Public Private Innovation Partnerships

Creating Public Value & Scaling Up Sustainable City Solutions

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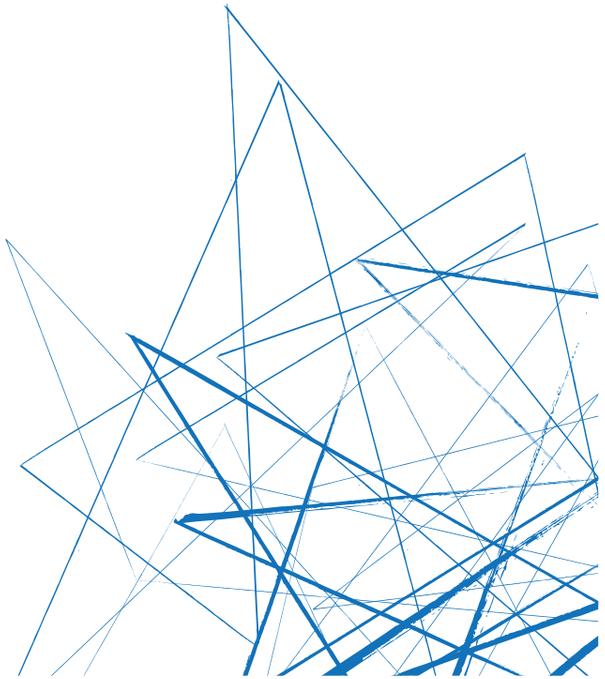

PUBLIC PRIVATE INNOVATION PARTNERSHIPS: CREATING PUBLIC VALUE & SCALING UP SUSTAINABLE CITY SOLUTIONS

PhD Series 25.2021

Lasse Bundgaard

PUBLIC PRIVATE INNOVATION PARTNERSHIPS

CREATING PUBLIC VALUE & SCALING UP SUSTAINABLE CITY SOLUTIONS

CBS PhD School | **PhD Series 25.2021**

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Public Private Innovation Partnerships:

Creating Public Value & Scaling Up Sustainable City Solutions

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Doctoral School in Organization and Management Studies

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The CBS PhD School is an active and international research environment at Copenhagen Business School for PhD students working on theoretical and empirical research projects, including interdisciplinary ones, related to economics and the organisation and management of private businesses, as well as public and voluntary institutions, at business, industry and country level.

Preface

This PhD concerns the development of outcomes in Public Private Innovation Partnerships. It was written between March 2017 and August 2020 and is the result of a collaborative effort between the City of Copenhagen, Copenhagen Business School, Realdania and the Danish Innovation Fund. As an industrial PhD, the project was funded through the Innovation Fund Denmark's Public Industrial PhD scheme under which I have been employed by the City of Copenhagen at Copenhagen Solutions Lab.

First of all, I would like to thank my academic supervisor, Susana Borrás, and my company supervisor, Marius Sylvestersen, for providing competent and inspiring supervision, which is hopefully reflected in its practical and academic relevance. Susana Borrás was kind enough to plant the seed of an industrial PhD when I was still working in the Lord Mayors office at the City of Copenhagen. Marius and his Copenhagen Solutions Lab provided important guidance towards the challenges facing the smart city industry and what type of knowledge was in short supply by the city's innovation office. Secondly, I would like to thank my co-supervisor, Jasper Hotho, for his expertise in methods, specifically within Boolean algebra.

Thirdly, in writing my PhD, I have been fortunate to meet many people who have discussed, commented and provided me with much needed feedback on my papers and overall project. I would like to thank Patrick le Gales, Lene Holm Pedersen, Carsten Greve and Markus Grillitsch for taking on the role of discussants at my seminars. In addition, I would like to give a special thank you to Mart Laatsit for commenting on my draft papers and to everyone in the Research, Innovation and Organization group for inspiring talks and discussions. I would also like to thank David Howoldt, Anne Reff Pedersen, Kathrine Solgaard Sørensen, Jonathan Schmidt, Mark Moore and Lasse Gerrits for commenting on my draft papers.

Thirdly, as part of my journey, I have been fortunate enough to travel and talk to inspiring academics and practitioners, especially during my stay at Boston University's Initiative on Cities, where I spent four months in 2019. I would therefore like to give a special thanks to the institutes' co-director Katharine Lusk for helping me open doors around the city, and to director and professor Graham Wilson, Stacy Fox, Emily Robbins and Fatima Munoz. Lastly, I would like to thank Nigel Jacob of the City of Boston Mayors Office of New Urban Mechanics for sharing the city's perspective on urban development.

