1960s, Norbert Wiener pioneered a new discipline called cybernetics "the human use of human beings". They had pedestrian flow charts, futuristic visualisations and detailed plans in his book, "you find yourself returned to a time when certain people – cold-war technocrats, on both sides of the Iron Curtain – truly believed that they could use other people "to construct, literally, an entirely new world... a marvellous glimpse at tomorrow" (Wakeman cited by Kane 2016).

Although perhaps the "smartness" of a smart city shouldn't be measured on the advancedness of the technology used. Bringing up the Medellin example, it wasn't smartphone connectivity that solved their social issues but publicly funded sports facilities and a cable car infrastructures. It was named the most innovative city in the world in 2013 by the Urban Land Institute (Poole 2014). Another smart way to build cities could be to involve psychologists and ethnographers on the team for understanding city residents and visitors better (Rez cited by Poole 2014).

2.3 Power play and technopolitics

> *"In truth, competing visions of the smart city are proxies for competing visions of society, and in particular about who holds power in society" (Poole 2014)*

Although the smart city movement claims to be apolitical, there are still issues of power behind the improvements on offer. "Traditional European values of liberty, equality, and fraternity have been replaced in the 21st century by comfort, security, and sustainability. They are now the dominant values of our culture, a revolution that has barely been registered" (Koolhaas 2014).

2.3.1 The corporate top down approach from Big Tech

It's hard not to imagine all the major tech firms being involved in smart cities. Google and Facebook have offered free wireless internet and sensor-based apps for solving issues such as parking. But nothing is free when dealing with these companies. In return, they get user data which will fund these services. In the end, these tech companies will "have enough data not to have to ask you what you want" (Poole 2014). Once a city gets caught in these too good to be true sounding contracts, they could be stuck in a vicious cycle, needing to subcontract more and more infrastructure and services (Morozov and Bria 2018).

And why should they stop there when they can build entire cities from the ground up? "It is not far-fetched to imagine a Google or Facebook saying, 'The real-estate sector is a massive aggregation of data, let's commercialise it. Let's go and build ten million square feet of property and see what happens. From there, they could easily become slick, efficient developers in their own right and they could dominate the market the way Apple did with cell phones. In the future it might be said, 'Remember when there were all these old-school companies developing buildings? How weird was that?'" (Weber cited by Wright 2017)

In fact, Google's sister company Sidewalk Labs is attempting to do just that in Toronto. Aside from the technology infrastructure, they want to disrupt the whole way a city is built and run from sewage to transportation. They are even experimenting with something called a "building raincoat," a flexible awning that could extend if it gets too sunny, windy or rainy. It's purpose is to encourage people to stay outside longer, which is said to make cities more vibrant. This "community vibrancy" usually develops naturally but Sidewalk Labs is engineering it (Schwab 2019).

Not everybody is happy with this development. The Canadian Civil Liberties Association has sued the government of Toronto for lack of transparency over the procurement of Sidewalk Labs' services (BBC 2019). Although heavily criticized, cities shouldn't worry too much about tech corporations trying to take over. Running cities has been unprofitable for them so far. "America's already littered with the remnants of abandoned Google Moonshots. Amazon kills towns by crushing retail streets and moving all the clerks backstage into blind big-box shipping centers. The idea of these post-internet majors muscling up for some 30-year urban megaproject—a subway system, aqueducts, the sewers—seems goofy" (Sterling 2018).

People don't seem to be buying what they're selling. Looking at Silicon Valley, you'll see that the greatest tech innovations have been created from "a bland suburban environment that is becoming increasingly exclusive" (Koolhaas 2014). They have been encountering opposition even on their own backyard. The worlds of technology and politics are too diverged and must converge again in order to make successful smart cities.

Even Uber has attempted to take on public transportation. But experts have rang the alarm bells before they could begin. "If Uber took on 4.4 trillion passenger miles on public transportation in the 63 countries in which it operates — cities would grind to a halt, as there would literally be no space to move on streets" (Spieler cited by McFarland 2019). The effort to move people from point A to point B would end up in gridlock. Was this a well-intentioned proposal of the tech giant or another way to increase profit? A later update to the news article said that Uber will not target public transportation anymore (CNN 2019).

It's also difficult to blame cities for accepting or tolerating these services from tech companies. One must not assume corruption or malice by default, rather it should be "the desire to make do with the meagre amount of resources available to most cities today" (Morozov and Bria 2018). Some cities are ill-equipped to deal with the digital transformation needed to scale up their services for their growing populations. What other choice do they have aside from hiring external companies while they develop their internal capabilities?

2.3.2 Who needs Accountability, Privacy, Transparency or Consent?

"It wasn't me who made the decision, it was the data."
(Haque cited by Poole 2014)

There are several issues that can arise with these arrangements. Looking at the advertising by tech companies to cities, some could also make the assumption that city managers would be enticed by these services so that they could make externals accountable for decision making (Poole 2014). The lines between public and private services get blurrier especially with participatory development, collaborative governance, public-private partnerships, and other cross-sector governance models making the accountability between the two unclear (Hartley & Kuecker 2018). This lack of accountability is one of the many critiques being made to smart city initiatives like in the Sidewalk Labs Toronto project.

"We're data points.
We've never been consulted and there is no notice of consent in these systems...
Who decides who gets nudged?"
(Kitchin 2018)

Another issue is a lack of transparency in regards to these smart city projects. Why bother with surveys and public consultations when you can surveil people instead and get more accurate results into what they

actually do versus what they claim to want? (Sterling 2018) Singapore can be seen as an example. They used their data in the beginning for counter-terrorism but developed it further for economic and immigration policy, real estate property and school curricula. Even more extreme is China's Social Credit Scoring which assigns a number to citizens based on their internet behaviour and could determine what loans, jobs, or travel visas are available to them (Helbing et al. 2017).

2.3.4 Business as usual: Smart Cities will destroy democracy

> *"In the end, the smart city will destroy democracy"*
> *(Hollis cited by Poole 2014)*

As cities continue to embrace advanced artificial intelligence algorithms to run various sectors in the city, there is a risk that without education, the digital skill divide and adoption gap will widen. This can lead to a situation where real power and authority can only truly belong with the small group of people who understand these black box technologies (Bartlett 2018). It would be a more efficient world but it would be a threat to participation and democracy.

The dystopian Big Brother view of smart cities predicts a city driven by the priorities of big tech where citizens' data is harvested for command and control centers like the Rio de Janeiro operations center (Koppikar 2015). Just to make things more grim, activism and protest are now taking place in large online spaces like Facebook which are technically private. The right to free speech does not need to necessarily be enforced and is currently in the hands of the tech companies. "These corporate spaces are functioning as utilities" (McLaren and Agyeman 2015).

What's so great about democracy anyway? Only 30% of US millennials agree that "it's essential to live in a democracy", compared with 72% of those born in the 1930s (World Values Survey analysed by Foa and Mounk 2016). The results in most other democracies aren't any different. The traditional Western liberal democracy is unable to solve modern problems and trust is eroding. People might actually start embracing the smart city informatic dystopias and our new AI overlord (Bartlett 2018).

Helbing et al. warn of a new data king, that uses data like a magic wand. In reality, it is implementing "big nudging" which is big data with nudging, basically using people's data to manipulate them into making decisions by design. It would make governing a large amount of citizens more efficient because it doesn't need lengthy civic consultations (Helbing et al. 2017).

2.3.5 The system was already bad to begin with

> *"It's a land grab for the command and control systems that were mostly already there."*
> *(Sterling 2018)*

All of these might be a natural progression of an imperfect democracy. Smart city tech could be just "standard urban practices, with software layered over" (Sterling 2018) where nothing fundamentally changes. Smart cities are just a rehashed vision based on outdated urban planning ideals but with a fresh coat of new technology paint as Novikov describes it (2015). He also criticizes the smart city's centralized infrastructure as the ultimate manifestation of top-down governance. The same criticism has been applied to personal technology which aside from organizing protests and revolutions, have only let the existing power structures continue to exist (Hartley & Kuecker 2018). For smart city technology to succeed, they must offer true disruption to these causes of inequality (Hartley & Kuecker 2018).

Smart cities must begin to listen to the voice of those often ignored by traditional government (Goldsmith & Crawford 2014). Beyond improving quality of life, how would smart cities affect social justice and be more inclusive (Smith 2017)? These kind of things are not something easily quantified or measured. Cities can't just put up online forms without consideration. It risks investing too much on residents who are already "the most engaged and the most digital" (Goldsmith & Crawford 2014, p. 68). Smart city projects should have a way to involve even those who are offline.

2.3.6 Are smart city residents and visitors really benefiting?

The current system is not doing well with the challenge of gentrification. It's not just about higher social class people moving into lower income neighborhoods and changing their fabric pushing out less privileged people. It can also take the form of public investments such as "transit induced gentrification" where certain transit investments can change the demographics of a district. There are exactly the sort of issues that need more civic involvement during the process (Smith 2017). One way could be the use of participatory budgeting. Another good example would be using IoT to help disabled people use the city better (Eid 2017).

Governments and the private sector should try to democratize information and technology (Hartley & Kuecker 2018). There should also be more "democratic oversight" and "citizen involvement" in the smart city agenda, improve privacy and security and embrace end-to-end strong encryption, and develop a smart city advisory board and strategy, a risk and compliance board, core privacy/security team and a computer emergency response team. (Kitchin 2018). Some problematic examples are 'anticipatory governance', 'predictive profiling' and 'dynamic pricing' that need more citizen consent. (Kitchin 2018)

2.3.7 Can civic participation be a way to take back control from big tech?

This research attempts to find a middle ground between the competing visions, one that can truly benefit the citizens who live in them. In Townsend's Smart Cities book, he mentions a quote from Jane Jacobs: "cities have the capability of providing something for everybody, only because, and only when, they are created by everybody" (Townsend 2013, p. 16).

Looking at the mixed outcomes of cities that have shaped their smart city services around technology and data alone, perhaps a different approach is looking at the smartness in the "imaginative, aspirational and engaged lives of citizens themselves" (Kane 2016). Even corporate is starting to embrace that "The way forward today is a community-driven, bottom-up approach where citizens are an integral part of designing and developing smart cities, and not a top-down policy with city leaders focusing on technology platforms alone." That was a quote from a vice president from Gartner, often cited by consulting companies, in 2018. They also encourage citizen-to-government dialogue.

The top-down approach is often criticized but perhaps the bottom-up movement is too idealized. "You need innovation and experimentation, and you won't get there without disruptive startups, eager developers, bold entrepreneurs and technically fluent tinkerers. The energy will bubble from the bottom up. City governments can help in providing infrastructure, access to open data, and incentives for innovation and collaboration, but creating and sustaining the community is vital" (Karjalainen 2017)

Bas Boorsma suggests that top-down versus bottom-up is a false dichotomy. Indeed, top-down initiatives fail to achieve success due to lack of societal buy-in or bad user experience design. On the other hand, bottom-up can have the local support from residents but lack the resources to scale. Both have to work together to make a new digital deal. Have an understanding of what is expected from all sides and resolve conflicts in power inequalities. He places an importance of "the collaborative ecosystem that involves citizens, the public and private sectors, and big and small organizations together. It is a scenario that allows each stakeholder to do what he or she does best. It presents solution design as an iterative process involving a multitude of different players, each leveraging his or her own strengths. For long-term success, there is no other way." (Boorsma 2017)

On the other hand, Camilla Siggaard from Gehl Architects sees smart city tech as a soft infrastructural upgrade. Rather than emphasizing centralization of resource management, the systems control over the city, she would rather see more support for existing small communities (2015). Jesse Hirsh also supports a better focus on local and participatory democracy for making a smart city more responsive, compassionate and democratic (2018).

And participation is not merely slapping a survey or consultation on top of smartphone apps. These citizen led ICT tools and trends have not really addressed the "systemic failures of our urban form—failures that have instigated our looking to the smart city in the first place" (Russell 2015). There is still a long way to go.

2.4 Understanding Civic Participation

Delli's definition of civic participation is "any individual or group activity addressing issues of public concern" (2016). It is frequently used interchangeably with civic engagement. The definition remains too broad and if it means everything, then it risks meaning ultimately nothing (Pateman cited by Carpentier 2012). Carpentier seeks to define participation grounded by democratic theory. He has six guiding principles on participation:

1. The key defining element of participation is power.
2. Participation is situated in always particular processes and localities, and involves specific actors.
3. The concept of participation is contingent and itself part of the power struggles in society.
4. Participation is not to be seen as part of the democratic-populist fantasy, which is based on the replacement of hierarchical difference by total equality.
5. Participation is invitational.
6. Participation is not the same as access and interaction.
   (Carpentier 2012)

The sixth principle is important as this is the source of confusion for many and why a lot of processes can be misconceived as "participation". In Figure 5, Carpentier presents his differentiations between access, interaction and participation. As his definitions are not specific to any field, they can be translated towards smart cities.

Figure 5. Access, Interaction and Participation. (Carpentier 2012)

Access (presence)

	Technology	Content	People	Organizations
Production	Presence of (proto-) machines to produce and distribute content	Presence of previously produced content (e.g., archives)	Presence of people to co-create	Presence of organizational structures and facilities to produce and distribute content
Reception	Presence of (proto-) machines to receive relevant content	Presence of (relevant) content	Presence (of sites) of joint media consumption	Presence of organizational structures to provide feedback to

Interaction (socio-communicative relationships)

	Technology	Content	People	Organizations
Production	Using(proto-machines to produce content	Producing content	Co-producing content as group or community	Co-producing content in an organizational context
Reception	Using (proto-) machines to receive content	Selecting and interpreting content	Consuming media together as group or community	Discussing content in an organizational context (feedback)

Participation (co-deciding)

	Technology	Content	People	Organizations
Production (and reception)	Co-deciding on/with technology	Co-deciding on/with content	Co-deciding on/with people	Co-deciding on/with organizational policy

A huge problem of corporate smart city understanding is that they often incorporate civic participation in a minimalist approach of democracy. For instance, in EasyPark's smart city ranking (2016), Singapore is at the top when it comes to civic participation. Upon further investigation of the calculation of the metric, it appears that the only variable considered was electoral participation which is a representative definition of participation. Taking Carpentier's definition of participation into consideration, that singular number would ignore most of his principles.

Furthermore, "election never provides sufficient direction to decide thousands of policy questions that a government must resolve in a year. True engagement takes more time and commitment" (Goldsmith & Crawford 2014, p. 55) Co-creation and consensus building isn't as easy as clicking a button. The problem is that the everyday person may not have that much extra time to commit for participation. And if participation is only meaningful if it needs to be a certain activity like a protest or being a volunteer, then participatory democracy can become elitist and exclusionary "when certain processes and tools widen the gap between the rich and powerful and the poor and powerless." (Polimedio 2017) There are also issues that go beyond the local municipality which require national policy and legislation.

This doesn't say however that civic participation cannot be an objective. "When people are part of organizations and face situations where they have to make difficult decisions, or even engage with people with different worldviews, they can become more tolerant and feel higher levels of political efficacy. At the same time, we also know that we're not going to get thousands of people marching every weekend forever." (ibid)

Neither can it be expected to solve every issue. However smart cities need to make sure that their civic participation aspects must be accessible and transparent for the people who want to. Designers of these technologies need to take into account "the limits, and perhaps distortion, of social media and people's willingness and ability to participate" (ibid). For civic participation to be more sustainable, it has to be something that lasts beyond short one time issues (ibid).

In regards to specific actions, engagement and participation are often used interchangeably or lumped together. The academe also has differing definitions. Joakim Ekman and Erik Amnå clear up the confusion between the different processes under civic engagement, civic participation and political participation. Table 2, the following table on the next page shows the typology that they developed to make the subject easier to define. Despite this, the line between civic engagement and formal participation can still be blurry.

The topic of participation shall be further elaborated in the State of the Art 3.4 where case studies will be listed and Theory chapter 4.3 and 4.4 which examine participation frameworks.

Table 2. Political Participation And Civic Engagement: Towards A New Typology (Ekman & Amnå 2012)

	Non-participation (*disengagement*)		Civil participation (latent–political)		Political participation (manifest)		
	Active forms (antipolitical)	Passive forms (apolitical)	Social involvement (*attention*)	Civic engagement (*action*)	Formal political participation	Activism (extra -parliamentary political participation)	
						Legal/ extra -parliamentary protests or actions	Illegal protests or actions
Individual forms	Non -voting Actively avoiding reading newspapers or watching TV when it comes to political issues Avoid talking about politics Perceiving politics as disgusting Political disaffection	Non -voting Perceiving politics as uninteresting and unimportant Political passivity	Taking interest in politics and society Perceiving politics as important	Writing to an editor Giving money to charity Discussing politics and societal issues, with friends or on the Internet Reading newspapers and watching TV when it comes to political issues Recycling	Voting in elections and referenda Deliberate acts of non -voting or blank voting Contacting political representatives or civil servants Running for or holding public office Donating money to political parties or organizations	Buycotting , boycotting and political consumption Signing petitions Handing out political leaflets	Civil disobedience Politically motivated attacks on property
Collective forms	Deliberate non -political lifestyles, e.g. hedonism, consumerism In extreme cases: random acts of non -political violence (riots), reflecting frustration, alienation or social exclusion	"Non -reflected " non -political lifestyles	Belonging to a group with societal focus Identifying with a certain ideology and/or party Life -style related involvement: music, group identity, clothes, et cetera For example: veganism, right -wing Skinhead scene, or left -wing anarcho -punk scene	Volunteering in social work, e.g. to support women 's shelter or to help homeless people Charity work or faith -based community work Activity within community based organizations	Being a member of a political party, an organization, or a trade union Activity within a party, an organization or a trade union (voluntary work or attend meetings)	Involvement in new social movements or forums Demonstrating, participating in strikes, protests and other actions (e.g. street festivals with a distinct political agenda)	Civil disobedience actions Sabotaging or obstructing roads and railways Squatting buildings Participating in violent demonstrations or animal rights actions Violence confrontations with political opponents or the police

Summary

In ancient cities, citizens were equal and active in making civic decisions. Alexandria is closer to today's modern city which has a representative democracy. The ideal city concept has evolved over time from Howard's Garden City, Corbusier's Radiant City to Jane Jacobs and new urbanism. Today, the original polis would be unrecognizable. The evolution of cities and technologies are interconnected and smart cities aren't an entirely new concept. However with the ubiquity of the internet, smart cities have captured the public's imagination.

Polemicists like Poole and Morozov warn against giving big tech companies too much control over our cities. This continues the trend of technology used massively and mindlessly, exacerbating problems that have been there before. There are issues of the lack of accountability, privacy, transparency and consent that have arisen. Continued outsourcing of city tasks and decisions to technology without analyzing the risks involved can possibly lead to the end of democracy.

Can the reintroduction of more civic participation from the city's residents save it from this threat? First, it must be clarified what civic participation actually entails. It is an act of that goes beyond mere ability to access and interact with the city and its governance.

3 State of the Art

This chapter looks at the latest research regarding cities and participation and how to proceed to talk about the city from there. In 3.1 are new ways to look at the smart city to focus on democracy. 3.2 dives into the democratic values mentioned previously. The question of who actually uses the city is answered by 3.3. In 3.4 the evolving processes of civic participation and new case studies are outlined.

Perhaps the key to unlocking the success of the smart city movement compared to previous techno-utopian fantasies, is to go back to our Hellenistic roots and consider eudaimonia over quality of life. Eudaimonia's meaning of happiness is more than one's personal enjoyment, but also one's contribution to society which in this case is giving them back control over their personal data that the government is collecting. Townsend concludes in his Social Science Research Council essay on smart cities: " ...the generation, use and handling of data about people and their activities needs to be baked into how city government works at the most basic levels. This will trigger debates about what rights people have to control information about them, and this will be the first step towards building the trust that will be needed for them to believe what the science that is done with their data says, what it means for policy, that it is even asking the right questions in the first place, and how governments use that to carry out their business" (Townsend 2017).

3.1 Reclaiming the City from Big Tech

In line with this way of thinking, noted technology polemicist Evgeny Morozov with Barcelona Digital Innovation Commissioner Francesca Bria in their paper Rethinking the Smart City, acknowledge the various criticisms against smart cities and remind us that cities are still capitalist market systems. They propose alternative ways of thinking about the smart city that involve ideas inspired by Paul Mason's keynote at the launch of Barcelona Institute for Technological Sovereignty in 2016:

Table 3. Rethinking the Smart City (Morozov and Bria 2018)

1. Promote **alternative data ownership** regimes.
2. Move information services to **open source, open standards**, and adopt **agile delivery**
3. Transform **procurement** to make it **ethical, sustainable, and innovative**.
4. Control **digital platforms**.
5. Build and grow **alternative digital infrastructures.**
6. Develop **cooperative models** of service provision.
7. Maximize innovation with **public value**.
8. Rethink **welfare schemes** and **complementary currency systems** at the local level.
9. Promote **digital democracy** and **digital sovereignty**.

The core values of their new principles emphasize democracy, transparency and sustainability. They urge cities to find alternative models aside from corporate structures, challenging the capitalist vision of the smart city with a more socialist point of view. Ben Green, who has worked extensively with data and technology in Boston, makes some similar suggestions in his book the Smart Enough City (2019). Both make a huge focus on the values of democracy.

Table 4. The Smart Enough City (Green 2019)

1. Address **complex problems** rather than solve artificially simple ones
2. Implement technology to address **social needs and advance policy,** rather than adapting goals and values to align with technology
3. Prioritize **innovative policy and program reforms** above innovative technology
4. Ensure that technology's design and implementation promote **democratic values**
5. **Develop capacities and processes** for using data **within** municipal departments

The following subsection dives deeper into what exactly are democratic values in the context of a city.

3.2 Democratic Values: The Right to the Smart City

David Harvey, a leading geographer in recent times, has called for "a right to the city movement grounded in an anti-capitalist ethic if we are to succeed in the quest for better urban living for all. (Harvey 2017)" As with Green, Poole and Boorsma, he agrees that thinking of the smart city purely in terms of efficiency will doom it. "Tech goggles" will not improve the current social inequalities in the city. It cannot give everyone "the right to decent housing provision in decent living environments. (ibid)" It will make cities more investable but not necessarily more liveable.

This call has been answered by Rob Kitchin, Paolo Cardullo and Cesare Di Feliciantonio in their paper "Citizenship, Justice and the Right to the Smart City." Harking back to Henry Lefebvre's 'Right to the City' concept which expands the right of the citizen from occupation and use of space to the actual design and function of the city. The concept has been further developed "the right to wrest the use of the city from the privileged new masters and democratise its space": it is the right of the excluded, the distressed and the alienated to demand and receive the material (e.g., a living wage, shelter) and non-material (e.g., recognition, respect, dignity) necessities of life (Isin 2000, Marcuse 2012 cited by Kitchin et al.).

It calls for the right for all city dwellers to fully enjoy urban life with all of its services and advantages – the right to habitation – as well as taking direct part in the management of cities – the right to participation" (Fernandes, 2007, p. 208 cited by Kitchin et al.). The right to the city is "not about inclusion in a structurally unequal and exploitative system, but about democratizing cities and their decision making processes. (ibid)" This is in line with Carpentier's definition of participation which is used in this paper.

3.3 Smart Residents and Visitors

In their book The City of Tomorrow, Ratti and Claudel proclaim that there can be no smart cities without smart citizens (2016). The rhetoric of most smart city literature still refers to "citizens." It can be argued that the term is not inclusive enough because it is not only legal citizens that use the city. The term ignores a substantial amount of people.

Immigrants and refugees in smart cities is an underresearched topic. Smart cities will no doubt attract new residents and future citizens. As innovation centres, some cities have thought of digital-inclusion and integration strategies. There have been no groundbreaking results at the moment but they are the first steps at making sure cities are equipped to handle upcoming trends in human migration. (Mattoo et al 2015) Some examples of these innovations include Refugees Welcome, which matches volunteer hosts to refugees in Berlin, a Welcome to Dresden app in multiple languages and Techfugees, a civic tech community in the UK that prototypes solutions for newcomers (ibid).

And what of tourists? The fragmented landscape of digital tools might be useable for locals but confusing for tourists and seasonal workers (Sterling 2018 Atlantic). Therefore, smart residents and visitors should be used as a more inclusive terminology. For simplicity, this paper will refer mostly to residents.

With the right to the smart city, what then is the role of the city resident to the smart city? Are humans destined to become human sensors that are data collection farms for big tech firms? Are people going to be predictable pixels on an urban dashboard? McLaren and Agyeman offer a city paradigm to go against the neoliberalism of smart cities. Since humans are natural sociocultural sharers, they are betting on our future in a city where resources, infrastructures, goods, services, experiences and capabilities are shared (McLaren, D. and Agyeman, J. 2015). The values of the city shift from convenience, security and efficiency to trust, collaboration, equity and justice.

3.4 Civic Participation in the time of Post-Representative Democracy

How then do people participate in the smart city? In 2.4, Ekman & Amnå outline some examples of traditional participation. However, taking them and making them available with ICT tools is oversimplifying the answer to that question. It would only cover a part of the tapestry.

In America, traditional metrics of participation such as voting, joining local organizations and civic exam results have been falling. Ethan Zuckerman, in his paper "New Media, New Civics," thinks that this is an outdated way to look at civic participation and that one cannot make assumptions from them. He counters the view that social media usage is simply slacktivism as Morozov has suggested, but also warns against embracing it wholeheartedly.

He presents evidence from Joe Kahne and Cathy Cohen's surveys which show that digital media is being used strongly by the youth for political discussion and disseminating civic content. Therefore, it is not surprising with the growing disillusionment towards the political process not just in the US, but in other countries

worldwide, that young people are disengaging with traditional methods of participation. In Europe, he points to Ivan Krastev who studied the movements in Spain and Greece under austerity. Krastev warns that "encouraging citizens to seek change through influencing those governments may be a dead end" if governments are powerless over external forces such as the global market (Krastev cited by Zuckerman 2013).

He posits that people want to participate but the traditional methods are no longer effective, thus it would be a lost cause. He cites Ron Fournier's interviews with the American youth where the results show that millennials are drawn towards service but dislike politics. In a similar study that he did with MIT's Center for Civic Media, people preferred to be labelled as activists rather than "political" because politics was "something professionalized, captured by powerful forces and entirely outside of their control."

Traditional methods facilitated through digital means have enabled direct participation which is happening in a "post-representative democracy." Unfortunately, because there are too many issues and too many options, there is a risk that people prioritize less urgent problems.

Numerous case studies of participation from various cities have already been documented by academics to mixed results. In Barcelona where Francesca Bria is the chief technology and digital innovation officer, the Data Commons Barcelona Program and Decidim are being trialled (Calzada 2018). In Japan's "Smart Communities," Granier and Kudo uncover that citizens are expected to provide very minimal input (2016). James Sloam finds evidence of young activists turning to new media to express dissent from digital platforms in Spain, blogging in Italy and the birth of pirate parties and liquid democracy (2014). Fedotova et al. review e-government platforms in Portugal finding that most are only on the informing and consulting level and call for more high level collaboration platforms (2012). In Manchester, Veeckman and van der Graaf find that living lab toolkits can help empower citizens (2015). Across the pond in the US, Desouza and Bhagwatwar come up with a framework for examining technology enabled participatory platforms in Philadelphia, Salt Lake City, Chicago, Tampa, Oakland, and Portland to name a few (2014). Although they see a lot of potential with them, they also point out issues of legitimacy and social selectivity.

Existing research has looked at lower levels of civic participation and social media with both positive and negative results. From Helsinki, in the case of Mechelininkatu street which involved citizens in the decision making process of a new bike lane, there were many clash of opinions which delayed the final outcome (Valjakka 2016). In Texas, only 50% of their local government agencies use social media for public involvement in transportation planning (Majumdar 2017). Gal-Tzur et al. also look into the use of social media in London for "bottom up" transportation planning (2014). A similar Glasgow study looks at tweets during the Commonwealth games and also concludes on the high potential of Twitter for civic participation for the design of transport systems (Cottrill et al. 2017).

Social media and other tools that foster participation serve as catalysts for people's preexisting alliances and sentiments. Surely, the Arab Spring and, to a smaller extent, Bernie Sanders's revolution, the Women's March, and Trump's "Make America Great Again" probably would have progressed at slower paces and potentially in a less well-organized fashion without the help of tools like Facebook and Twitter. But to claim that the existence of organizing tools was the fundamental reason behind the feasibility of these movements

is not an accurate assessment of the events that unfolded. Social movements were there before social media (Polimedio 2017).

A lot of the new technology enabled participation methods are rooted in non-digital participation. Issue reporting apps replace phone calls, participatory budgeting and co-creation can now be done online, mapping can be done with digital rather than paper and sketching urban design suggestions can be done with augmented reality (Vandenbroele 2017).

Summary

In order to reclaim the smart city, Morozov, Bria and Green present different strategies including alternative data ownership, open source, cooperative models and more ethical procurement. They all mention the importance of democratic values. This calls back to Lefebvre's 'Right to the City,' whose concept has been further developed from the citizen's right to occupation and public life to the right to democratizing the city from the privileged elite to including those who are marginalized to have the same rights. These are rights that smart city projects might intentionally or unintentionally take away. Adding to the discussion of inclusion in the city, the study calls for new terminology. The use of "smart citizens" excludes other people who dwell, work and visit in the city. These are the ones whose rights are the most threatened.

Civic participation in the age of social media has not gone unnoticed by academia. Zuckerman proposes that traditional metrics no longer illuminate the full picture of participation. Some examples around the world include social media, blogging, digital e-participation platforms, open street mapping and participatory budgeting.

4 Theory

In this chapter, a strategic review of frameworks is conducted in order to narrow down the numerous options in which to conduct the research. In 4.1, the city is viewed as a network composed of different communication links. Three kinds of frameworks central to the research are explored, namely smart cities in 4.2 and civic participation in 4.3 and a combination of both in 4.4. The first two topics on their own are generally well-explored in academia. A Google Scholar search of either "smart cities" or "civic participation" as of 2019 yields around 100,000 results. On the other hand, "civic participation framework" returns at least 68,000 and "smart cities framework" around 50,000. A joint search of '"smart cities" "civic participation" framework' results in around 700 articles.

Due to time constraints, only a small number of frameworks were reviewed. Existing literature reviews were also consulted. The criteria in selecting the frameworks are: high number of citations, most recent and the most relevant to the research question. Only including highly cited papers could miss out on the latest additions to the field and therefore the second criteria was added. The relevance to the research question was a more subjective criteria but was effective in reducing the selection. Frameworks that hit at least two of the criteria were considered. Due to the academic nature of this study, frameworks defined by corporations or commercial ventures were ruled out of consideration.

4.1 The City as Network

> *"The future smart city will be the internet, the mobile cloud, and a lot of weird paste-on gadgetry..."*
> *(Sterling 2018)*

According to Manuel Castells, cities "can be understood as 'platforms', or 'material interfaces' that connect individual city dwellers with collective practices, experiences and rhythm" (de Waal, de Lange & Bouw 2017). Echoing the sentiment, Paul Goldberger said that cities were 'the original internet', as 'random connections are what make them work, and surprise and a sense of in nite choice is what gives them their power' (de Waal, de Lange & Bouw 2017).

There are two kinds of communication links within the city as a network. The first is **"Citizen-Government-Citizen"**. As towns exploded into cities with big populations and an extended land area, the interpersonal relationship shifted from being neighbours to being mostly strangers. Larger populations meant weaker communications. The government became the new link between residents. (Novikov 2015)

With the new ubiquitous internet, mobile communication and new social network platforms, the second link, **"Citizen-to-Citizen"**, began to challenge the role of the public sector as the main link. "The Internet

makes it possible to create independent platforms for coordination between residents regardless of a city's size. Local authorities no longer hold a monopoly on mediation between residents." (Novikov 2015) An example of this is the peer to peer lending infrastructure in China (McLaren & Agyeman 2015, p. 110). It is a technological network manifestation of a cultural trait called guanxi, a net of mutual obligations.

Another link that the internet made even more scalable was the **"City-City"** link, no longer limited by geographical distances. One improvement made in a city in a different continent can be accessible by another.

4.2 Understanding Smart City Frameworks

How are smart cities currently being strategized and measured? How much importance do they place on the human factor? Majority of smart city frameworks fall under two categories: the macro view looking at the smart city as a whole and a micro view which looks at only one smart city initiative.

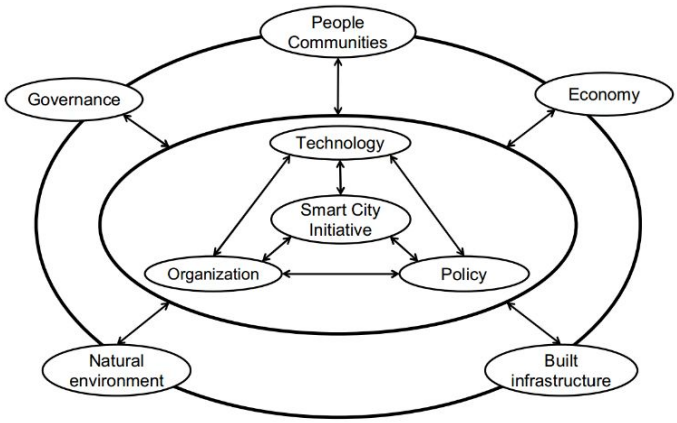
Table 5. Smart City Frameworks (Author).

Title	Year	Author	Source	Cited By
Understanding smart cities: An integrative framework	2012	Hafedh Chourabi, Taewoo Nam, Shawn Walker, J. Ramon Gil-Garcia, Sehl Mellouli, Karine Nahon, Theresa A. Pardo, Hans Jochen Scholl	2012 45th Hawaii International Conference on System Sciences	1470
Conceptualizing smart city with dimensions of tech	2011	Taewoo Nam & Theresa A. Pardo	12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times	1446
Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation	2011	Hans Schaffers, Nicos Komninos, Marc Pallot, Brigitte Trousse, Michael Nilsson, Alvaro Oliveira	The Future Internet Assembly	964
Smart city policies: A spatial approach	2014	M Angelidou	Cities	389
Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems	2013	S Zygiaris	Journal of the Knowledge Economy	343
How to strategize smart cities: Revealing the SMART model	2015	SB Letaifa	Journal of Business Research	217
Exploring Quadruple Helix: Outlining user-oriented innovation models	2010	Robert Arnkil, Anu Järvensivu, Pasi Koski, Tatu Piirainen	Tampereen yliopisto	185
Understanding 'smart cities': Intertwining development drivers	2018	Tan Yigitcanlar, Md. Kamruzzaman, Laurie Buys,	Cities	32

with desired outcomes in a multidimensional framework		Giuseppe Ioppolo, Jamile Sabatini-Marques, Eduardo Moreira da Costa, JinHyo Joseph Yun		
Analysis Matrix for Smart Cities	2014	Pablo E. Branchi, Carlos Fernández-Valdivielso and Ignacio R. Matias	Future Internet	27
The Hackable City: A Research Manifesto and Design Toolkit	2015	Cristina Ampatzidou, Matthijs Bouw, Froukje van de Klundert, Michiel de Lange, Martijn de Waal		27
Social Smart City: Introducing Digital and Social Strategies for Participatory Governance in Smart Cities	2016	R Effing, BP Groot	International Conference on Electronic Government	16
(Un)Plugging Smart Cities with urban transformations- towards multi-stakeholder city-regional complex urbanity	2016	Igor Calzada	URBS, Revista de Estudios Urbanos y Ciencias Sociales Journal.	10

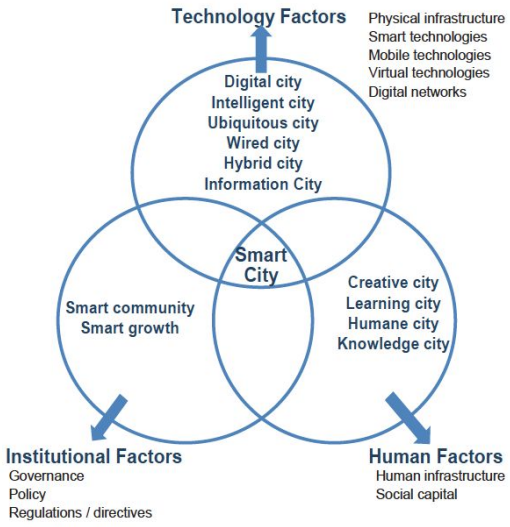
The most cited framework according to the Google Scholar search is the Success Factors model from Charoubi et al. in Figure 6. It places the smart city initiative in the middle of everything with people, communities and governance as success factors. It is an approachable and applicable model, however it only looks at the micro view and for this paper we also need something with a bird's eye perspective.

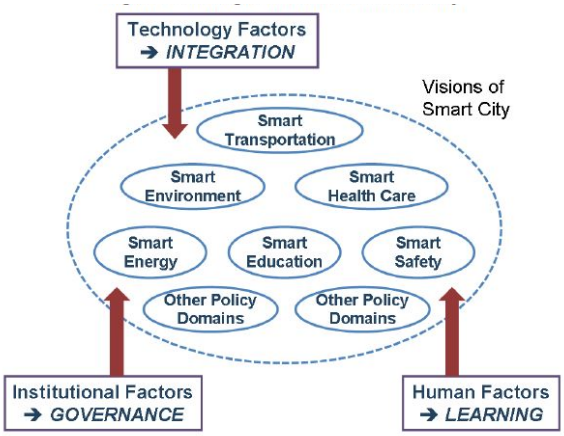
Figure 6. Smart City Success Factors (Charoubi et al.)



The second most cited paper is by Nam & Pardo, which is a macro strategic framework. In Figure 7, all the different city imaginaries can be seen being combined into the "smart city" as the all-encompassing narrative which was discussed in 1.1.2. Meanwhile in Figure 8, the different policy domains of smart cities are here. What seems to be missing here is the environment and societal factors that other frameworks have.

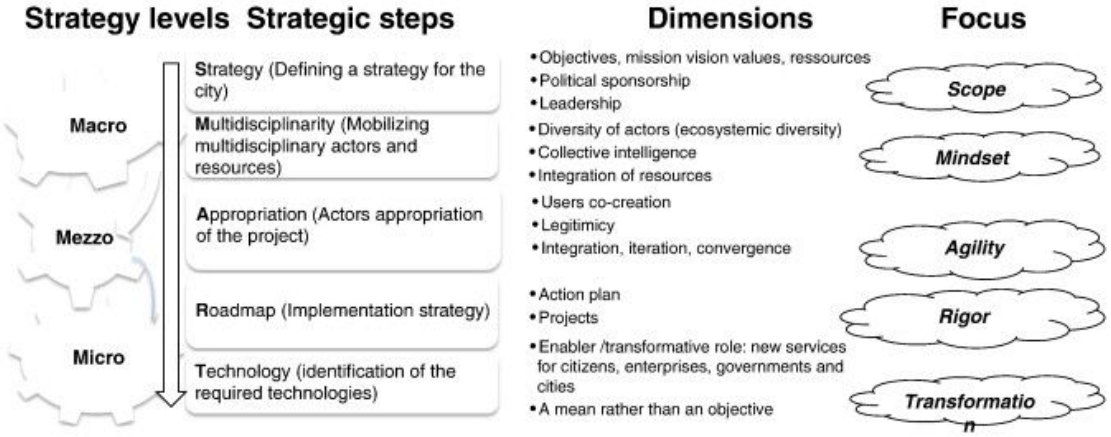
Figure 7 (left). Fundamental Components of Smart City (Nam & Pardo).
Figure 8 (right). Strategic Directions of Smart City (Nam & Pardo).