As mentioned above, this PhD has come into existence through the help of a group of funders who have all assisted in guiding me on my journey. Thank you, Simon Kofod-Svendsen of Realdania for his efforts and for on-boarding me with the Bloxhub Science Forum. Thank you, Pernille Berg, of the latter for exposing me to challenges and generously including me on the Smart City research cluster's study trips to London and Boston. Through the partners to the project I have been fortunate enough to have great practical and philosophical discussions on the future of urban sustainability. I would like to thank Rasmus Bertelsen, Kim Spiegelberg, Christian Gaarde Nielsen, Tina Hjøllund, Søren Nørgaard Madsen, Maria Krysfeldt Rasmussen, Torben Klitgaard, Hilde Kjensjord, Rasmus Reeh, Peter Bjørn Larsen, Frans la Cour, Malene Højlund Pedersen, Lara Anne Blasberg, Matthew Claudel, Dr. Jonna Nyman and finally to Mikael Simpson & Tilde Bang-Kristensen for their input and for providing a productive research environment.

Finally, I am very grateful for the excellent administrative support I have received from the head of department, Signe Vikkelsø, and the head of administration, Marianne Aarø-Hansen. By the same token, I want to thank Katja Høeg Tingleff at the PhD school and the OMS PhD coordinators Janine Leschke, Antje Vetterlein, Morten Thanning Vendelø and Ursula Plesner who have all been very helpful in navigating the processes and procedures necessary for obtaining the degree. Similarly, I want to thank Katrine Guldager and Ole Vissing from the City of Copenhagen for helping me navigate through my journey.

Abstract

This PhD dissertation studies Public Private Innovation Partnerships (PPI). In particular, I study the use of PPIs in an urban context, where partnerships between municipalities, the private sector, universities and other stakeholders are responsible for developing the supposedly *Smart City*. Smart City Projects are PPIs that aim to create sustainability through the use of technology and data-based innovative solutions for the public sector. Specifically, this study is focused on *outcomes* of PPIs, and is guided by the research question (RQ) *'What outcomes do Public Private Innovation Partnerships lead to?'*. The answer to this RQ is structured around three research articles and this introductory synopsis. Each article answers a sub-RQ related to the main RQ, which takes the reader on a journey through concepts such as *scale up* and *public value.*

The current literature on Public Private Innovation Partnerships has focused on the complex *processes* of PPIs and has identified a number of factors impacting this process. However, there is an important gap in the literature regarding the eventual *outcomes* of such processes. This dissertation attempts to fill that gap by studying different types of outcomes in order to clarify what impact solutions provide. By studying outcomes in an urban context, I address an arena where sustainable solutions are a growing necessity if cities are to deal with the challenges posed by global warming, rapid urbanization, growing inequality and austerity policies.

This PhD consists of three Research Articles that address different aspects of Public Private Innovation Partnerships in Smart Cities. Article I examine what governance conditions influence the ability of PPIs to *scale up*. Article II provides an analytical framework for studying *what* outcomes PPIs provide in terms of Public Value as well as *how* these outcomes emerge, which in effect couples the analysis. Article III establishes the concept of *Soft Public Value*, and argues that three underlying processes can be analyzed to systematically provide an understanding of what outcomes PPIs lead to.

The three articles make use of two different theoretical frameworks. The first article uses the literature on scale up and governance conditions to understand how scale up happens in an urban context, providing pathways for this particular outcome. I identified five governance conditions that were theoretically expected to influence the process of scale up. By identifying combinations of conditions that lead to scale up, this article attempts to answer the RQ '*Under what governance conditions do smart city pilot projects scale up?*'. The article examines 17 cases of Smart City Projects, which yields two separate pathways to scale up: '*bureaucratic tailoring'* and '*low uncertainty partnering'*. This emphasized the importance of resourceful and capable municipalities and enhanced collaboration in the face of technological uncertainty. The cases largely confirm the theoretical expectations; however, the *articulation of needs is* only sufficient for scale up in its absence. In sum, the article shows that various governance pathways to scale up exist for PPIs, yet it also shows that scale up is not the same as *public value creation* nor is it simply a recipe for success, even though it is important for solutions to make an impact.