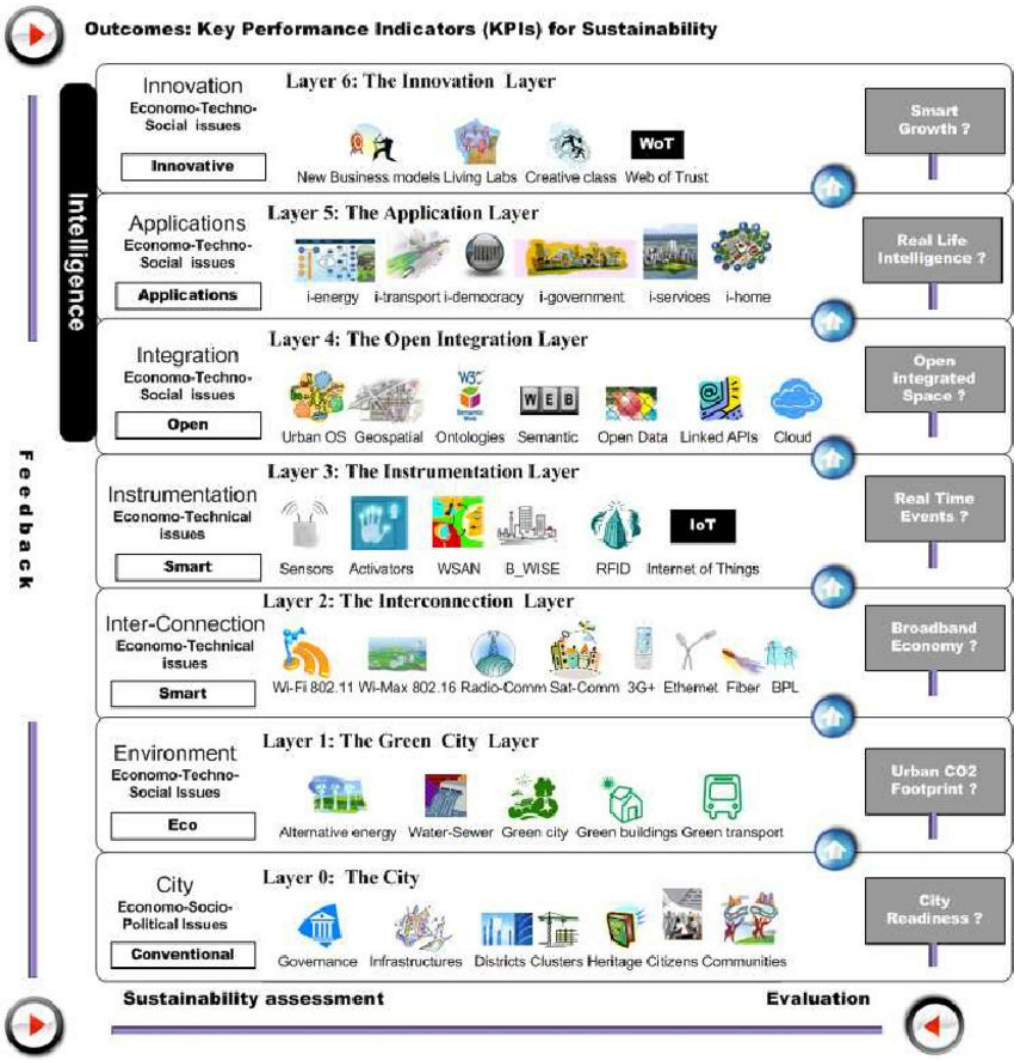
Next in Figure 9 is the SMART Framework by Letaifa which is another high-level strategic model for the smart city. What is good here is that it is an actionable step-by-step process for governance. Another advantage is the acknowledgment of multidisciplinarity, ecosystem diversity and co-creation with users.

Figure 9. SMART Framework (Letaifa)



The most complex macro smart city model to be evaluated is from Zygiaris in Figure 10 on the following page, which contains six fully-defined layers. Although this might be the most comprehensive framework, it might be too complex and rigid for the purposes of this research paper. A simplified version which also combines relevant factors from the other frameworks could be used.

Figure 10. Smart City Reference Model (Zygiaris)



Another strategic approach is developed by Angelidou who identifies four strategic choices a city can make:

1. National versus local strategies
2. Urban development stage: new versus existing cities
3. Hard versus soft infrastructure oriented strategies
4. Reference area: economic sector-based versus geographically based

What makes hers different from the rest is the focus on the geospatial factor of the city since the city does not merely exist in a technosocial vacuum. It also acknowledges politics can go beyond the municipal level. Smart city initiatives can be planned nationwide or even regionwide with the case of the European Union. Some can even span a global network.

4.3 Measuring Civic Participation: The classic way

As with smart cities, there are multiple frameworks that are available.

Table 6. Participation Frameworks (Author)

Title	Year	Author	Source	Cited By
A ladder of citizen participation	1969	SR Arnstein	Journal of the American Institute of planners	18578
Political Participation And Civic Engagement: Towards A New Typology	2012	Joakim Ekman, Erik Amnå	Human affairs	558
The split ladder of participation: A diagnostic, strategic, and evaluation tool to assess when participation is necessary	2015	M Hurlbert, J Gupta	Environmental Science & Policy	122
Beyond the Ladder of Participation: An Analytical Toolkit for the Critical Analysis of Participatory Media Processes	2016	Nico Carpentier	Javnost - The Public	68
A closer look inside collaborative action: civic engagement and participation in community energy initiatives	2014	J Radtke	People, Place & Policy Online	40

From the field of urban planning came about the ladder of civic participation. It consists of several levels including manipulation, therapy, placation, informing, consulting, partnership, delegated power and citizen control (Arnstein 1969). The bottom three levels are the non-participation levels while the ones at the top are the citizen power levels. Despite its age, it is still a widely used framework for participation.

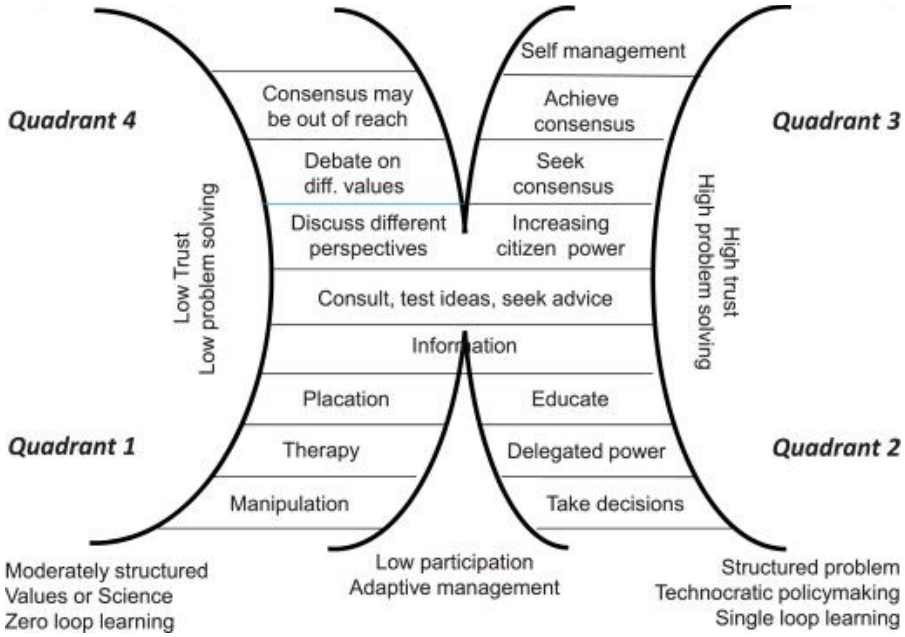
Table 7. Ladder of Participation (Arnstein)

Nonparticipation	1 Manipulation.	Both are non participative. The aim is to cure or educate the participants. The proposed plan is best and the job of participation is to achieve public support through public relations.
	2 Therapy.	
Tokenism	3 Informing.	A most important first step to legitimate participation. But too frequently the emphasis is on a one way flow of information. No channel for feedback.
	4 Consultation.	Again a legitimate step attitude surveys, neighbourhood meetings and public enquiries. But Arnstein still feels this is just a window dressing ritual.
	5 Placation.	For example, co-option of hand-picked 'worthies' onto committees. It allows citizens to advise or plan ad infinitum but retains for power holders the right to judge the legitimacy or feasibility of the advice.
Citizen Control	6 Partnership.	Power is in fact redistributed through negotiation between citizens and power holders. Planning and decision-making responsibilities are shared e.g. through joint committees.

	7 Delegation.	Citizens holding a clear majority of seats on committees with delegated powers to make decisions. Public now has the power to assure accountability of the programme to them.
	8 Citizen Control.	Have-nots handle the entire job of planning, policy making and managing a programme e.g. neighbourhood corporation with no intermediaries between it and the source of funds.

Until now, it is still being utilized by academia and public sector. Researchers have also attempted to make their own variations on it such as Hurlbert and Gupta's split ladder of participation.

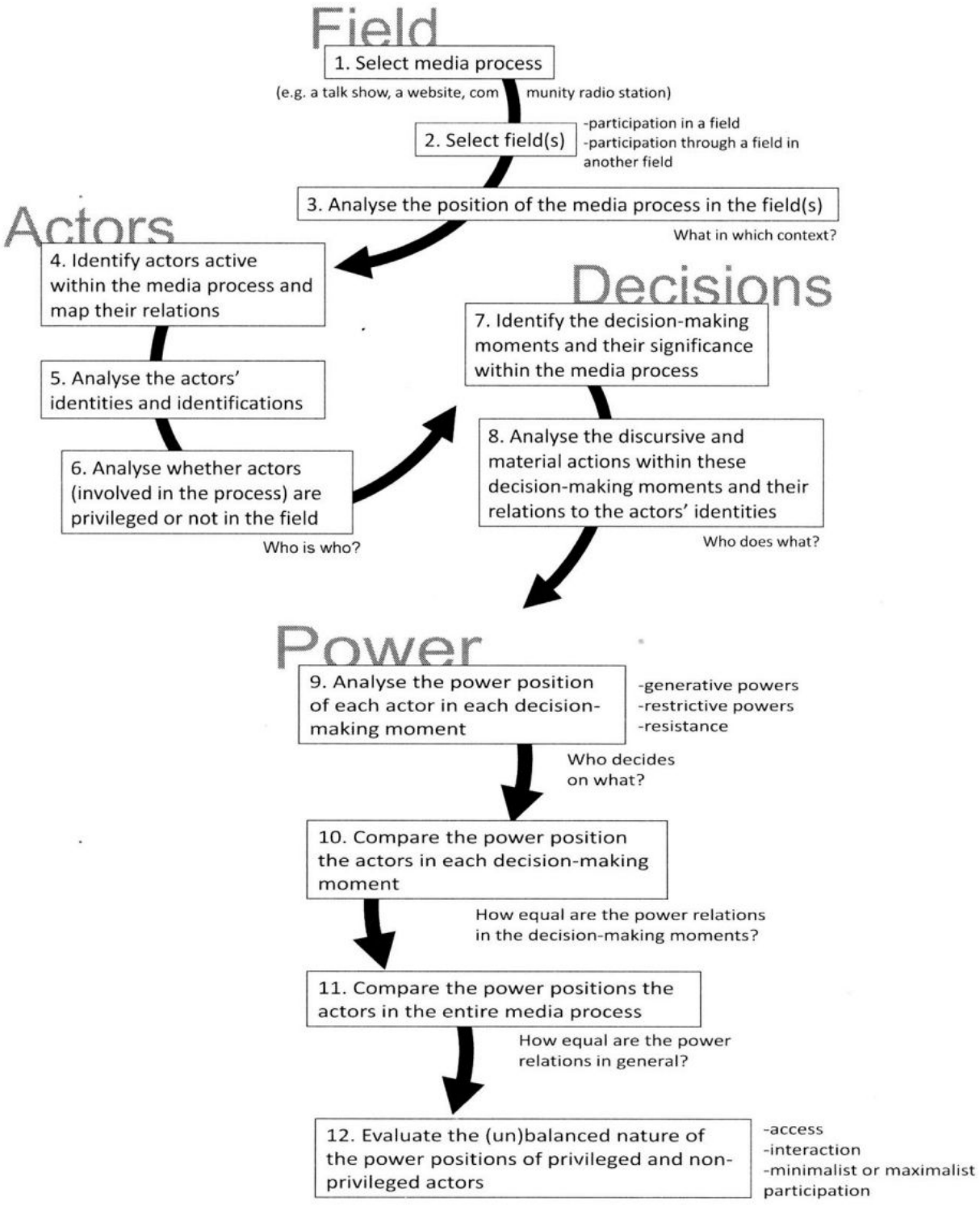
Figure 11. Split Ladder of Participation (Hurlbert & Gupta 2015)



However, Carpentier also criticizes ladder type models because it implies that processes can easily be put into boxes. He says that participatory processes are much more complex and multi-layered. He adds that over time, the same process can lead to varying levels of participation. The ladder approach also implies that it is something that can only go up or down. Another issue is that power becomes under-theorised. In reality, there are multiple directions and aims of different stakeholders involved.

To tackle the multi-layeredness, Carpentier offers his own Foucaultian model of analyzing participatory processes. His 4 part analytical model keeps in mind the definition of participation that acknowledges power and privilege. The participatory toolkit is illustrated in the following page.

Figure 12. Participation Toolkit (Carpentier)



4.4 Towards a Joint Framework of Participation in Smart Cities

In the history of cities, technology and participation, one of the key concepts to arise has been eParticipation. eParticipation is defined as "ICT-supported participation in processes involved in government and governance" utilizes a top-down approach (*source*). This research however, tries to look at participation from a broader perspective and thus eParticipation frameworks alone would not be adequate for our analysis.

Another debate in the literature is the inclusion of social media in civic participation. It has been denounced as "slacktivism" (Morozov). However, more recent studies have found that political social media use can lead to participation in offline activities such as the Extinction Rebellion (*source*).

The terminology that is gaining more traction is "civic technology" or "civic tech." This refers to technologies developed by city residents from the bottom-up (*source*). However since this does not include initiatives that originate from the government, a civic tech framework would also not be enough.

Table 8. Participation Frameworks in the digital age (Author)

Title	Year	Author	Source	Cited By
Social Media Use for News and Individuals' Social Capital, Civic Engagement and Political Participation	2012	Homero Gil de Zúñiga Nakwon Jung Sebastián Valenzuela	Journal of Computer-Mediated Communication	1231
From e-government to we-government: Defining a typology for citizen coproduction in the age of social media	2012	Dennis Linders	Government Information Quarterly 29 (2012) 446–454	806
Evaluating How eParticipation Changes Local Democracy	2006	Ann Macintosh, Angus Whyte	Proceedings of the 39th Annual Hawaii International Conference on System Sciences	96
Evaluating eParticipation Projects-Practical Examples and Outline of an Evaluation Framework	2009	Georg Aichholzer Hilmar Westholm	European Journal of ePractice	88
ICT Is Not Participation Is Not Democracy – eParticipation Development Models Revisited	2009	Åke Grönlund	International Conference on Electronic Participation	68
A framework for scoping eParticipation	2007	Efthimios Tambouris, Naoum Liotas,Dimitrios Kaliviotis, Konstantinos Tarabanis	Proceedings of the 8th Annual International Conference on Digital Government Research, Bridging Disciplines & Domains	60
Increasing collaboration and participation in smart city governance a cross case analysis of smart city initiatives	2017	Gabriela Viale Pereira, Maria Alexandra Cunha, Thomas J. Lampoltshammer, Peter	Information Technology for Development	25

		Parycek, Maurício Gregianin Testa		
A Multi-Level Framework for ICT-Enabled Governance Assessing the Non-Technical Dimensions of Government Openness	2011	MISURACA Gianluca ALFANO Giuseppe VISCUSI Gianluigi	Electronic Journal of e-Government	24
Citizen Participation in Smart Cities Evaluation Framework	2017	Anthony Simonofski, Estefanía Serral, Johannes De Smedt, Monique Snoeck	2017 IEEE 19th Conference on Business Informatics	11
Social Network services for innovative Smart Cities- the RADICAL platform approach	2016	Fotis Aisopos, Antonios Litke, Magdalini Kardara, Konstantinos Tserpes, Pablo Martínez Campo2 and Theodora Varvarigou	Journal of Smart Cities	6
Social Networks in Smart Cities: Comparing evaluation models	2015	Leonidas Anthopoulos, Panos Fitsilis	2015 IEEE First International Smart Cities Conference (ISC2)	5
The design of civic technology: factors that influence public participation and impact	2018	Andrew May and Tracy Ross	Ergonomics	5
Understand the Design and Implementation of Civic Technologies	2016	Youyang Hou	CSCW '16 Companion Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion	5
Evaluation of an eParticipation Project Against eParticipation Success Factors	2018	Hans-Dieter Zimmermann	International Conference on Electronic Governance and Open Society: Challenges in Eurasia	-
Making A Civic Smart City: Designing For Public Value And Civic Participation	2018	Engagement Lab at Emerson College, the City as Platform Lab at the University of Waterloo, and the Center for Smart Cities and Regions at Arizona State University	Knight Foundation	-

A good framework to base our analysis on is Linders' typology of citizen co-production initiatives (2012) which can be seen in Table 11. His approach looks at the different network links that are defined in 3.1. These include citizen to government, government to citizen and citizen to citizen. This has been the most comprehensive typology to use in the context of the smart city.

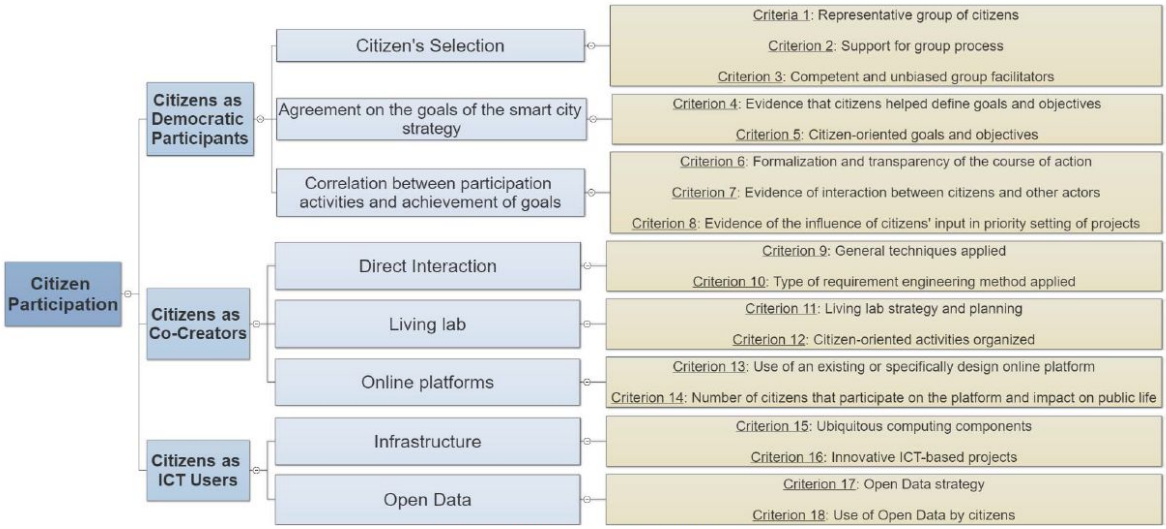
Table 11. Civic Participation in the Tech Context (Linders 2012)

Classifying citizen co-production initiatives in the age of social media.

	"Citizen sourcing" (C2G)	"Government as platform" (G2C)	"Do It Yourself Government" (C2C)
Design	**Consultation and ideation** Citizen consultation enables citizens to share their opinions with government, often in an attempt to improve representation and responsiveness and to help governments best select from among the policy and design alternatives.	**Informing and nudging** In informing, governments equip citizens with data needed to make informed decisions. In "nudging," government uses behavior economics to design policies and services in such a way that they preserve freedom of choice but encourage the "socially optimal" option (ex: changing "opt ins" to "opt outs").	**Self-organization** Citizen to citizen "self-organization" occurs when communities govern themselves with little or no interference from the government.
	Traditional: Town halls, letters, election board *ICT-Facilitated*: eRulemaking, IdeaScale, eDemocracy party	*Traditional*: Brochure, health label *ICT-Facilitated*: Crime mapping, data mining	*Traditional*: Neighborhood council *ICT-Facilitated*: "Smart mob", community portal, virtual world
Execution	Crowd-sourcing and co-delivery In "crowd-sourcing", government turns over a problem or activity for resolution or (co-)execution by citizens so as to tap into the unique skills, talents, and knowledge among the public. At the individual level, this could take the form of personalization whereby the citizen chooses or tailors the service to best fit their needs. At the level of society, this can take the form of funneling public services through social enterprises and volunteer groups.	Ecosystem embedding Government can create an environment more conducive to private (and peer) production via greater "embeddedness" whereby government agents become a part of the community through informal contributions that create public value and build trust, often outside of official mandates (Ostrom, 1996). More widely, this can take the form of openly sharing government knowledge, infrastructure, and other assets for use by the public that originally paid for them.	Self-service Self-service occurs when government expects citizens to essentially provide a "public" service themselves, sometimes within a facilitating framework provided by government. Examples include turning parks over to community volunteers or neighborhood watches. Self-service can also take a collaborative form whereby citizens help one another, as with car-pooling—the 2nd largest commuter transportation system in the US.
	Traditional: Crossing guard, park volunteer, charter school *ICT-Facilitated*: CrisisCommons, Challenge.gov, PeerToPatent, government-run wikis	*Traditional*: Academic alliance, embedded community health workers *ICT-Facilitated*: GPS, Gov Open Sourcing	*Traditional*: Private school, carpool *ICT-Facilitated*: Open Source, SETI@Home
Monitoring	Citizen reporting In citizen reporting, citizens provide information (i.e. intelligence) to government. Examples include feedback on government services (user satisfaction, etc.); reporting of crimes and potholes; and corruption monitoring.	Open book government Governments are increasingly moving towards "open book government" (Dunleavy & Margetts, 2010) whereby requests for information regimes are replaced by proactive information dissemination and a presumption of open publication. The goal is to make open and public the inner workings and performance of government to empower citizens to hold their government to account.	Self-monitoring Self-monitoring takes the form of "online citizen testimonial systems" whereby online customer feedback mechanisms replace "top-down, central controls over and regulation of local delivery in hospitals, schools, and local governments" (Dunleavy & Margetts, 2010).
	Traditional: 311/911, survey, office visit *ICT-Facilitated*: SeeClickFix, FixMyStreet	*Traditional*: FOIA, Fed Register, Bulletin *ICT-Facilitated*: Data.gov, Recovery.gov	*Traditional*: Word of Mouth *ICT-Facilitated*: Yelp, NHS Choice

However, a mere classification would only be descriptive. Another layer must be added in terms of looking at the evaluation of the participation. Simonofski, Serral, De Smedt and Snoeck attempt this in their own Citizen Participation Evaluation framework seen in Figure 13.

Figure 13. Evaluation of Citizen Participation in the Smart City (Simonofski, Serral, De Smedt, Snoeck)



However, their approach is limited in terms of only looking at three levels of participation and also a limited selection of smart city activities. This framework would be overly simplified to answer the research question. In chapter 9.2, all the lessons learned from this chapter reviewing the existing frameworks including the data generated by the methodology will be synthesized into an integrated framework.

Summary

After going through multiple frameworks, the most relevant models that can be applied to the research question have been selected. Nam & Pardo's macro approach will be used in chapter 6 to describe the components in the smart city of Copenhagen. An integrated framework of civic participation in the smart city using the Ekman & Amnå and Linders' typology are in 9.2 and 9.3. For a critical analysis of civic participation, a modified version of Carpentier's participatory toolkit is used to frame the discussion in 9.4.

5 Methodology

This research is an exploratory study utilizing a mixed methods approach with both deductive and inductive reasoning. The study will be conducted in 3 parts. The first part detailed in 5.1 is collecting the data which includes unstructured interviews, gathering smart city and participation projects and semi-structured interviews. The second part in 5.2 is applying thematic analysis to the semi-structured interviews in order to extract both macro and micro insights. Third in 5.3, the results from the data collection, project identification, interview analysis and participatory toolkit will be synthesized to produce an updated participation framework which will be used to better tell the story of civic participation in Copenhagen. The last section 5.4 goes over the limitations of the methodology design and the justifications of the researcher.

5.1 Data Collection

To supplement the framework development, additional data will be collected from desktop research and semi-structured interviews.

5.1.1 Unstructured Interviews

In order to understand more about the context in Copenhagen and further refine the research topic, immediate experts from the author's immediate network were consulted and more people were contacted using the snowballing technique. Further people were reached through contact over email or LinkedIn and attending events related to smart cities.

See the full list of interviewees and notes in Appendix 13.3.

Through the interviews, a clearer context of Copenhagen as a smart city was formed. Furthermore, the initial smart city topic was narrowed down to civic participation.

5.1.2 Smart City/Civic Participation Project Data

Smart city/Civic Participation projects in Copenhagen was collected through desktop research with Google, Facebook and Meetup events.

The criteria for qualifying as a smart city project in this list:

1. Use of technology
2. Used in Copenhagen
3. Involvement of citizens

Search keywords used:

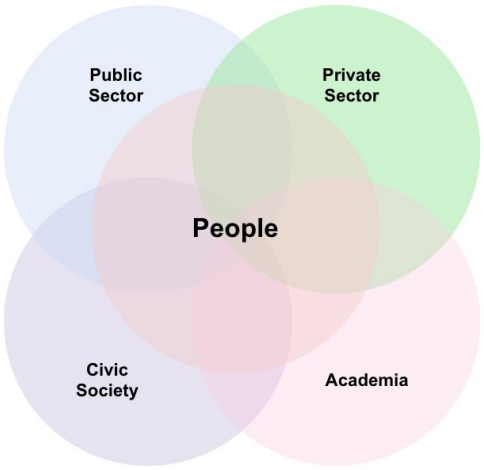
a. Smart city
b. Technology
c. Democracy
d. Design
e. Copenhagen, Copenhagen related places

Notes from events can be found in Appendix 13.4

5.1.3 Semi-structured Interviews

Two to three experts were selected based on the groups from the Pentahelix framework from "(Un)Plugging Smart Cities with urban transformations" (Calzada) and in order to reach the recommended 6-12 interviews before saturation (Ando et al. 2014). The Pentahelix framework is a logical next step following the Quadruple Helix model. The Pentahelix adds people to the quadruple helix. Other researchers refer to it as the Quintuple Helix (Carayannis & Campbell 2010).

Figure 14. Pentahelix Model (Calzada 2016)



The five groups are defined as follows:

A. Public
B. Private
C. Academia
D. Civil Society
E. Social Entrepreneurs

Finding contacts for groups B to E were relatively easy. However, group A was more challenging due to lack of connections and strict internal communication policies within the municipality.

The selection was attempted to be as diverse as possible, with experts from various disciplines and projects across different domains. All interviewees were given the option to choose the date, time and venue of the interview. They were equally given the option to see the questions beforehand but not everyone took advantage. All were also asked if they preferred to be anonymous, only one wanted to remain private. The interviews were recorded in two devices so that there would be a backup recording. Finally, a team of students were hired to transcribe the audio files and then reviewed by the author. Aside from the transcription, all of the research was done by the author.

Table 9. Interviewees (Author)

Interview Code	Group	Affiliation	Interview Notes
I01	A	Danish Design Center (Public Sector)	Met someone at event who referred me to her. Interview at office. Interviewee was very nice and cooperative. Gave me a booklet post-appointment.
I02	A/C	Copenhagen Solutions Lab, Copenhagen Business School	Referred by my work colleague. Had 2 phone calls with him. Second phone call had a big time difference due to him being in Boston.
I03	A/D	Formerly in charge of Open Data projects	Cold-emailed via LinkedIn. Interview at her office. Interviewee was passionate and spoke in length.
I04	B	KPMG Senior Consultant, Public Sector	Work colleague. Interview at office. Brief interview due to project not being a perfect fit.
I05	B	Freelance Architect	Referred by person who I met at event. Had phone call because she was based in Silkeborg.
I06	B	Google Airview Project (collab with 3 universities Aarhus, Utrecht, KU)	Referred by connection at Google. Interview at office. Busy but accommodating. Did not reply to follow up email.
I07	C	Aarhus University, Organicity, Open and Agile Cities	Cold email. Phone interview. Very rushed.
I08	C	Techno-Anthropology Lab, Aalborg University Copenhagen	Cold email. Interview at school. Busy but accommodating. Did not reply to follow up email.
I09	C/E	ITU Pervasive Interaction Technology Lab, IoT Expert, Public Wifi group organizer	Met at event. Answered via email due to having too many engagements.
I10	D	Gate21 - Senior Project Manager, Sustainability Projects for District Heating using IoT	Met at event. Interview at cafe. Relaxed and lengthy conversation.
I11	D	Alexandra Institute	Referred by person who I met at event. Interview at office. Brief tour at beginning. Realized that should have been interviewing his colleague. Unfortunately his colleague was too busy. Results still usable.
I12	E	Foodstack.org, WeOU	Met at event. Gave a tour of office and lab. Interview at outdoor area of office. Relaxed and lengthy conversation.
I13	B/E	KPMG Director of NewTech, Next Generation Democracy organizer	Direct boss at current job. 2 interviews at office. Relaxed and good conversation though slightly rushed.
I14	E	Initiativet.dk founder	Met at event. Interview at office. Relaxed and good conversation.

The questions were devised without only a singular framework in mind, but with the combination of different literature sources due to the exploratory nature of the report. Some of the questions were raised due to being research areas that lack attention. The full list is in appendix 13.5.

5.2 Thematic Analysis

After the interviews are completed, the transcripts were systematically analyzed and subjected to a thematic analysis. Thematic analysis is a robust qualitative method that can be inductive and deductive for uncovering patterns and ideas from qualitative data. Because it is so flexible, the methodology can differ depending on the school of thought. It is a good choice for an exploratory research study such as this where there is some theory already available. Due to its subjectivity, the disadvantage of thematic analysis is the issue of reliability and reproducibility. A different researcher could find alternative interpretations from the same dataset. It is imperative that the entire process is documented and that every step is transparent.

This research defines "themes" in two ways, the first is as a "domain summary" and the second defines it as a "meaning based pattern" (Braun et al. 2018). In domain summary thematic analysis, the themes are pre-defined analytical input where the result is a literal summary of the range of answers given in the theme-category. In the meaning based pattern approach or "reflexive thematic approach," a theme is an output of coding which is cultivated by qualitative and analytical thinking effort by the researcher. In this study, both definitions are accepted. Every line of data collected in a theme undergoes coding in which the meaning of the quote is assigned an index which allows for analysis.

Both domain summary and reflexive thematic analysis were performed in the following steps:

1. Develop domain summary themes from the questionnaire guide as analytical input. This is the first coding guide.
2. First coding of data using the domain summary themes. Simultaneously looking out for candidates for reflexive themes by spotting patterns. The coding was performed manually due to the small data size.
3. A second guide was created from the potential reflexive themes. Other methods used to help find themes include the aid of a digital word frequency tool.
4. A second coding of the data was performed. Some overlapping occurs. Some coding from the first version is corrected. The coding was also performed manually. New themes are identified.
5. The coding data is digitized for easier processing. More corrections of the coding were performed. Frequent recurring codes are upgraded into themes.
6. The data is filtered and separate tables per theme are created.
7. The narrative for the themes are written. In some cases, reflexive themes are merged back into the domain summary themes.

5.3 Synthesis

All the insights from the framework evaluation, data collection and analyses will be synthesized in this final step. The final framework will be described in chapter 9 and applied to the city of Copenhagen.

5.4 Issues with Current Methodology

Initially, a representative survey was considered for the research topic. However, during the question formulation and exploratory nature of the research, almost all the questions were open. Because closed questions are preferred for surveys, the plan had to be modified to qualitative interviews.

A criticism towards this methodology could be that, as a research about civic participation, should I not be interviewing the normal city residents? An issue with this is making a proper selection of interviewees. A randomized sample might lead to residents not knowing anything at all related to the topic. Another issue is the language barrier and missing cultural nuances due to the author's different background. A translator might be necessary should interviews be conducted in Danish. Cultural context is also a huge factor and double edged sword. I could notice some things that somebody raised in Denmark would not. But I could also miss some points that are embedded in the culture.

A workshop or focus group discussion methodology was also considered due to the interesting insights that bringing the different helixes would generate together. However, the experts were already difficult enough to schedule on their own that finding a date when a majority would be available to meet at one location would have to be scheduled months in advance.

5.4.1 Interview Biases and Challenges

The author is aware of the possibility of bias during selection of interviewees. Two of the semi-structured interviews were conducted with colleagues. The work relationship could influence their answers even though one of the projects discussed was not connected at all to the work. Five were scouted through attending related events to the topic of smart cities, technology, democracy and design. Another five were introduced via snowballing technique. The selection bias was dependent on the availability of events from October 2018 to May 2019 in Copenhagen.

These are addressed by going outside the immediate network and cold-contacting strangers to request interviews. Some never replied. Some also rejected on the basis of being too busy or the topic not being relevant enough. Three successful interviews came out of the cold-calling or cold-emailing method.

There is another issue with the questions not being equally relevant to everyone or needing to be adjusted to the context. In order to create a smoother flow and put the interviewee at ease, some questions have been rephrased which can have an impact on the answer. There are also cases when I ask about specific processes when a question might be too open for an interviewee and they don't know how to answer. This could lead to a biased outcome.

Although the general impression is that the answers had a sense of authenticity, there is of course the notion that some organizations would be hesitant in admitting more negative answers. Especially when the person that is sent for the interview is a Public Relations expert.

5.4.2 Limitations

Additional interviews could have been held with municipal project leaders and real estate developers. The topic of smart cities and civic participation is rather ambitious of size and scope. This research barely scratches the surface, especially with only one person on the team.

Summary

The three part methodology is undertaken through data collection, thematic analysis, and synthesis. Data is collected through unstructured interviews, gathering smart city and participation projects and fourteen semi-structured interviews. The thematic analysis method was selected in this study due to the exploratory nature of its research questions. The study utilises the thematic analysis described by Braun et al. which has an analytical input and output model. Through synthesis, the civic participation frameworks from chapter 4 are brought together and used to frame the results of the study. The limitations of the study due to the scope of the topic and potential interview biases include reproducibility and generalisability.

6 Copenhagen in Context

Using a combination of smart city frameworks from 4.2, this chapter includes a short background of the urban development, traditional civic participation, policy drivers and digital usage in Copenhagen in order for the reader to better understand the thematic analysis in chapters 7 and 8. Basic facts about the city are enumerated in 6.1 and traditional civic participation metrics are presented in 6.2. The technological factors about policy and governance are discussed in 6.3 and digital usage is examined in 6.4.

6.1 Key Facts and Figures

Copenhagen is the capital city of Denmark, with a population of 775,033 (Danmarks Statistik 2018). It is ranked first in EasyPark's Smart City Ranking study (2017) and Future Today Institute (2019). It frequently graces livability and quality of life rankings. Cities around the world turn to Copenhagen for cycling infrastructure and sustainability inspiration. One of its lofty goals is to be the first carbon-neutral capital in the world by 2025. Denmark is often misconceived to be a socialist country, rather it is capitalist with a welfare system. It has been a democratic society since the establishment of the Danish Constitution (Grundloven) in 1849.

Figure 15. Empati Fremfor Profit (Empathy instead of profit). The picture on the left taken by the author captures graffiti in the city expressing dissent on a real estate development.

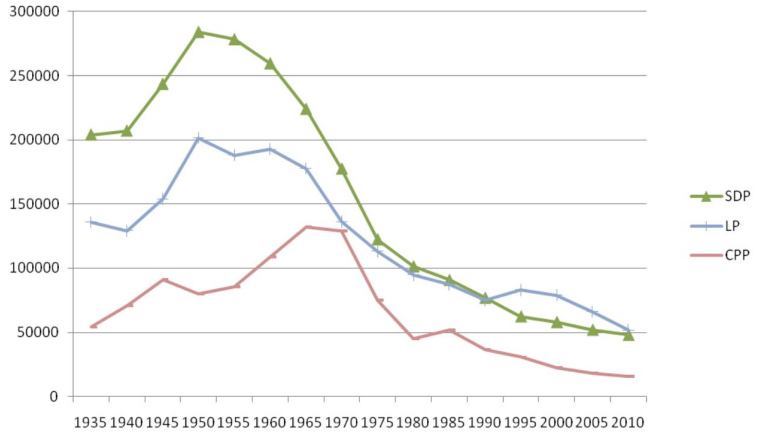
Despite all its praises, it is by no means a perfect city. There are issues with affordable housing. It is dealing with the effects of climate change like the rest of the world. Gender equality is falling behind other countries while other Nordic countries are in the top 5. Immigration policy veers further right. Citizens complain about declining public services despite high tax rates.

Echoing the words of Rem Koolhaas in 2.3, the architecture critic Kristoffer Lindhardt Weiss says that Copenhagen's values have shifted from accessibility, transparency and openness which were the foundations of the welfare society (). It is now a "prosperity city," a space that only benefits the few. The success of the welfare system which allowed for social mobility, which ironically brought on the rise of inequality again. Copenhagen may be the most liveable city in the world, but for who?

6.2 Danish Civic Participation Metrics

Harking back to the "new media, new civics" trend as described by Ethan Zuckerman in 3.4, a similar situation can be seen building in Copenhagen and the rest of the country.

Figure 16. Top 3 Danish Political Party Membership Rates (Kosiara-Pedersen 2009)



SDP - Social Democracy Party LP - Liberal Party CPP - Conservative People's Party

In Kosiara-Pedersen's study, she notes that membership figures alone do not show the whole picture. Smaller parties have had considerable gains. However, not all the members participate equally. She says it is concerning that there are low levels of participation but also it could be good that a lower barrier to access participation allows more people to join.

On the volunteering sector, the proportion of volunteers in the population and outside the working community is 41% (Social Ministeriet 2017). Both the volunteer population of Denmark and the proportion of volunteers have been stable from 2012 to 2017. Meanwhile, the proportion of non-working citizens who are volunteers has risen from 26% in 2012 to 30% in 2017. The proportion of volunteers who are engaged in the social field (eg pensioners' associations, weather centers, refugee friends and day-care institutions) has increased from 3% to 7% since 2012.

These findings are consistent with the general sociopolitical environment described by Zuckerman.

6.3 Smart City Policy and Governance

The municipality of Copenhagen adheres to EU policies and standards, national and regional strategies regarding smart cities and digitalization. This subchapter gives a short summary of the multitude of overlapping agendas and priorities.

6.3.1 EU

One of the EU's initiatives for smart cities is called the European innovation partnership on smart cities and communities (EIP-SCC). The main aim is to "improve urban life through more sustainable integrated solutions and addresses city-specific challenges from different policy areas such as energy, mobility and transport, and ICT." The priority areas include: sustainable urban mobility, sustainable districts and built environment, integrated infrastructures and processes in energy, information and communication technologies and transport, citizen focus, policy and regulation, integrated planning and management, knowledge sharing, baselines, performance indicators and metrics, open data governance standards, business models, procurement and funding. The citizen focus priority is important to highlight as it is relevant to the subject of this research. They have already begun projects in this area, one of which is called the CitizenCity.

As a digital single market, the EU has established the following policies on smart cities as listed on their website:

- Cross-border corridors for Connected and Automated Mobility (CAM)
    - 29 European countries are committed to the development of large-scale testing sites of connected and automated driving on European motorways in the form of cross-border corridors.
    - A collaborative network of cross-border corridors between European countries will enable a better environment for the testing and deployment of 5G technology.
- Energy
- Environment
- Clean transport, Urban transport

Under EASME, the Executive Agency for SMEs, the EU also launches bids for its member cities to join. has just launched a new tender, the Intelligent Cities Challenge. The Digital Cities Challenge was successful in 41 European cities and they have decided to go further with the Intelligent Cities Challenge. The EU also has the Research and Innovation Framework Programme Horizon 2020 which funds many projects related to smart cities including ones that are mentioned in this paper.

The priority themes listed in the Urban Agenda for the EU overlaps with those of the EIP-SCC in urban mobility, sustainability, procurement, digital and energy transformation. Other themes are Air quality in cities, Circular economy in cities, Climate adaptation in cities, Culture in cities, Housing in cities, Inclusion of migrants and refugees in cities, Jobs and skills in the local economy and Urban poverty.

6.3.2 A stronger and more secure digital Denmark

Denmark has no smart city strategy, something that has been called out as sorely needed in a report by ARUP and CEDI (2016). Currently, it only has a small section on smart cities under the national digital strategy. Within its definition, smart cities focus on technologies such as IoT and data. As a front-runner in climate adaptation, energy efficiency, waste management, and user-friendly design and architecture, Denmark is positioned to be a top exporter of smart city solutions.

Public sector data has been listed as a growth driver for the country. GPS data is particularly highlighted because of the upcoming launch of the European Galileo satellite navigation system. Open data and smart city partnerships are also prioritized.

Bo Fristed, head of the ICT department and smart city work in Aarhus municipality calls for a national architecture and standardized smart city solutions: "Today we know that only about 10% of the municipalities work in a concrete and strategic way with smart city. We lack a common municipal framework architecture for the Internet of Things (IoT). Today we have 98 municipalities that risk working with each their own systems. It may be that a common IoT framework architecture must be anchored at Kombit (the municipality's IT community, owned by KL, ed.). If we can make a national solution on formats and standards, it can become an important infrastructure for smart city solutions. ()"

Two more strategies have been published by the government namely the 'Danish Cyber and Information Security Strategy 2018-2021' and the National Strategy for Artificial Intelligence. They aim to improve coordination and cooperation in digital security as well as develop an ethical foundation for artificial intelligence. These strategies provide a good support for smart city strategies to be developed from.

6.3.3 Smart Greater Copenhagen

The region of Greater Copenhagen has invested into a regional strategy for smart growth with the vision of "developing the smart region of the future, where digital initiatives contribute to a green and innovative region with high growth and quality of life." The main goal is using technology and user-driven solutions to solve challenges, including traffic, climate and health. It should also "create the best framework for the development of more coherent digital systems, automations and artificial intelligence (AI), which can increase growth and jobs." The focus areas include building digital infrastructure and a common data hub in Greater Copenhagen.