Research Article II and III rely on a theoretical framework built on Public Value Theory. Article II asks -*What public value is created in Public Private Innovation Partnerships and how does it emerge?'.* In answering this dual RQ, Article II couples the analysis of the process of PPIs with an analysis of outcomes of utilitarian and deontological public value. The findings show that PPIs are mostly suited to the creation of *deontological* public value, but also create important learning for future utilitarian value. *Collaboration* and *leadership* inside the municipality are the most important drivers of these outcomes. Furthermore, the second article shows, that unlike the conditions affecting scale up, public sector *needs* for a particular solution is a significant driver of *public value* outcomes.

Research Article III uses an explorative case-study to investigate '*How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?*'. This paper seeks to deepen the literatures' understanding of these outcomes as they emerge in Public Private Innovation Partnerships from three theoretical processes; *(I) Learning; (II) Transparency; (III) Public Sphere.* The analysis shows that these three processes can lead to diverse Soft Public Value outcomes that consist of technical and organizational knowledge, trust between partners, desired narratives and equal access to experimentation. Finally, through the Public Sphere, PPI's can enable co-creation and development of citizen's collective values to help direction-setting. The implications of this research highlight the juxtaposition of competing interests in PPIs and suggests practitioners should be aware of - and direct processes towards - a wider set of public value outcomes.

In sum, this PhD dissertation has highlighted some of the issues with employing Public Private Innovation Partnerships to develop a Smart City. The research shows that outcomes in PPIs are *deontological* and *soft*, rather than swiftly scaling up and resulting in organizational efficiencies. Through PPIs municipalities have an opportunity to provide public value beyond the logic of efficiency. By employing their close proximity to citizens, and animating private firms and citizens, municipalities can orchestrate long-term sustainable transformations using Public Private Innovation Partnerships. Scholars of PPIs must build on these findings in order to develop a detailed understanding of what actors to involve in order to realize long term sustainable cities.

Resumé

Denne PhD-afhandling omhandler Offentlig-Private Innovationspartnerskaber (OPI). I særdeleshed studerer den OPI'er i en urban kontekst, hvor partnerskaber mellem kommuner, den private sektor, universiteter og andre interessenter skaber løsninger under fanen *Smart City*. Smart City projekter har mange formål, men først og fremmest at skabe bæredygtige samfund ved at udnytte det teknologiske potentiale i data-baserede løsninger. Specifikt fokuserer denne afhandling på de resultater OPI'er formår at skabe. Forskningsspørgsmålet afhandlingen besvarer lyder således *"Hvilke resultater fører Offentlig-Private Innovationspartnerskaber til?"*. Dette spørgsmål guider afhandlingen, der består af tre forskningsartikler. Hver forskningsartikel besvarer således også et underspørgsmål, hvilket tager læseren gennem forskellige begreber såsom *skalering* og *offentlig værdiskabelse.*

Den eksisterende litteratur om Offentlig-Private Innovationspartnerskaber har hovedsageligt fokuseret på de komplekse *processer* der udspiller sig i OPI'er og har identificeret en række faktorer, der har en effekt på deres forløb. Når der kommer til litteraturens fokus på de *resultater* OPI'er afstedkommer har litteraturen overordnet set ikke tilstrækkeligt berørt dette. Denne afhandling forsøger at udfylde det hul i litteraturen ved at gøre det klart hvilke effekter forskellige løsninger har på alt fra offentlig værdiskabelse til skalering. Afhandlingen studerer dette i en urban kontekst og således også en kontekst hvor bæredygtige løsninger er efterspurgte siden urbane miljø er stærkt udfordret af effekterne fra global opvarmning, stigende urbanisering, voksende ulighed og nationale sparepolitik.

PhD'en består af tre forskningsartikler der hver især adresserer forskellige aspekter af OPI'er. Artikel I ser på hvilke organisatoriske- og samfundskonditioner der har effekt på om løsninger fra OPI'er ender med at blive skaleret. Artikel II skaber de analytiske rammer for at studere hvilke *resultater* OPI'er skaber, der tilføjer offentlig værdiskabelse, men også hvorledes denne værdi bliver skabt. Artikel III etablerer begrebet Blød Offentlig Værdi og at tre unikke processer fører

til denne slags resultater. Offentlig værdi fra OPI'er kan konceptualiseres via dette begreb og bruges til at udbygge forståelsen og værdien af disse. Dette er både vigtigt for at kunne forstå hvad offentlig værdi er, men også for at forstå hvordan det skabes.