They hope that more than 75% of the municipalities in the region will have a smart city strategy in 2020 and that over 50% will have implemented at least one smart city solution within e.g. mobility, energy and lighting. The strategy also has very ambitious economic targets like tripling the employment within smart growth companies in 2025.

The following study reports are available on their website:

- Greater Copenhagen Wifi and Contemporary Mobile Broadband coverage
- Needs Analysis for a Common Data Hub and Competence Center - The Way to Strengthened Digital City Development in Greater Copenhagen
- Mapping of the Capital Region Smart City Competencies and Initiatives

The regional projects include SMART Greater Copenhagen 1 og 2 - Kom Digital which support digital literacy in SMEs, Smart Innovation where small companies can develop a product prototype with DTU, SMART WATER, a water digitization project with a focus on business growth and optimization, Safer Copenhagen, for open but secure access to data and Ready for smart growth, educational courses for the municipalities on available smart city solutions.

6.3.4 Municipal Strategy

Copenhagen doesn't currently have a smart city strategy but it did have a digitalization strategy from 2015 to 2017. Its overarching strategy at the moment is Community Copenhagen 2015-2025. The municipality also has local policies on an action plan for green mobility, intelligent transport systems or ITS, clean public transport, traffic in regional context etc. It also has a strategy for city nature for developing Copenhagen into a green and climate-adapted city.

Copenhagen has a lot of work ahead of itself if it wants to achieve its ambitions. The core organization in charge of the smart city is the Copenhagen Solutions Lab, led by Marius Sylvestersen. He has pointed out the first mistake of the smart city area: "...we have previously been too focused on the technologies and not the problems. We have used a lot of gunpowder on the fiber network, wifi, artificial intelligence and other technological solutions instead of focusing on what problems we would like to solve and see which technologies are best suited to the task. ()" One of its majorly invested projects, the City Data Exchange platform which cost Copenhagen 9 million DKK, has already been shut down. The municipalities' data has inconsistent quality so companies don't see the business value in them.

Another big hurdle that smart city projects need to overcome is moving from pilot to scaling up. "Cities are probably the most complex area of the Internet of Things, because they are open environments where an infinite number of factors are involved. It is much easier to develop Industry 4.0 solutions for closed production environments, where the manufacturer has control over all processes. You don't have that in the city. Therefore, we must make sure to develop systems and solutions that can handle that complexity," says Martin Brynskov, associate professor of information science at Aarhus University with a focus on smart cities ().

6.4 High Digital Usage in Denmark

What Copenhagen has going on for it is its digital infrastructure. According to the Digital Economy and Society Index (DESI), Denmark is one of the most advanced digital economies in the EU. Denmark is leading in the field of connectivity (4G and broadband) and average in human capital. Over two thirds of the population have basic digital skills while ICT expert population is also rising. The study cites the initiative 'Danish Technology Pact' and National Coalition for Digital Skills as factors to its strong performance in the index.

Denmark is also leading in the usage of internet services as 95% of the population use it regularly. Only 2% of Danes have never used the internet, far below the EU average of 11%. In the following table is a breakdown of online activities and the percentage that use them.

Table 10. Citizens use of eBanking, eCommerce and interaction with public authorities online (DESI 2019)

	Denmark				EU
	DESI 2017	DESI 2018	DESI 2019		DESI 2019
	value	value	value	rank	value
3a1 People who never used the internet % individuals	**2%** 2016	**2%** 2017	**2%** 2018	***1***	**11%** 2018
3a2 Internet users % individuals	**94%** 2016	**95%** 2017	**95%** 2018	***1***	**83%** 2018
3b1 News % internet users	**NA** 2016	**86%** 2017	**86%** 2017	***9***	**72%** 2017
3b2 Music, videos and games % internet users	**90%** 2016	**90%** 2016	**90%** 2018	***4***	**81%** 2018
3b3 Video on demand % internet users	**49%** 2016	**49%** 2016	**56%** 2018	***3***	**31%** 2018
3b4 Video calls % internet users	**60%** 2016	**62%** 2017	**69%** 2018	***5***	**49%** 2018
3b5 Social networks % internet users	**77%** 2016	**78%** 2017	**81%** 2018	***6***	**65%** 2018
3b6 Professional social networks % internet users	**30%** 2015	**31%** 2017	**31%** 2017	***2***	**15%** 2017
3b7 Doing an online course % internet users	**NA** 2016	**9%** 2017	**9%** 2017	***10***	**9%** 2017
3b8 Online consultations and voting % internet users	**14%** 2015	**14%** 2017	**14%** 2017	***5***	**10%** 2017
3c1 Banking % internet users	**91%** 2016	**92%** 2017	**92%** 2018	***3***	**64%** 2018
3c2 Shopping % internet users	**84%** 2016	**82%** 2017	**86%** 2018	***2***	**69%** 2018
3c3 Selling online % internet users	**36%** 2016	**30%** 2017	**30%** 2018	***5***	**23%** 2018

Open data, a new addition on the index, Denmark ranks quite low at 27. As from 2018, the level of maturity of open data is based on the four following indicators:

I. Open data policy: the presence at national level of specific policies on open data, licensing norms, and the extent of coordination at national level to provide guidelines to national, local and regional administrations, and set up coordinated approaches towards data publication.
II. Open data portals: the development of national portals and their level of sophistication to feature available open data.
III. Open data impact: the impact of open data at country level on four dimensions: political, social, environmental and economic.
IV. Open data quality: the extent to which national portals have a systematic and automated approach to harvesting and the compliance level in terms of the metadata standard DCAT-AP (specification for metadata records). (DESI 2019)

However there are not yet any data ownership standards aside from GDPR.

Summary

Copenhagen is a leading world capital and frequently features on 'best of' lists and rankings. However, like any other city, it faces the same problems that rapid urbanization brings about such as rising inequality. Just as Ethan Zuckerman described in chapter 3, traditional metrics of civic participation such as party membership are falling while volunteering is rising.

As a member of the European Union, Copenhagen is subject to the EU's Urban Agenda. This is a good deal for smart cities because the EU offers funding for many smart city related projects as long as it aligns with their strategies and standards. Denmark ranks near the top in terms of digital infrastructure and usage. All these factors combined lead to a solid foundation on which the smart city can be developed on.

7 Thematic Analysis

This chapter presents the first part of the results of the study. These are the domain summary themes, a list of themes derived from the interview guide from 5.1.3, which are the analytic input:
Smart City Project Goals, Citizen Involvement, Metrics and Measurement Methods, Recruitment of Participants, Motivations of Project Creators and Participants, Current and Emerging Technologies and Opinions on the Public Sector. Every theme will be discussed in its own subchapter.

7.1 Smart City Project Goals

Within the area of the different goals of their specific smart city projects and the smart city in general, there have been common patterns observed.

7.1.1 Goals of Individual Projects

The smart city project usually falls into a domain specific or area of interest such as **environmental issues, green city** and **sustainability** being a top priority. This is in line with Copenhagen's brand as a green city as stated in chapter 6. **Mobility** was also a domain that was mentioned multiple times such as in the National Access Point project which aims to "share all traffic and travel data in Denmark, in one place."

Another major point of discussion for smart city project goals is **data**, particularly about ownership, control, openness, access, awareness and understanding. This is in line with the discussion by Carpentier about the difference between access, interaction and participation. *These are further discussed in 8.1 and 8.2.* Building communities, networks and ecosystems was also a goal of the projects. *This theme is discussed with more detail in 8.8 and 9.1*

Interviewees also had a **discussion** or **conversation** component in regards to what their project is about. The power of conversation is in its potential to give rise to grassroots movements. I12, I13 and I14 told the story of how their communities began just with the small act of talking to their friends. I14 also highlighted that it is not just conversation that is vital, debate and spaces for debate are highly needed especially in the digital sphere.

Standardization is also necessary for scaling, which is the next step for smart cities. The concept of **minimal interoperability** was brought up by two of the subjects. Minimal interoperability means the interoperability of data, systems, and services between cities and suppliers around the world on the minimal common ground (OASC 2019). This could bring about the original desired aims of the smart city which include efficiency, lower cost for innovation, data-driven policy making and local economy stimulation (ibid).

7.1.2 General Smart City Goals

Interviewees also shared their opinions on what they thought smart cities were for. **Technology to solve problems** was another repeated theme, veering close to the technology solutionism that polemicists warned about. Although at the same time, its counterpoint was also raised "**not tech for techs sake**" and data as a means not the end. I03 mentioned that "Smart City could be an area in which we don't focus so much on the data itself, but we focus on some kind of thing that either a problem we want to solve, or new opportunities that we want to bring into the world. And then data just becomes the means and not the end goal."

I02 mentioned that Copenhagen could take some lessons from Barcelona's experimentation. This is in fact already happening. In I07's Organicity Playbook, experimentation is a core methodology.

The results here mirror the expectations gathered from the literature review in 3.1. Companies, NGOs, municipality actors and community leaders have listened to the critiques of the smart city, acknowledge its fall from hype and are recognizing the need for transparency and standardization. However, this cannot be generalized into the whole city due to the selection of most interviewees and projects with some level of participation involved.

7.1.3 Who is it for?

Interviewees usually mention who the main stakeholders in their projects were after the initial question about their goals. After being prompted for a specific "who is your project for" question, I03, I13 and I4 have said "**everybody.**" And why shouldn't it when "it's all ages, it's all races, it's all classes of society affected" by the power in society shifted by technology.

However, just because a smart city project is intended for "everybody" did not necessarily mean that the project is really accessible by "everybody" when inspected with a microscope. Only one interviewee, I04 from the private sector, explicitly said that the specific target audience was "**not for you and me.**" Ironically, it would still be accessible by the public, but perhaps not easily usable.

Another thing to note is the rhetoric that the interviewees use, either referring to people as "**citizens**" and "**users**." "Citizens" is not the most inclusive term since it excludes other people in the city. However, it is being used as a blanket term to mean everyone in the city by the interviewees. Meanwhile, "users" is a technological based term and reduces the power of someone to just be a consumer rather than a "**partner**" or co-creator.

7.2 Involving People

This next theme is really at the core of the research. Looking at the different answers of the interviewees, a broad spectrum of participation and understanding of it can be gleaned. There are some projects which involve people from start to finish and some where people are thought of as central to the whole project yet

not involved at all. Most of the methods where people were involved fit into the typology for co-creation in the age of social media (Linders 2012) which is used as a frame for this subchapter.

7.2.1 C2G Citizen Sourcing

Consultation and Ideation

Traditional methods of gathering feedback through **consultations, fieldwork, interviews** and **meetings** are still heavily used (I01, I02, I03, I05, I06, I10, I11). The only ICT intervention is only when interviews are done online such as via email (I11). During this phase, challenges, how-might-we's and best practices are identified by design experts working in or outsourced by the public sector.

Design thinking and **participatory design** seem to be used more and more in conjunction to the traditional citizen consultation method (I01, I02, I10). The difference between the two is that during consultation, the public sector presents a project and then gathers opinions from the people. Whereas design thinking and participatory design methods are introduced earlier in the process and people have an active role in co-creating the project. Participatory design also has roots in Scandinavian culture. Common methods include **workshops**, **focus group discussions**, **prototyping**, **experimentation**, **ideation** and **brainstorming**. Although these methods are used frequently during the design phase of a project, they can also be used for day-to-day crowdsourcing of ideas.

Hackathons and similar **competitions** are another way of the government to get innovative ideas from city residents (I02, I03). They have been criticized as innovation theater due to lack of results although I02 claims otherwise.

Crowdsourcing and Co-delivery

Another participatory method that is being used more with good results is the **living lab** (I07, I09, I10). It is a relatively new user research concept that is centred around people and communities (Bilgram et al. 2008). People are not just observed subjects but contribute heavily to designing their future. The living lab is neither top-down nor bottom-up but a collaborative ecosystem of partners.

One of the projects discussed, Underbroen is a **fab lab** (I02), a space where makers can access digital fabrication tools. Underbroen is a fab lab specifically for creating smart city solutions where the public sector finds inspiration from the members. I02 mentioned that at least one of their inventions has been used as a real solution.

Citizen science is another area that requires civilian volunteers to collect data. "For example, to get people who are very enthusiastic about nature to actually go out in certain areas and count the proliferation of a certain plant or insect or something and reported back (I03)." However the interviewee also warned that this was not a reliable source of labour because people only did it out of interest.

Citizen Reporting

If the number of users is any indication then **report apps** are a very successful method of participation. I02 describes an app where "we ask them where's a pothole or a dangerous cross or missing pipe path in the city

and since they're the users, the daily users so they know it best" got 12,000 data points in 10 days. He thinks that the lesson is to "make sure that you are interested in what the citizens have to say and make sure that it is a question that you know they can give a bit of answer to than you can figure out yourself." Although popular, an issue with reporting apps such as this, is that it usually has a specific question it asks people and therefore, a narrow type of participation.

7.2.2 G2C Government as a Platform:

Informing and Nudging

This category of methods aims at equipping people with enough information to make informed decisions I02 wanted to make smart city technologies more democratized for the people to understand. I06's project with the municipality aims to make their air pollution collection data public. I10 describes how a joint venture with an energy company can use your electricity usage data to "nudge" you into using less heating. However, she also notes that there is not yet an opt-in or opt-out mechanism designed for it. Their organization publishes project reports but nobody reads them.

Ecosystem embedding and Open book government

On the other hand, an open book government would require all data excluding personal and competitive data to be made public. I03's **open data** project is "about identifying basic data or core data sets that many, many public authorities, at all levels that could be central, regional and local, use over and over again. This should be shared in a very easy way." I04's project, **National Access Point**, aims to make all national transport data public. This is good news for the transparency being called for by smart city critics.

However, when asked if the average person can handle open data, the answer was sadly no (I03). And I04 stated that the transport data project was not directly aimed with people as the end-users. It would be other businesses' task to transform that data into something usable. How open is open data if a normal city resident can't understand it?

7.2.3 C2C DIY Governance

This section is where the bottom-up smart city initiatives fit into.

Self-organization

I09, I12, I13 and I14 were all started for and by Copenhageners without any government intervention. The whole process from planning to technology selection and **crowdfunding** is done by them. I12 mentioned some government support at the beginning.

Self-service

I09 has their own IoT driven **water distribution system**. I12's hi-tech **food cooperative** could be the future of farming for urban dwellers who want to reduce the food supply chain and increase their self-reliance. I13 is a community of people who teach themselves about how technologies can affect democracy. I14 is developing an **online platform** that could disrupt the traditional party system. The Save our Air project by I08 if implemented, would require a lot of work from people participating in it with regards to collecting air pollution specific to them. At the moment, the sensors are still too heavy for prolonged use.

7.2.4 Non-involvement

Not all the interviewees involve everyday people in their projects. I11 has a "standard approach of having this **user-driven development** in many of our technical projects, and this includes interviews with different stakeholders." I06 "always look to listen to **experts**, we team up with experts and NGOs within a lot of areas." I04 mentions "you can travel much cheaper and have car, bicycle, and public transport ticket from one service per month and you will have, in general, have cheaper transport" as an end-result of their project. But talking to people about these kind of services is not part of the scope in their part of the overall picture. From their point of view, users don't need to see the full data but only use apps and services built with it.

7.2.5 Summary

The citizen sourcing methods were mostly traditional although they were used for developing ICT services or smart city infrastructure in contrast with the Government as a Platform and DIY Governance which used more ICT.

7.3 Metrics and Measurement Methods

A broad range of answers were collected for this theme. Most measured their participation via counting attendance or users. This ranged from **high** (above ten thousand) to **low** (less than ten) to none. The quantity also depends on the size and scale of the project, so this metric alone would not tell the whole picture. The bottom-up projects had an observation of "levels" of participation.

Some had **systematic** approaches to measuring participation and have reports available (I01, I07, I08, I10). Often this was because of requirements from their private or EU funders. However, their funder could also be the reason for not having any metrics for participation. "Many of the projects are quite large and expensive and we have a lot of demands from the ones who give us the funding for example and barely none of them ask for involved two thousand users (I10)." Others only made **ad hoc** observations. I03 had no measurement due to technological limitations of the platform they used at the time.

From the public sector, I02 had an interesting answer about measuring "valuable outcome from the work that they do. And at the end of the day, those outcomes are a lot more tangible to measure and to show value of than the inputs are."

For grassroots communities, they have a lower bar for continued existence. "So we thought, if there was gonna be around 30 to 40 people or something, then that would be relevant, then we would have some have foundation. We were really pleasantly surprised that we had more than 300 sign-ups. And, it was a good success (I12)."

7.4 Recruitment of Participants

There were two methods of recruitment from the answers received. The first was by **selection** where people are invited based on a criteria. It could be experts only (I04, I06) or based on nearby residence (I05) for example. For convenience, students were a common resource for user testing (I11). This is problematic because it introduces a bias in the research results.

Second is **open** where anyone can join. People find out about their projects online through social media, by attending similar events (I12) and word-of-mouth (I03). Traditional media and physical advertisements were uncommon ways to discover members but still used (I13, I14).

Finally there is **no recruitment** where the people started the project for themselves. Hence they did not do any recruitment (I09).

There was no explicit mention of inclusion in any of the interviews, except for Organicity where it is one of their core values as stated in the framework.

7.5 Motivations of Project Creators and Participants

This is very interesting to go through because it explores motivations of the different members of the pentahelix for either starting or participating in a project. For the public sector, most of their smart city projects are initiated because they either have a **business case** for it or it is driven by top-down forces such as EU directives and **political agendas**.

On the other hand, people who start a project from the bottom up do so despite the lack of financial incentives or push from the public sector. They are motivated by **social responsibility** and the **need to fill a gap** left by the public sector. One observation to be noted is that all of the community leaders' backgrounds were working in ICT related fields. Perhaps it is a learning curve issue that smart city grassroots movements are started by people who already have a pre-knowledge of technology. This is not necessarily a negative thing, but there might be a risk that they are seeing the world with "tech goggles" (see chapter 2.1.4).

General interest in the project domain is something that people who start on a project, people who work on a project as part of their job regardless of sector and people who participate on a project, all have in common as a motivation.

Some interviewees mention not knowing potential motivations of participations because they have never asked. Interviewees did not explicitly ask their participants on their motivations. Those who made personal observations report that the ones participating on a project or consultation are motivated by relevance to personal interests such as **financial concerns**, **something they have knowledge about** or **something that they care about**, **networking**, **change of routine**, **curiosity** and **coziness**. Coziness in particular has a cultural context. In the Danish context, it is a particularly important part of culture which is known as *hygge*.

There are **cultural** motivations for both participation and non-involvement. As discussed in chapter 6, civic participation has been traditionally high in Denmark. In 7.2.1, participatory design is also deeply rooted in the culture. This is something that has also been confirmed by the interviewees. "We have a long **tradition** of citizen engagement in Denmark and that goes above and beyond what most other countries (I02)." However, some people also see the public sector as being responsible for everything and so they don't want to do anything that they perceive to have too much effort.

Based on their observations, most reasons of participants for participating are for their own self-interest. While no formal interviews on participants have been done as part of the official methodology, based on ad-hoc conversations with event attendees, non-selfish motivations also exist. For example, one said that the reason they attended Next Generation Democracy was because they wanted to be a part of something bigger than themselves, like being part of a **movement**.

There could be a discrepancy between the perceived motivations of project heads and actual participant motivations. Further research is needed in this subtopic.

7.6 Current and Emerging Technologies

The technologies that these people work with range from low tech to cutting edge innovations. The newer technologies are what most people associate smart cities with and these include **artificial intelligence, machine learning, IoT (sensors, Lorawan, Sigfox, smart lights), augmented reality, autonomous vehicles** and **blockchain**. There are also more established ICTs such as **ERP systems** that are being used by the city. What some might not realize is that more accessible technologies can be enough to start a project. Interviewees mentioned using the **internet**, **social media (Facebook, Instagram, Linkedin, Twitter, Meetup), Google, Microsoft Office** and **digital communication tools** such as **Slack**. Other digital platforms like WikiFactory and GitHub are also utilized. At the lowest level, I05 mentions only using pen and paper for sketching prototypes with city residents.

Some do not mention specific technologies, because they are **technology agnostic**. "Agnostic means that we don't have any contract with big companies. So therefore, when we provide advice on a given technology, it's not because we hope to sell more of that. Because it's exactly the same if we say that the best cloud solution would be, for instance, Siemens cloud, or Google cloud; or if the best radio technology is NB-IoT or if it is Sigfox—for us, it doesn't change anything in terms of commercial follow-ups. So therefore, this way, we hope—and we like to say—that we are not biased when we provide some expertise. (I11)"

I12's Foodstack is not **technology-specific**. "It could be different technologies for growing algae, different type of food production technologies such as mushrooms, plant stuff, plant tissue, tissue culture. But, Growstack is specific around vertical farming, right. But it's still sort of agnostic within that so, we've just used aeroponic because it's the most controllable version of technology. So we thought, we're not really that sort of religious about which technology we use as long as they fulfill some requirements."

And for I07 it's "every technology you can imagine. That's the whole point. So you don't want tech specific methods. You want people specific methods."

The answers pertaining to the technology share some similarity to the hackable city framework by de Waal and de Lange.

Table 11. Hackable City Framework (de Waal & de Lange)

License	Open Source	Proprietary
Simplicity	Simple	Complex
Cost	Free	Expensive
Flexibility	Flexible	Vendor Lock-in
Size	Lightweight	Heavy
Modularity	Modular	Integrated
Vendor	Multiple	Single
Protocols	Shared	Hidden
Data Access	Open	Closed
Data Ownership	Public	Private
Usability	Basic and Intuitive	Requires specialized training

Not all interviewees were aware of new upcoming technologies that could facilitate higher participation. A few emerging concepts were mentioned such as **liquid democracy** (I13) and **welfare technology** (I01). But perhaps I09 was right when he said that "Participation is not predominantly a question of technology. Certain technologies might lend themselves more or less to participation, but ultimately it is negotiated in the political and social domain."

Interviewees also didn't know about potential constraints or issues of these new technologies. However they were able to critique the current technologies being used at the moment. First is the **knowledge gap** and learning curves in order to use certain technologies such as IoT (I09) and accessing open data (I03). *More of this is elaborated upon in 8.6.*

Second is the **overreliance on social media**. I13 sees the irony of the situation, "It's sort of funny that several of our speakers is arguing against social media. But we are using social media to invite people. That's a little bit funny, right?" I08 thinks it's "super problematic that we are at the mercy of commercial, a few, commercial, very big companies like Google, Facebook, and Amazon."

Third, is the **lack of inclusion**. "If you just take everything that comes from the platform and say, "okay, this is just the decisions that we make," I think that's probably not good. Because then you'd have an inclusion problem, then you'd have people who cannot use tech depend on decisions made on a digital platform—which is not good (I14)."

However, it's not just technology that we need to watch out for, but the people using technology (I07). *Data related issues are discussed in 8.1.*

7.7 Evaluation of the Public Sector

The question regarding performance of the public sector also elicited a varied response although most concluded that there is a lot of room for improvement and that it is an ongoing journey with them. I06 was the only one that was **completely positive** with their feedback, describing the Copenhagen municipality as a credible, agile and forward-thinking partner. "It is not always easy to execute these partnerships, and I think they have a nice focus on actual results, and that matches what Google's here for when it comes to every project."

As a caveat, it could be that because of recent public scrutiny, they avoid saying anything that could damage current partnerships. However, I04 is also positive. He thinks that the transportation arm of the public sector are "much more mature and ready for using the new technologies and preparing themselves for that; for taking them into use and managing their business and on different levels, much more data-driven and much more proactive than I have seen earlier."

I07 thinks that working with the public sector is **necessary** and **non-trivial**. "It should be seen as something positive that there are institutions because they work as proxies for individual responsibility. We don't want each of us to go on and go around and individually be responsible for micromanaging or coordinating that everything works. So there has to be something in between the individual and the world if you will. And that's especially important when you want to work on agendas such as social inclusion, environment, climate."

The non-triviality of working with the public sector is echoed by I10, "the real changing of the public sector from within to be more citizens-focused is a boring title job of navigating structures." There are several issues that must be overcome:

Bureaucracy
The first issue mentioned is the bureaucracy, inefficiency and political processes which will be discussed more in 8.5. A common complaint is that "some things are done over and over again...it should be easier for agencies to use each other's data, instead of having to create new data sets (I03)." Different regions in Denmark also "redo the same thing with a slightly different approach... there is an advantage in trying things at least a few times, but when there are many people re-doing the same thing instead of using each other's efforts, that's a problem (I10)." He adds that because of the overlap in work, the government tends to pay multiple times for the same things.

Budget Focus
The waste of money is especially problematic. Despite wrestling with low budgets, the public sector makes mistakes by "getting the input too late" (I05) when it ends up that the people don't actually need what has already been designed. There are already not enough resources to go around. Because "everything is very

business-case oriented" (I03), more experimental projects with unclear value add will not be prioritized. *More on the issue of money as a resource in 8.3.1*

Lack of knowledge
The size of the municipality might be a factor into why big municipalities like Copenhagen have communication issues leading to work and procurements being doubled up. I10 says this is why Copenhagen can be challenging to work with. Thus, they don't even know internally "who is doing what, and what other projects they have, et cetera. Sometimes we know that better than they do."

Aside from lack of knowledge within the institution, they also lack knowledge about technology. I14 asks "do they really understand what is going on tech-wise?" I13 echoes the sentiment, saying that "Most people are capable of using software, but most people are not capable of writing good software that is highly usable." I08 says that "There's all these calls for open data. But I mean, it's very difficult to find a way to organize it and to also design the access to the data in a way so that users can actually use this data."

Another important thing that the public sector is ignoring is how citizens can manage their own utility and consumption data (I09). "Data has instead mostly been privatized and de-facto given up on, with sometimes bizarre ramifications." The effect of this is that the "public sector as well as citizens are largely losing control of their data, giving them away to private corporations."

Perhaps they just don't know how to use existing resources. I08 says that "it's striking how little all these new digital data sources have been used to understand the city. I'm thinking about it. There are so many traces of interactions in the city, it striking how little it is used to actually understand the city and how it functions."

More agencies wanted to do something, but they had a tendency to misunderstand what businesses and NGOs and citizens really wanted (I03). They can also use design thinking more as it is "not an everyday thing to actually do yet" they get a little surprised when they get asked why do we actually want to have a lot of change in the technology, what do we actually use it for? (I01)"

Suggestions for improvement
The interviewees also came up with some suggestions on how the public sector can improve. I10 says that "The infrastructural technology can help the municipality or the public institutions, and, and become more efficient and that's also good because then like we'll probably save some resources to actually spend them on other tasks and where they create value for citizens."

I10 adds that "It's even more important that we ensure that the systems are open enough, ...that there is a clear definition of what standards are used for communication but also for data formats—something that makes sense, so that there can be natural progression over the years, and that you don't need to start from scratch too often. Building systems on international standards when available; and when not, to try to work together between municipalities and all the public sectors, to minimize fragmentation. And maybe, some even better communication, but also more open source could help in entry software."

Current bids are not open enough for I14 who wants "an open invitation from the government would be so fantastic." I12 thinks the public sector should be open to "collaborating more with other organizations because municipalities are really good in keeping order, distributing some cash around when needed by someone. And also developing some good city policies and implementations but it's not where innovation happens." *More about openness in 8.2 and the role that the public sector should play in 8.8*

On the contrary to a lot of the other answers, I07 adds that "cities don't need to be fixed. People don't need to be fixed. And institutions, bureaucracy doesn't need to be fixed. Some processes work better than others. But that's something you just have to be proficient in doing."

Summary

Overall, the first reading of the data has resulted into a wide array of insights. Most smart city project goals are aligned with Copenhagen's brand of being a sustainable green city. Others highlighted the importance of building communities, networks and ecosystem. A concept that is expected to become more mainstream is the minimal interoperability and standardization of data and upcoming technologies. The involvement of people ranges across the whole spectrum of participation from access to information to consultation, co-creation and bottom-up self organization. Metrics and measurement also vary depending on the size, effort required and relevance of the project. Recruitment of people is either closed and invitation only or open. Inclusion is not registered as a concern by most of the interviewees.

Motivations for starting a smart city initiative by the public sector are financial and political. On the other hand, people starting their own community projects are more likely doing so out of a sense of social responsibility. Perceived motivations of participants were mostly out of self-interest. Further research is required in this topic. Current and emerging tech ranges from very new and complex artificial intelligence and IoT sensor to more established and accessible tech like the internet and social media. Some of the initiatives reported being technology agnostic or technology neutral. Interviewees were not all able to point out potential issues with the technologies. Those that were mentioned include knowledge gaps, overreliance on technology and lack of inclusion.

The external and internal evaluation of public sector has been mostly negative. The positive reviews come from the private sector who are interdependent with them. Areas for improvement are managing bureaucracy, budget optimization, technology training, internal knowledge sharing, standardization and openness for collaboration.

8 Reflexive Thematic Analysis

This chapter presents the second part which is the results of the reflexive thematic analysis described in chapter 5. The reflexive themes were being simultaneously identified with the domain summary thematic analysis. Prior familiarity with the interviews and an online word frequency count also helped identify the patterns.

The reflexive patterns that emerged during the analysis include: Data and Data Issues, Openness, Resources: Money and Time, Physical Infrastructure of the City, Politics, Power and Democracy, Information Asymmetry and Knowledge Gaps, Education and Clear Delineation of Roles. These themes will be discussed in their own respective subchapter.

The coding of the thematic analysis can be seen in Appendix 14.7.

8.1 Data and data issues

Data is in the foundation of a smart city. For a smart city initiative to succeed, the following data issues must be addressed.

Data solutionism
Both I03 and I06 share the sentiment that data can be used to solve the world's problems. However, "it has to be done in a proper manner, thoughtful manner where we take into consideration to do it in public. (I06)" There was also a point in time when Denmark thought it could use data to solve everything. "...somebody would give [Denmark] a huge hammer [referring to open data] and suddenly everything looked like nails, and they just started banging on things. (I03)"

Trustworthy data
I06 also states that it can't just be any data that is put out there. "You need to validate the data, not put any small sample out there, you think it's truthful to validate it, with the help of our partners or through universities. So, we are not putting any random data out there, we are validating it, making sure it's trustworthy data. (I06)"

Data bias
Another misstep is not thinking critically about the origins of the data on hand. "I think that we've had a data bias because we've had a lot of data on cars for example and when you have a lot of data on cars you tend to design your cities with the data that you have and that creates a data bias. (I02)"

Data access
An ongoing issue is still the "huge uncertainty on what to do" in terms of data access. I07 describes it as "very difficult to find a way to organize it and to also design the access to the data in a way so that users can actually use, there's a huge need for thinking about how to access this data and how to make it available to citizens. (I07)"

Data awareness

One of the growing issues is that people continue to generate data that can be used for a lot of things that people are not even aware of. "Obviously, you are aware, that in principle, somebody could look at your electricity consumption because you know that it's actually being recorded and you know that is being used to send you a bill and that sort of thing. But think of all the things out there in the city where things that you do will be registered one way or the other, and you don't even know it. You don't want to know it because that would be too much information. (I03)" How much information is too much information? How much time can a person allot to knowing about which of their data is being used where? *This issue of time is discussed in 8.3.2.*

Data literacy

In general, the interviewees had a low estimate of the average data literacy in Copenhagen. People need "data literacy, just at a very basic level, so that you're able to differentiate between something that is dodgy and something that seems to be solid evidence of something. I think that should definitely be in there. (I03)" The public sector also lacks knowledge regarding potential data sources. "It's striking how little all these new digital data sources have been used to understand the city. (I07)"

Data ownership

Data ownership is another issue that the public sector is failing to address (I09) both for their own services and for individuals in the city. Who owns that information? "Whoever set-up the center? So would you have to have many different sensors and parallel measuring the same thing because it's the person who actually places the sensor within the urban area that owns the data that comes out of it? (I03)"

"I've seen what is quite important for the public sector is to have some aspects focusing on standards and data ownership, to make sure that when a public sector is buying a system that is able to do something, that they will be able to change to another company while keeping the same—while keeping the data and some of the infrastructure. If it is too much closed system [sic], it might become difficult to export the data. (I11)"

On the question of individual data collected by private companies, "Who owns the data because without each individual consumer, the data would not exist? It is personal data because if you look at the patterns of consumption, that really tells a lot about people's habits. (I03)"

A lot of these data questions still remain unanswered. I03 is pessimistic that these questions will not be answered "until we have some real problems." People should not wait until then. Addressing them sufficiently will be crucial to the development of the smart city "so that data can be shared, you could say that the free flow of data with trust. (I08)"

In connection to this subchapter, the following section will deal with the topic of open data, open source and openness in general.

8.2 Openness

Open data means open data

Initially, the public sector was skeptical of opening up data for people to use because people might misuse it. "One agency [responsible for geographic data] was a little bit concerned about making certain data available because they were afraid that if data were used for the wrong purposes, it could actually lead to accidents… They wanted to make available some marine charts, maps of the sea ways around Denmark. And, as you know, there's sea everywhere around Denmark. So people go sail everywhere. (I03)" Some of their data sets were not made for that purpose because they weren't detailed enough, but people would put it in their sailing navigation systems. They had to warn them so the agency wouldn't be liable.

There are no crimes with using open data. For example "if you used an open data set to commit fraud, you would actually be charged with fraud, not with misusing an open data set. The point is not that you misused an open data set, the point is you committed fraud. So it's the definition of fraud that would actually land you in prison or if you're fined. It's not that it has anything to do with open data. (I03)"

"Open data means no restrictions. The only restriction they were allowed to impose was that they would have to be credited as the source. (I03)" Personal data and competitive data are exceptions. Another exception is "if the government holds this kind of data or information, but does not own it, only has the right to use it. For example, if a government agency has, for example, has brought some pictures for use on websites and in reports, but they don't have the ownership of it. And that's why they cannot make it available to everybody else. They have a right to use it, but not a right to transfer ownership. (I03)"

Surveillance

For I03, personal data is completely excluded by the public sector in open data. What is interesting is the shifting attitudes. On the fourth year, officials started to ask "but wouldn't it be interesting if we could use certain personal data?" And then after another four or five years we got GDPR. Now she thinks "people would be really, really scared of doing anything to do with personal data."

Defining what is personal data when you have data collected everywhere is also difficult "because certain types of data are not personal data, but if you have enough of them, it starts to get personal anyway, because you can correlate it and at some point you can actually see a pattern and you can pinpoint who we are talking about. (I03)"

This can be dangerous because "if you want to break in and steal everything, you know exactly when to do it if you have access to this kind of data because you know that every Friday afternoon, they need to go to their holiday cottage, and they're not back until very late Sunday evening. Things like that. So even if they have all kinds of alarms and, you know, systems that would turn the lights on in the house. If you look at the consumption data, you would still know.But they're not there because some of their electronics are not being used, for example, computers and televisions, so they're definitely not there."

On the flip side, "what's the difference between overview and surveillance?" I07 asks. There is not a one size fits all to this data issue, he thinks. The same situation can be wrong in different contexts. For example, your data can be used to find you if you have a heart attack and you want to be found and get medical help. How can people give consent for those situations and how do you draw the line? These are just a few dilemmas I07's projects and research try to address.

Finally I03 reminds us that open data should not be the means to an end and that "at some point, we may not need to call it open data. We would just talk about data."

Open source

Open source is something that is suggested by multiple smart city polemicists to combat giving too much power to the private sector (Morozov & Bria, Green, de Waal & de Lange). This is also mentioned by several interviewees. "It enables, it empowers people to use open source bricks, and also ensures that we don't give money to private companies and then get locked down in a locked ecosystem. So with open source, approach is...is it reduces these types of risks. (I11)"

Open source has two meanings: free software and "the ideology part of open source, which is that we are contributing to have better and better software that are not restricting people's freedom. (I11)" The positive aspects of open source gives the public sector and other organizations the ability "to change their provider over the years, to be able to change model, to have iterations, to have better possibilities for municipalities to reuse each other's code...there are great opportunities for collaboration between open source systems and closed source systems. (I11)"

It also allows for better internal collaboration. "This is an approach that has been used, for instance, in the USA because they have great difficulties on getting the different states to collaborate internally. That didn't work, so they decided to actually open source their stuff so that they could, at open source level, work together. (I11)"

Open in general

The public sector "ought to be more open in, just in general. (I14)" He also thinks that they are skeptical and closed off. His suggestion is that people should be able to create technology platforms for the government on their own terms. For example, if the government was looking for ten platforms which help open up policy creation, "just have whoever wants built [sic] the platforms, try them out, and make do with what works. But if that would demand a leap of faith from them—that I don't see them doing anytime soon."

8.3 Resources

This subchapter focuses on a vital driver of smart city projects. It is a concern shared by all sectors of the pentahelix.

8.3.1 Money

Financial reasons are an institutional factor observed in a pilot automated plant watering system project in the neighbouring Frederiksberg municipality (Aldaba et al. 2018). In the study, the authors used the institutional theory where the fifth proposition stated that "Business and IT executives are more likely to introduce environmentally responsible programmes, if they are aware of the cost reductions associated with the implementation of Green IT initiatives and the resulting increase in profits." They identified that cost reductions were the biggest motivation for the municipality to take on the pilot.

Business Case Driven Public Sector

The lack of funding can become a roadblock for innovation and experimentation. I01 did not continue with the prototyping phase of their project because "the regional administration lost some of their money and empowerment to implement these things." Underbroen, where a lot of experimentation can take place, does not have a large PR budget despite the fact that they need to "show what it is that they've done and why they should keep getting funding from the city or where they get their funding these days." And I03 explains that for experimental projects "it's so difficult, especially at that early stage to make a business case, because the whole point is you don't know what people can do with data."

Design Thinking for Cost Reduction Purposes

Design thinking workshops can cost up to a hundred thousand kroners to run (I10). "Many of the projects are quite large and expensive and we have a lot of demands from the ones who give us the funding for example and barely none of them ask for involved two thousand users." For I10, design thinking can be the last priority in the budget. In I10's view, the knowledge of it, is a has been placed in the sector that is fluid and expensive and also want to work with like this. "You need to find those resources [designers and agile experts] outside." But skipping the process can actually cost municipalities and organizations more. "So we quite fast-discovered that it was a very, very good way of saving the client's money. (I05)"

It also has the added benefit of involving people who are concerned about the municipality wasting money. These workshops can help them understand why certain decisions are made. "When we don't do this user process, people will ask a lot of questions…why did we do it like this, why did we do it like that; that's a lot of money…we could have used it for the overly paid for, we could have used them for the schools. If we do it like this, they understand why the mall, for instance, want to spend their money for this project in particular. (I05)"

People tend to engage "if it is a project that people are really afraid of going to at once on the end of the daylight, they don't come a lot because they are afraid of what will happen; or is it getting expensive for them? Or will their apartment or house will devalue? (I05)"

Procurement

While the public sector has challenges with costs, it does not seem to be a problem of big tech. "We have a lot of resources in Google so why not use those resources to help battling the big challenges we have on the planet? So [air pollution] is a huge problem because society allot it billions of money, so that's why we wanna

do our best to solve this issue. It's making our resources available in the city in a way they want, and they decide for it to be a part. (I06)"

Again, it is the private sector which knows more about technology and so they hold the power over the procurement process. As multiple interviewees said, the public sector lacks the technical knowledge and so they get help in developing tenders for the procurement process. Some companies take advantage of this and can write the tenders so that the government will accept their bid because the criteria is skewed for them.

On the other hand, non-profits like the Alexandra Institute are offering their services to write the tenders for the government as explained by I11. Alternatively, I10 works with the "free procurement model which means that you step out of your no more public-private roles and you make a contract of developing as equal partners."

Funding in Academia
Both of I08's projects rely on external funding. Save Our Air was a partnership effort that received an initial funding from Organicity. It can continue an expansion in Bogota if their partner "can get some money and for this, we can make a development for the app." Meanwhile, Doing Data Together is funded by Innovation Foundation and other investors. Organicity is I07's project that is funded under the European Union's Horizon 2020 programme.

Crowdfunding and Cooperatives for Smaller Bottom-up Projects
Making farming technology more accessible was one of the goals of I12 because they were too expensive or too time intensive. Having the facilities makes it an "easy and cheap way to get started and, and seeing whether this type of crop they would like to produce is actually viable for them." They also have a simple cooperative where they buy seeds, plants and equipment together to make it cheaper.

Meanwhile, I13 is funding everything out of his own pocket at the moment. This is not very sustainable and he is planning to make it an open membership so that other people can help fund the organization.

8.3.2 Time

The co-creation processes like design thinking workshops can take a lot of time to do. I01 says they "used a lot of time trying to understand what are [the needs], and pinpoint where could we actually see these [technologies] work." Likewise, I05 said that "it can cost a lot of money to make these processes and it can take a lot of time for people joining in." It is the same situation for making data reusable in the public sector. I03 says "they actually have to put some effort into describing what is this data set and especially what is it not." These are just a few examples since the question was not explicitly asked to all the interviewees.

But the problem is that people across the sectors don't have enough time. I04 explains about their transport data program is in a really tight time schedule, and therefore does not leave a lot of room in the scope. In bigger organizations, especially the municipality, if you don't know what someone has already done you might end up doing redundant work.

I11 describes that the municipality tends to "reinvent the wheel over and over again, or get copies and then run their own copy of the data registry, and then it would not be completely up to date and which one would be authoritative and, you know, the whole mess, and it's very costly." So not only does it waste time but also money. Social entrepreneurs have the same issue "when there are many people re-doing the same thing instead of using each other's efforts, that's a problem. (I12)"

Using private time is even less. And that is what open source and grassroots initiatives mostly run on. For I12, it's definitely a problem as "you don't have a lot of time initially as a vertical farmer." As an open source contributor, I11 says that "we do quite a lot and we contribute to some extent, both professionally but also, in my case, in my private time." And for I13, "the constraints [for running a non-profit group] that we are seeing is time. That's the issue. [If] we sit down and work on this 24/7, we could really take it further."

For the general population, I14 advises that "you get decision fatigue, if you ask too many questions to the population. You also risk people not taking the time to actually think about what it is they are voting for."

Because participation takes a lot of time and energy, I02 hypothesizes that "the technologies on my point of view that works the best are the ones that you don't have to engage with all the time. Ones you don't have to spend time with... I think a lot of the potential digital technologies in smart cities lies within the technologies that don't need constant civic engagement." However this would require a lot of trust in the technology which we are not into yet. Time and effort is definitely something to take into consideration for people who want to develop civic technologies.

Perhaps the civic smart city is just ahead of our time. "The development of this area is way ahead of our thinking and the way that we deal with it, even if I think that smart cities are only developing very slowly. It's definitely developing a lot faster than our thinking. (I03)"

8.4 Physical Infrastructure of the City

I08 explains that "it's important that the smart city is not just thought of as an Internet of Things framework. Because that will automatically reduce the city of physical movements—movements of physical goods or physical things and I think the social infrastructure has been super important as well." However, the physical aspect should still be discussed because the digital infrastructure and social infrastructure are only parts that make up the whole. It also seems that smart city projects that have something rooted to the physical aspect of the city tend to be more successful.

I07 is an advocate for living labs and connecting it to places in the city. "...You should connect it to libraries or other innovation hubs, physical spaces, like spaces in the city square, where these kind of things can be openly discussed." A good example of a project connected to an existing space is Underbroen, which created "a physical entry point for a civic tech understanding of what a Smart City is... I think that it has felt natural to put Underbroen under the bridge because the harbor was the site of all the old heavy industries and now, they were inaccessible and now there's like a transparent organization working with citizens to prototype things."

It worked really well because one of the problems that they've solved was rooted to an actual physical problem in the city— rats and rat traps. They organized a hackathon at Underbroen to develop an IoT solution for connecting the rat traps online. The built product saved a lot of time since the rat trappers no longer had to check the traps every single day.

The physical space is easier for people to understand and could be used as a metaphor for explaining smart city technologies. I11 says that "it's also very important for the citizens to actually know that the city is built using open source components, which means that they can access them; and they can see, actually, the digital bricks that the city is using. It's a bit like you can observe the physical infrastructure but you cannot observe just as well the digital infrastructure."

This can help with the discussion and debate about data commons. I10 asks "should these sensors be a kind of not common good, but some kind of, you know, shared infrastructure that you can tap into and anybody should have the opportunity to then buy or get data from it? These are huge questions. I think that made a lot more difficult because they involved both government and business and individual citizens. And it's all sort of mixed into one big stew. And, actually, it's the mixing and the stewing that makes it really valuable."

The interviewees also had opposing opinions on meeting physically. I14 thinks that "we don't engage in that way with anything else; we don't meet up fifty people in just some room and discuss politics with our, like, closest party, co-members. It's not an actual thing to do in, like, a modern society. It was maybe sixty years ago, meeting up physically and doing all these sorts of things." He also thinks that it's the reason for the decline in political party membership because "people are not as involved physically." If people are moving their lives to the digital sphere "how do we move this part of our lives with, as well?" But it's not meeting physically that's the issue.

For example, "the design thinking workshops work because you're here and we move together, and we're talking face-to-face. So I think it would be difficult to substitute that. (I01)" The Next Generation Democracy meetup by I13 also shows that there are still people who are willing to meetup to discuss politics in an alternate way to political parties. However, this is only a small portion of the population and more data is required.

8.5 Politics, Power and Democracy

Who holds the power in the smart city? Most interviewees end up talking about politics, power and democracy when discussing participation. There is a clear link which reflects Nico Carpentier's definition of participation (2012) as seen in chapter 2.4.

Political Processes

As mentioned in 7.7, some interviewees have encountered political processes that have hindered their projects. I12 was "getting some support from the municipality. But then what happened was there was a little scandal in the development we were talking to. The mayor left after all because of something. And we kinda back to square one with that."

The next phase of I01's project was cancelled. "From what we know, it's been like part of a political process. And they had a debate, a political debate afterwards. But I would say that there was a reform afterwards, where they actually decided to move this resolve and to another place and to divide a lot of things actions into the municipalities instead of the region. The administration, the regional administration lost some of their money and empowerment to implement these things. So I'm quite doubtful that they actually managed to move further into these initiatives, unfortunately. A lot of things happened but I think some of the good ideas will live on into some of the other departments and areas. But it was mostly lost in political processes, which is, very much a shame."

The Open Data initiative by I03 took years in the making before it finally happened. "I think before that, you know, two or three of the main players would want it. And then, two others would go, 'Yeah, well, we don't know, maybe not like that.' And it would always be like that. But suddenly everybody just seemed fire up, 'Yes, this is the time to do it.'"

Power is shifting to the private sector

However, it is not only the public sector that interviewees are concerned about. "Data is identified as the core currency of the information society, and plays a crucial role in the green transition of our societies. However, the public sector as well as citizens are largely losing control of their data, giving them away to **private corporations**. (I09)"

"So, I think that will be all about data ethics and data ownership and power of data. It should be important in terms of what we do. And definitely a constraining factor… this data is quite powerful and interesting for questions that our experiments bring up in social sciences. So, I think we have to engage with it. But it's super problematic that we are at the mercy of commercial, a few, commercial, very big companies like **Google, Facebook, and Amazon**. (I08)"

"And I look at their presentations, and you have the very sort of technical researchers, and the public sector and then there come the UX designers. They have this nice flow PowerPoints and stuff. But what are the, **power hierarchies between the different interests in the projects**? (I10)"

"Actually for today or tomorrow, the power moves from the public sector to the **private sector**. And that's not like something you can definitely have opinions about it that it will happen. So the thing is that, I do believe that there is a good will and altruism in the private sector. (I10)"

"So when it's built on open source components, you actually get a chance to do that; and think of our future generations, and new innovative ideas and stuff like that. So it's a lot easier to do that, and it enables, it empowers people to use open source bricks, and also ensures that we don't give money to **private companies** and then get locked down and locked in locked ecosystem. (I11)"

Our dependence on technology services from the private companies will make them even more powerful and exacerbate the issue. "I think, we need to find a good balance between technology and what is good for the public, and for citizens. We might not always want or need to have a technological solution to everything, and so it's also important to make sure that we do not dehumanize society too much—which means that it's

very good to have more technology to help things. But you can compare that a bit to automation, in some other domains. For instance, in cars, in aircrafts, using in factories. I think, automation is okay, as long as you have a manual way to not use it. So if we depend too much on technology in a way that it's the only option, I think that's negative. It's also very important to be sure that we have a resilient society that can withstand many forms of indifferences—it could be, for instance, some sudden trouble to have electricity; it could be an attack from foreign countries; it could be a certain desire to be closer to nature. So, we shouldn't push too much in having the technology and electronics everywhere, and try to make it in a smart way that is more for the nice-to-have things, to increase the quality, but not for things that are indispensable—that are fundamental. So if we cut electricity now, we should all still be able to continue having a normal life, more or less. If it's not the case, then we have a problem. (I11)"

What is democratic? How can people get back their power in a smart city?
For designers, involving people in co-creation and planning is democratic. "A lot of municipalities are starting to work more creatively with getting insights from and input from the citizens instead of doing the classical hearing. And I think of course we always had like the democratic and the participatory foundation for hearing and participatory like asking the citizens. (I01)" I05 thinks "it makes so much sense to do it because that's what democracy is all about—to make people give influence, to hear the voices…what do they think about the different kind of way of living. So for me it's really democracy."

For I02, it's "democratizing the access to prototyping and then also using it as a crowdsourcing tool for ideas and using the knowledge produced there using that actively in understanding what kind of products the city should pursue." Open data is also more democratic now because it is "happening in a more a more organic and natural way now and not driven by people wanting to do something because this is definitely the thing to do. (I03)"

None of these are really addressing the risk of the private sector taking over, who are not really prepared to "act as a common good and stakeholder, and not just a company. (I10)"

I08 thinks that by producing data yourself "you begin to ask questions about how data is produced anyway and make it more critical of how society is datafied by who's in power." That could be a first step.

And for I07, it's quadruple helix and equal partnership. "So it's not just the businesses, public sector and academia experts that come together, but you involve the fourth leg in that helix thinking, and that's civil society. So really having that as an equal partner in, you know, thinking about and working with technology."

Finally, to answer the question if politics can be done at scale, I14 says "The answer is no—you cannot do politics at scale if it's not digital…if you just take everything that comes from the platform and say, 'okay, this is just the decisions that we make,' I think that's probably not good. Because then you'd have an inclusion problem, then you'd have people who cannot use tech depend on decisions made on a digital platform—which is not good." Because it is not just a problem of efficiency as Green said in 2.1.4.

Debate is necessary as a lot of these important data questions aren't answered yet. "I strongly encourage a debate of public data, citizen data, ownership, access, control and the role of the public sector. A debate

around 'data commons'. (I09)" We may not have a digital avenue for it, but it is something we need to do better than discussing it on Facebook which would be ironic.

8.6 Information Asymmetry and Knowledge Gaps

Another pattern identified over 4 interviews in relation to the previous section are the knowledge gaps which contribute to the power inequalities within the smart city ecosystem. With the open data initiative, I03 doesn't think the average person knows how to handle open data. The data sets are also lacking qualitative descriptions that say how they can be used. She finds it "really hard to figure out how technology could really help with that because it's about getting that kind of almost a priori knowledge that is within the data set experts head, and push it out there in a form that other people can use. And I think that's the real problem."

IoT technologies are potentially useful and participatory but "perceived as being too difficult to use for non-expert users. Learning curves and usability remain challenging. (I09)" I10 asks "What is involvement, but the knowledge gap and the capacity gap? Even between someone like me I'm just a normal employee. How can I have a feeling that something is not involving me enough?" How can people know that they are not involved if they don't know enough about the technology and the projects in the first place? "Is that feeling larger than or different than the dichotomy of the sort of the ones who produce or the ones who work?"

The other gap that should be addressed is if "the dynamics of developing tomorrow's Smart City is crucially based on the knowledge of what people actually want? (I10)" Or is based on assumptions made by smart city developers?

In Underbroen, where the knowledge produced there is used "actively in understanding what kind of products the city should pursue," they attempt to close these knowledge gaps. "We know it's possible because we've done it with amateurs in this lab and so the information asymmetry between the private and public will sort of lower you could say and so they could take guidance. (I02)" The following section proposes education as one of the solutions for this problem.

8.7 Education

Although education is not explicitly mentioned in all the interviews, it is still an important emergent theme that should be added to the framework of participation. I13 and his associates think that it is the answer to the question "how do we make this society ready for this change that we'll need to go through." This is also despite the fact that a guy from the US tried to dissuade them because they would "never be able to implement these changes quick enough because your democratic processes are too slow, you should work the dictator." However, they believed in the power of democracy especially in Denmark and hence they started their non-profit organization. They also plan to visit universities to get more members there.

I03 suggested that open data should be used more in education, not just using open data to teach students rather data literacy in general. It is "important to understand the, you know, basic sort of technical aspects of handling a data set, but also just understanding what kind of information can you actually get from a data set. And all the jokes about all the kind of cheating you can use statistics for."

She thinks it is vital especially in this era of fake news. In addition to that, she thinks that democratic skills should be taught with the technical data skills. She also hopes that "at least some of all the pupils who would be exposed to that kind of teaching would actually think 'that was interesting.' And then they would just start using it, the way that they use the internet to look for information on this, that, and the other, and to find people across the world who are experts, and what they need to know on things like that."

Ideally it should already be taught before university, as early as middle school. And the great thing is that I08 is already working on it. "We want to write something about how you can integrate data and data practices into a teaching curriculum. By using not only data provided by either university or state agency but also data produced by yourself, you begin to ask questions about how data is produced anyway and make it more critical of how society is datafied by who's in power."

At the moment, Underbroen is actively being used for educational purposes, they have visits from schools, and high schools, and universities, and so on and so forth. They also offer training to people who are already working. Education should continue even after the traditional academic system with top-ups.

8.8 Clear Delineation of Roles

As I09 brought up, the role of the public sector must be discussed. This subchapter answers that question and also discusses the role of the other sectors. Who should do what? Who are going above and beyond?

Public Sector
As I07 stated in 7.7, working with the public sector is necessary and non-trivial. The bureaucracy is there to serve a purpose. They are working as the people's representatives in the democracy because people have limited time to deal with all the issues that urbanism is facing. I10 is wondering why nobody is discussing what the public sector should provide.

They need to address data ownership and access according to I09 and I10. I10 also wants the public sector to understand the operations, and knowing what is common good when it comes to digital infrastructure.

Although he appreciates the public sector's effort such as beginning an AI strategy, I13 questions the technology capacities of the public sector to do it effectively. "if you are just in the ministry, you do not necessarily get exposure to this. You sort of need to be out in the trenches and actually working with it, to really understand what's going on." The public sector needs to collaborate with the private sector or pursue further training.

I14 also rates the public sector's skills negatively saying that "the rules of a public IT system is usually defined by people who are not competent in IT; and if people who don't know how to build software writes spec for a software, then obviously the software that comes out in the other end is not good. Don't do the spec. Let the people who wanna accomplish the task define the task as well".

I10 thinks that the public sector should not try to compete with existing social networks like Facebook. They should stick to digitizing existing services that are "clear contracts with the state." I08 agrees, noting his observations that it's hard to move people to new civic tech apps.

I10 also wants to know, because the public sector has power in the political sphere, if it is their responsibility to use their private negotiation capacity to nudge people into using civic technologies that would have good clear results for the smart city.

Private Sector
As stated by I10 in 8.5, the power is transitioning from the public sector to the private sector. She believes that there is "good will and altruism in the private sector" if they can only understand how to act as a common good and stakeholder not just a financially driven instrument. This echoes the concerns of McLaren and Agyeman mentioned in chapter 2.

I04 deals with the public sector's data but assures us that "it's quite clear who owns the data and the owner is responsible of having data in the right quality and in the right standards and we'll be the one that have the whole responsibility of uploading data and securing free access."

I06 from Google seems to have read the criticisms lodged against big tech. He acknowledges that "it's important to understand that we, as Google, are not the ones deciding on the data. So ultimately, it's not in our hands to make it public, it's in the city of Copenhagen's hands."

Academia
The academe seems to have a clear role in the smart city and something that the interviewees have been consistent with. They "aim to widen and deepen knowledge and to publicize papers. (I10)"
I06 partners with universities "in order to have the data validated." They provide legitimacy to studies and data evidence. For I08, the academe is there to look at the data and smart cities with a critical lens, "data beyond evidence provided by either university or state agency."

Civil Society
I13 is not even sure if educating the people on the threat of new technology on democracy is something that the public sector should do. He thinks that it is the responsibility of the civil society because the public sector cannot do everything. "They should focus more on the stuff that they are good at," he adds. Although I14 thinks that it is the private sector's role to design the tenders, I11 thinks it's the civil society's responsibility. It is one of the services offered by the Alexandra Institute.

People
For city people, the choice to be made is within the private sphere which is increasingly getting blurred with the public sphere in the smart city because the lack of data ownership principles. "So in what Smart City areas, is the private sphere, the private choice, how far is it yours? When it comes to traffic noise [in the Silent City], you know this is your house, but where is the nudge node on the municipal road? There's no intersection here. You don't know exactly where it is plus the other hundred thousand houses and recommended levels [of noise]. (I10)"

One option is to vote with their feet and move out of the increasingly digitized city. "Our track record of existing in the digital world is there all the time. So you can be a nomad and move out to a little cottage and say, 'I don't like that.'" (I10) The other option is to "work within the systems, and say, 'The future [city] is digital. The future [city] is going to know what I do and where I am. So let's make a fair and transparent deal out of it and build our democracy on it.'" (I10)

The question of the city resident's responsibility remains limited but also open. If people go with the second option, is too much work as prescribed by Morozov, Bria and Green (chapter 3) being asked from the individual? How can the work be divided in a fair way among the different sectors in the pentahelix?

Summary

The exploratory nature of the analytical input has led to a rich qualitative dataset where several patterns have been discovered. Until now data ownership issues remain unresolved. Data solutionism still exists but this is a problem if the data is not trustworthy or if it contains biases. Data access is a design problem because of the sheer amount of information and lack of awareness and literacy for the general public.

Openness is another theme. Open data is open data. Misuse of open data in itself is not a crime, it is the crime committed using open data that will be charged. Personal data is excluded in open data. However, it is possible with some types of open data, given enough of it, that it can be de-anonymized. There are also situations where you would want authorities to know your personal data such as in accidents so that you can be rescued. Open source is frequently brought up as a principle used to avoid big tech from having too much power and as a tool for better collaboration.

The pragmatic reality of cities is that resources are limited. Therefore, the public sector is budget conscious and likely to make decisions for financial reasons. The same goes for city dwellers who use their spare time to spearhead or volunteer in grassroots tech-related initiatives. There are simply too many decisions in the city to make. Another resource is the physical infrastructure of the city. Interviewees stress that connecting smart city initiatives to physical places and meeting physically help people understand them more and feel more involved.

As Poole suggested in 2.3, the smart city is about who holds power in society. Both high ranking officials in the public sector and big tech companies are at the top. The public sector has the power to prioritize agendas whose budgets will get approved. Smart cities that are dependent on too many services provided by big tech companies are also at risk. Should this continue and tip the scale towards the private sector, it could become problematic because the private sector has different aims. Interviewees suggest people learning to produce data themselves as a first step, projects that democratize the planning process and access to technologies and quadruple helix and equal partnerships.

Information asymmetry and knowledge gaps exist in all the sectors of the pentahelix. The average city resident would not know how to handle open data or work with an IoT network. Public sector and civil society employees are also challenged by new and emerging technologies. Fab labs are a good initiative that

makes new technologies more accessible to the general public. The public sector is so huge that it is unaware of its own overlapping projects, doubling the work done and wasting the people's tax money. The information gap that needs to be closed is if smart city developers are actually developing it based on what people want versus what they *assume* people want. In order to address these, education has been suggested as necessary for the future of the city. It is not only tech skills such as handling data but also thinking critically about its connection to power and democracy.

Finally, there must be a clear delineation of roles in order to clear up confusion among sectors and drive people to action.

9 Synthesis

The purpose of this chapter is to integrate all the insights gathered from the data and thematic analysis into the research narrative. In 9.1, the constellation of smart city players is mapped. In 9.2, the extended framework for civic participation in the smart city is based on the results of the interviews and thematic analysis. In 9.3, the projects identified from the desktop research are plotted in the new framework. Finally, Copenhagen is presented in the lens of this new framework in 9.4.

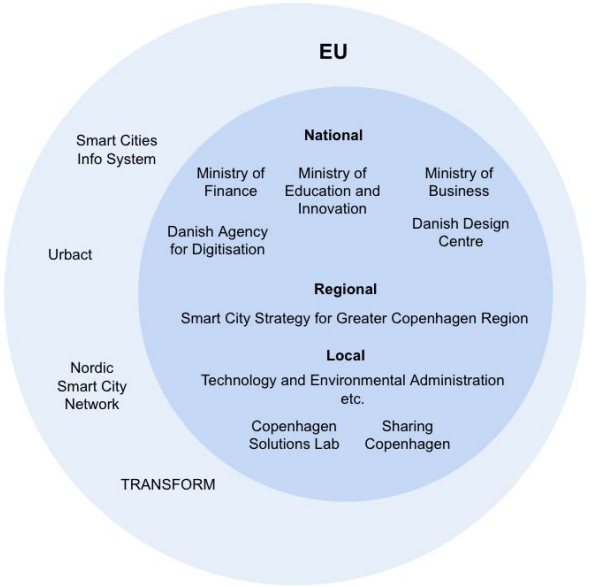
9.1 Ecosystem Map

The different communication network links in a city from 4.1 can be expanded especially with the power shifting from the public to the private sector. Non-profit networks of technologists are also forming. I11 with the Nordic IoT Center want to "help build an ecosystem around silos of technology."

City-to-city networks are also on the rise. I07 describes "consistent ecosystem collaboration is peer to peer learning over five to ten years, that's the single most clear characteristic of community or ecosystem." It also "creates a bigger benefit if you actually work together across all these municipalities. (I01)"

The complete diagram of the parties and their connections identified in the interview process and data collection, the Copenhagen smart city ecosystem is illustrated below:

Figure 17. Public Sector (Author). Figure 18. Private Sector (Author).



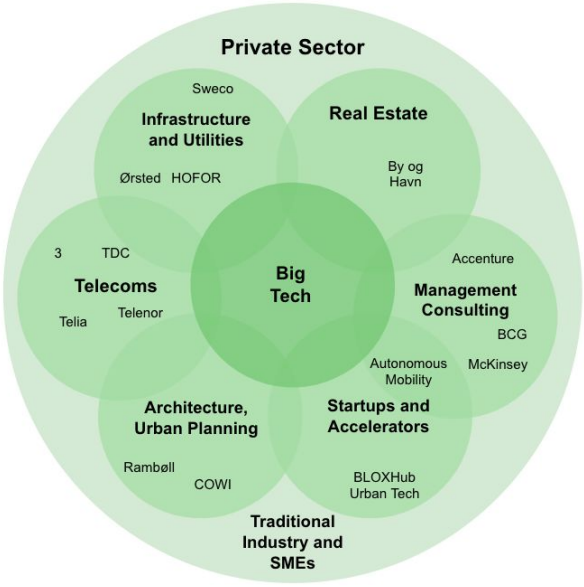


Figure 19. PPP, Triple Helix and Quadruple Helix Initiatives (Author).

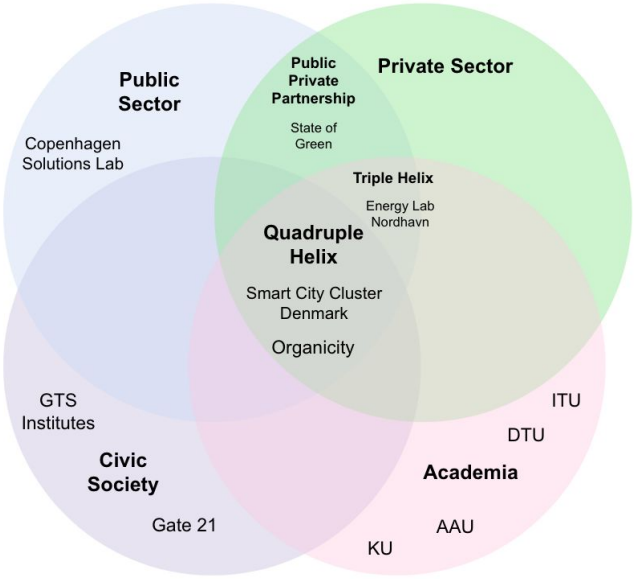
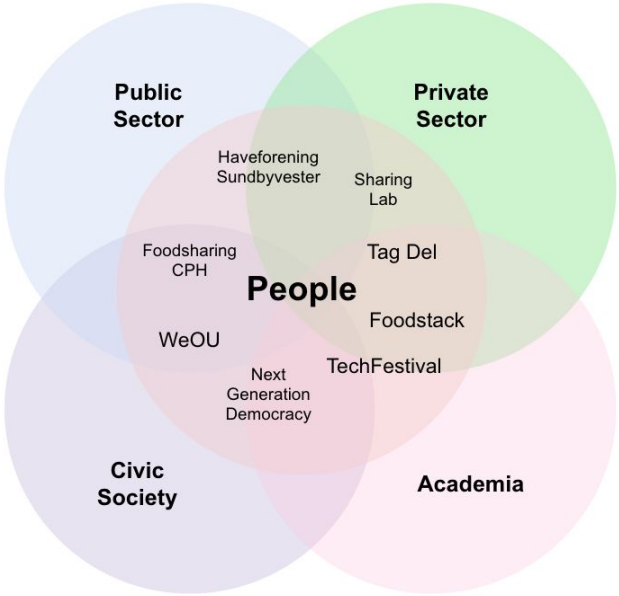


Figure 20. Grassroots communities in the Pentahelix Model. (Author).



9.2 Framework Integration

In the creation of the eclectic framework, the good points of existing frameworks and integrated them after reviewing the frameworks. The earliest version of the eclectic framework is illustrated below in Table 11. It was prototyped in the first stages of the research.

Table 12. Prototype A (Author).

Arnstein Ladder Categories	**Levels**	**Translated into Smart City Context**	**Examples**
Nonparticipation	1 Manipulation.	Citizens as ICT Users	Infrastructure
	2 Therapy.		
Tokenism	3 Informing.	Citizens as Democratic Participants	Open Data
	4 Consultation.		Agreement on goals of smart city, Correlation between participation activities and achievement of goals, Direct Interaction
	5 Placation.		Citizens Selection, Living Lab
Citizen Control	6 Partnership.	Citizens as Co-creators	Online Platform
	7 Delegation.		Citizens Selection, Living Lab
	8 Citizen Control.	Citizens as Hackers	Bottom-up Civic Tech

However, the framework in Table 11 is not sufficient for evaluating participation. It is lacking in several reasons as stated in chapter 4. After the review of additional new frameworks as suggested in the literature and by the supervisors, the following framework was designed in Table 12.

Table 13. Final Framework (Author).

	Civic Access/Interaction	**Civic Interaction/Participation**	**Political Participation**	
	Social Involvement (attention)	**Civic Engagement (action)**	**Formal Participation**	**Activism (Legal/Illegal)**
Individual				
Collective		City Person to City Person	City Person to Government	
			Government to City Person	

Although not perfect, the framework in Table 12 is adequate for the purposes of this particular study.

9.3 Identification and Categorization of Participation Methods

In this section, the data collected will be categorized according to the classic and new typologies of civic participation. The projects by the interviewees are highlighted in pink. The other colors are arbitrarily assigned in a categorical scheme for easier visual distinction.

Table 14. Categorizing the Participatory Methods (Author).

	Civic Access/Interaction	Civic Interaction/Participation	Political Access/Interaction/Participation	
	Social Involvement (attention)	Civic Engagement (action)	Formal Participation	Activism (Legal/Illegal)
Individual	Getting political Facebook posts on the feed following individuals or organizations on social media	Donating to crowdfunding platform reading, watching, liking, sharing, commenting on online news	Emailing or messaging government on social media running for office (using apps for campaign, social media)	Signing petitions online skrivunder.net
Collective	Joining a community related Facebook group or online platform as a passive member	Volunteering in Civic Society Signing up online Open Street Mapping	Political Party Activity Joining a political party online	C2C Self-organization Joining online forums organizing a protest online klimamarch FB Venligboerne samler ind til flygtninge FB
		C2C Self-organization Organizing a community or societal group on social media organizing events Borigo Next Generation Democracy (I13) initiativet.dk (I14) App-partiet	C2G Consultation & Ideation Borgerpanelet User Testing (I10) Design Thinking Workshops (I01, I05)	
		C2C self-service Haveforening Sundbyvester (I09) Foodstack (I12) WeOU Foodsharing CPH Tag Del	C2G Crowdsourcing & co-delivery Borgerforslag City Hackathon Organicity (I07) Save Our Air (I08) Silent City (I10)	
		C2C Self-monitoring Online testimonials on platforms Copenhagen Scam Facebook Cykelrazzia Cyklistforbundet map	C2G Citizen Reporting Givetpraj	
			G2C Informing and nudging Brugbyen.nu Google Airview (I06)	
			G2C Ecosystem embedding Sharing Copenhagen Underbroen (I02)	
			G2C Open Book Government Open Data Initiative (I03) Opendata.dk (I02) National Access Point (I04)	

9.4 Civic Participation in Copenhagen

In this subsection, a simplified version of the participatory toolkit in 4.3 is used to critically analyse the methods and projects and actors involved in the smart city. The process that will be examined is the smart city project which is a joint scheme between several actors using ICT to improve the urban area.

Fields

Working with smart cities encompasses over multiple disciplines. Not only does it use information communication technologies but other technologies as well. Geography and geopolitics are important as it is situated within the city but also transcends borders into regional, national and global city networks. One must traverse through policy, governance, city planning and architecture. The specialties of design, anthropology and other fields related to understanding how people live in the city are also relevant.

As a person living in or visiting a smart city, one experiences it physically through the interactive urban environment and virtually through online connected media. The economy of smart cities is also important because of the different power structures created by who can afford to fund and develop projects. Anything that falls under the smart city domains such as sustainability and mobility should also be considered. Therefore it would be impossible to list all possible fields in this section.

Actors

Through the interviews and thematic analysis, one of the findings is that the pentahelix framework would be inadequate to capture the complex power relationships in the smart city ecosystem. Sub-ecosystems and hierarchies must also be defined. One may refer back to the visuals in 9.1 for a graphic overview of the different actors.

Within the public sector, the Copenhagen municipality is governed by the Lord Mayor who is the chair of the City Council. Within the council are seven committees. There are seven administrations that perform the tasks of the seven committees. These include Finance, Culture and Leisure, Children and Youth, Health and Care, Social Services, Employment and Integration and last but not the least, the Technical and Environmental Administration. Under this is the Copenhagen Solutions Lab which should be handling all the smart city projects. The real situation is more fragmented. Any of the other committees can be running projects involving technology which the Copenhagen Solutions Lab might not be aware of.

Copenhagen also follows the regional and national strategies pertaining to digitization. Under the Ministry of Finance, the Danish Agency for Digitisation heads many national projects which intersect with eServices available in the city. The Ministry of Higher Education and Science also funds smart city projects. The Ministry of Businesses supports the formation of technological startups which can sell smart city related products and services. Other smaller national agencies like the Danish Design Center consult for smart city projects. As narrated by the interviewees in 8.5, political processes and agendas are crucial in the survival of a smart city project. Not all members within the public sector are equal, politically speaking.

In the private sector, big tech firms are the most powerful and pervasive. For example, Google initiated their smart city project because they had the resources to spare and out of benevolence. Several interviewees across sectors mention using applications and services from big tech. Two have mentioned issues with being dependent on them and their implications. It would not be paranoid to worry about losing control over cities to these corporations with questionable motivations.

On the next level are consulting companies that implement technological projects but may not always have on the ground experience of people who will live with them. Their measures for success, like how much money and time are saved, are usually financially driven. They are unlikely to be motivated to use open source technologies out of social responsible reasons but because it would be more cost-effective. Due to understanding business needs, they are well placed in making business cases for smart city projects.

Traditional companies like real estate and construction are undergoing a digital transformation. Technological capabilities are not yet high and they would be dependent on big tech and consulting firms for implementing smart city solutions. Smaller smart city startups have the potential to compete with big tech firms if supported by the ecosystem. This would lessen dependence and the power of big tech.

Depending on which sector initiates the IoT water project, technology or engineering consultancies would make a bid for the strategy and implementation of the project possibly in partnership with IoT technology vendors. In the case of smaller housing cooperatives such as Haveforening Sundbyvester, whose budget might not be enough for a consultancy to take on, they could hire boutique agencies or freelance consultants.

The civil society sector is also uneven depending on their technological capabilities. There are non-profit organisations in Denmark such as the "Godkendte Teknologiske Serviceinstitutter" translated as Approved Technological Service Institutes. These are special organisations formed under the Danish Innovation Policy, which are already technology and innovation focused and are approved by the Ministry of Higher Education and Science. They have special access to the ministry's funding. Alexandra Institute, FORCE Technologies and Technology Institute are three out of the seven members. They are situated higher than more traditional non-profit organisations with different aims in the city. A lot of them could adapt better to the benefits of the smart city with digital transformation.

Universities in Denmark are funded by the state. Being employed in a Danish university is to be employed by the Danish state. The public sector has a lot of power over how universities are run. University research should be typically where technological innovations begin before being monetized into a business by the private sector. Academia is seen as the source of truth. Businesses and non-profit organizations partner with universities to add legitimacy. For example, Google's Airview project is in collaboration with several universities to validate their data.

Finally there are the city residents and visitors. There are several ways to frame people in the smart city. From the public sector perspective, they are "citizens" who they serve. With technology goggles, they are "users", "human sensors" and units of data. In the cloud, they are zeroes and ones. However, they should not be seen as merely passive consumers of urban technology. They are also capable of being active "produsers" (Bruns 2007) who build the smart city in which they inhabit.

In Denmark, people have the right to form their own communities and organizations. These informal groupings form organically based on mutual interests with a wide range from activities to social causes. Some could grow bigger and become official non-profit organizations or become startups and move to a different sector. Projects from the interviewees in this project that fall under this category are Next Generation Democracy, the Initiative and Foodstack.

Decisions

In the smart city, there are several decisions that can be made. Technically, a project can be started by anyone who feels there is a need for it in the city. However there are still several factors that would make the project survive and thrive. In order to get some kind of funding from the EU or the local government, the project must be aligned with their smart city agenda or digital strategy. In the case of the civil society, the public sector or the people come directly to them with a real urban problem or need. For professors in academia, it also depends on what kind of research that the public and private sectors are willing to fund.

Big tech companies can choose whatever domain they want to implement a project in due to their access to money, technology and experts. However, they still need the partnership of the local government. People who want to start their own project need to have access to knowledge, open source technologies and free time. A city that overworks its citizens should not expect a lot of grassroots tech movements to occur. This is not the case with Copenhagen which ranks highly in the OECD Better Life index which measures work life balance (OECD 2019).

The next step is planning the project and selecting the technology for it. According to the interviews, not all smart city projects involve city residents at the beginning of the process. There are a multitude of reasons for this such as decision fatigue and cultural factors. However, the ones who had some form of involvement saw positive results both in financial terms and project acceptance.

In terms of ending the project, the most common reason is that the project does not get a funding extension or it was a pilot that did not get scaled. In this case, political powers go strongly into play. As for grassroots movements, they can run out of steam because they did not get enough members to sustain it. Project initiators have their own personal lives to deal with and while some can keep a project going on for a long time, others may not have the same luxury.

The everyday person according to Ekman and Amnå's framework, is either involved or not involved in civic participation. Thinking in Carpentier's terminology, those who are involved can either access, interact with or participate in smart city projects. Table below is the AIP model adjusted to fit the smart city.

Table 15. Access Interaction Participation in the Smart City (Carpentier 2012, modified by Author)

Access to the Smart City (presence)				
	Technology	Content	People	Organizations
Production	Presence of computers, mobile phones, reporting apps, internet, IoT, social media, etc.	Presence of smart city project information, open data, city archives, open source wikis	Presence of people with technological know how	Presence of fab labs, living labs and tech related organizations
Reception	Presence of computers and mobile phones connected online	Presence of updated and preferrably real time open data, news updates of smart city projects	Presence of online platforms that can be used for co-creation. E.g. Github, Google Docs	Presence of fab labs, living labs and tech related organizations

Interaction with the Smart City (socio-communicative relationships)				
	Technology	Content	People	Organizations
Production	Using computers, mobile phones, reporting apps, internet, IoT, social media, etc.	Updating smart city project information, open data, contributing to open source wikis, etc.	Co-creating smart city projects as a small interest group or community	Co-creating smart city projects in design thinking workshops organized by the public/private/civil society
Reception	Using computers and mobile phones to access smart city media	Selecting and analyzing data and information accessed from online	Interacting with smart city projects together as a group e.g. joining a Facebook group for Urban Tech	Discussing smart city projects in meetings or consultations organized by the public/private/civil society

Participation in the Smart City (co-deciding)				
	Technology	Content	People	Organizations
Production and Reception	Co-deciding on or with emerging technologies such as machine learning/AI	Co-deciding on or with content	Co-deciding on or with people	Co-deciding on or with organizational policy

Power

Those who hold the keys to the smart city are the ones who have the most of the following: technological capabilities, resources - money, time and manpower, political influence, domain knowledge, grassroots understanding. Currently the big tech companies, the EU and national agenda setters and policy makers are the gatekeepers to the technology, funding and political will. Civil society and academia have specialized knowledge that are crucial to the success of a project. However, they can easily be blocked by big tech and the public sector. As a city resident or visitor, the options in participation are even more limited. Not even all the projects are accessible. If the definition of smart city is only confined to infrastructure in the background, then interaction would be even less possible.

To participate, one must find an open invitation from the local municipality. It is only participation if they actually listen to the suggestions of the people. The more active alternative is to start or join a grassroots movement. But as I14 said, these kind of projects only gain traction if they have a real impact in society. Otherwise, the power imbalance remains the same. Social media is the most common way to interact with the smart city. However, the power imbalances because of giving big tech too much. Unless social media is used to form enough critical mass that shifts power gaps, this is not participation.

By Carpentier's standards, a participatory process "corrects a more general societal power imbalance, where actors that have different power positions in society enter into a process where this power imbalance is (partially) addressed and equalised" (2012). Do smart city processes currently address these societal power imbalances? Existing projects that require specialized knowledge will not facilitate true participation unless they are accompanied by complementary education and training to equalize the information asymmetries.

It is a trap to turn purely to technology to reduce civic engagement and replace people. For example, if people relied on machine learning algorithms to do everything, eventually they will make decisions for them. That is something we have to safeguard against. Humans should still make final decisions. The question is which should be up to machines and which should be humans. A lot of smart city projects exist to keep the status quo in place. Worse is when they make inequality gap bigger. The pragmatic reality is that most people have limited knowledge and time. To ask for too much would be pushing the limits of a representative democracy. There must be some balance found in between participation and technology.

Within Denmark, there is hope that this could actually happen within smaller communities. In Copenhagen, there exists a city within a city called Christiania. It is the closest thing the Danes have to a direct democracy. Can there be a smart Christiania? The new Danish startup Almenr and the Urban Village Project by SPACE10, IKEA's innovation lab, aim to make alternative self-sustaining democratic communities powered with ICT. They are still in the process of planning, designing and experimenting. In the end, market forces might turn it into a smaller version of a digital dystopia, or it could actually succeed with their ambitions. It might not be the future of cities for everyone but it is a promising alternative for those who want to be active participants in the smart city without having to live in a Luddite community.

Summary

The smart city ecosystem in Copenhagen and Denmark in general continues to evolve with more formal partnerships and informal connections across the helices being made. To create a new framework of participation, typologies of Ekman & Amnå and Linders are fused with Carpentier's definition of participation. There is evidence of all participation types in the new framework present in Copenhagen. Multiple power hierarchies still exist in the city.

10 Conclusion

The concept of participation will always be evolving. The field of smart cities is moving even faster. The contributions of this paper include an updated participation framework combining Ekman & Amnå and Linders' typology and looking at it with the critical lens of Carpentier's participatory toolkit. This new framework can be combined with many existing smart city frameworks that have a human component. The best examples of civic participation in the smart city from the interviewees are Underbroen, Organicity, Silent City, Next Generation Democracy, Foodstack and the IoT project of Haveforeningen Sundbyvester.

Further research is needed to explore the different underlying motivations of smart city actors. Through this initial exploration, the findings are that motivations for starting a smart city initiative by the public sector are financial and political. Grassroots community projects are more likely to be driven from social justice. While motivations of participants were perceived by other people to be mostly out of self-interest, through ad hoc conversations, there may be reasons that are more connected to democratic values.

The biggest power gaps in the smart city are not only because of money or status, but caused by information asymmetry which exists in all five members of the pentahelix. For example, the public sector is so big that not every department knows what the other is doing. Another information gap is whether the public sector and private sector developing smart city projects are building it according to what people actually want or only what they think people want. Suggested solutions are participatory design workshops and more education not only for tech skills but also its effects on democracy.

In general, the anecdotal evidence from the interviewees reflect the current literature. Looking at smart cities should neither be top-down, nor bottom-up rather through an ecosystem perspective. If a project claims to have civic participation, take it with a grain of salt. The actual processes that people can do must be analyzed. If these processes don't lead to any adjustments in the power inequalities, then this is just "participation theater." Slapping "design thinking" on a project is a band-aid solution. It is also important to look at funding mechanisms behind a smart city project.

In the following studies, it would be recommended to have exploratory qualitative interviews with smart city residents and visitors to see if they are aware of this smart city phenomenon, if they care at all and if they are participating in any projects. Another method could be a more ethnographic approach. Follow up interviews with municipality project leaders and real estate developers can also be done to validate the results of this study. Surveys can also be performed to be able to find generalizable insights.

On a final note, there must also be more research about the impact of smart cities on the environment. How do they get a voice in the human-centred smart cities?

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