De tre artikler bliver studeret ved hjælp af to forskellige teoretiske rammer. Artikel I bygger på fem organisatoriske- og samfundskonditioner, der bruges til at forstå skalering af OPI'er. Artiklen forsøger at besvare forskningsspørgsmålet *"Under hvilke stryingskonditioner skalerer Smart City pilotprojekter?"* ved at bestemme i hvilke kombinationer disse fem konditioners tilstedeværelse eller fravær fører til skalering af Smart City pilotprojekter, der er et sub-set af OPI'er. Disse kombinationer blev identificeret gennem en sammenligning af 17 Smart City projekter, og resulterede i to unikke stier som jeg har valgt at kalde *"skræddersyet bureaukrati"* og *"lav usikkerhedspartnerskab"*. OPI'er kan altså følge den ene eller den anden sti til skalering. *Skræddersyet bureaukrati* hentyder til at en kommune med veludviklede kapaciteter, der kan mobiliseres, har en større sandsynlighed for at opnå en skalering. Modsat fører den anden sti til skalering gennem tæt samarbejde, såfremt løsningen ikke er præget af teknologisk usikkerhed. Det empiriske materiale bekræftede i høj grad de teoretiske forventninger til konditionerne, undtagen *behov* som havde en positiv effekt på skalering ved sit fravær. Artiklen viste at forskellige veje kan følges for at skalere OPI'er, men den viste også at skalering i sig selv ikke er nok til at sikre offentlig værdiskabelse til trods for, at det er et skridt i den proces.

Forskningsartikel II og III's teoretiske ramme er baseret på Offentlig Værdiskabelsesteori. Artikel II spørg således *"Hvilken offentlig værdi skaber Offentlig-private Innovationspartnerskaber og hvorledes bliver den skab?* For at besvare dette dobbelte forskningsspørgsmål sammenkobler Artikel II analysen af *processen* og analysen af *resultaterne*. Jævnfør teorien blev resultaterne inddelt i to forskellige typer offentlig værdiskabelse; nytteværdi og filosofisk værdi. Artikel II's udfald viser hvordan OPI'er først og fremmest skaber filosofisk værdi og at den

nytteværdi der bliver skabt, i højere grad bliver skabt på lang sigt, og er afhængig af en kompleks institutionaliseringsproces. Derudover viste analysen at *samarbejde* og *lederskab* inde i den offentlige organisation er med til at drive disse specifikke resultater. Dette tilføjer nuancer til de teoretiske forventninger, der i høj grad argumenterer for *samarbejde* imellem organisationerne i OPI'en driver værdiskabelse, samt at *lederskab* i lige så høj grad kan komme fra den private partners synspunkt. Derudover viste analysen, at modsat som kondition for skalering, så er et *behov* for løsningen i den kommunale organisation et essentielt redskab til at drive offentlig værdiskabelse.

Den tredje og sidste forskningsartikel består af et eksplorativ casestudie der svarer på forskningsspørgsmålet "*Hvordan kan offentlig værdiskabelse udover effektivitet, blive analyseret/konceptualiseret sammenhængende?".* Artiklen udforsker begrebet gennem en dialog mellem teori og empiri med udgangspunkt i en OPI'en Copenhagen Street Lab. Artiklen viser hvordan begrebet Blød Offentlig Værdi kan indfanges af tre processer: (i) Læring; (ii) Transparens og (iii) den Offentlige sfære. De tre processer fører til unikke resultater i form af Blød Offentlig Værdi, men analysen viste også, at processen hvormed de skaber værdi kræver forskellig fokus i OPI'en. I tillæg afklarer artiklen, at den offentlige organisation skal være udstyret til at institutionalisere læring, udbrede resultaterne fra OPI for at disciplinere fokus i partnerskaber og aktivt involvere borgere og slutbrugere for at skabe blød offentlig værdi gennem en OPI.

Denne PhD-afhandling har fremhævet diverse udfordringer i forbindelse med brug af Offentlig-private Innovationspartnerskaber for at skabe Smart Cities. Forskningen viser, at resultaterne af OPI'er er komplekse og alsidige snarere end ligefremme, direkte skalérbare og i stand til at skabe organisatoriske effektiviseringer. Den offentlige sektor, især på kommunalt niveau, må stræbe efter at skabe offentlig værdi, også den type værdi der skaber længerevarende forandringer udover umiddelbar nytteværdi for at rette op på markedsfejl og gennemføre sparepolitik. I stedet bør kommunale instanser udnytte deres lokale

forankring og orkestrere langsigtede bæredygtige transformationer gennem Offentligt-private Innovationspartnerskaber.

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1 Introduction

This is an Industrial PhD dissertation, which has been co-funded by the City of Copenhagen, Realdania and Innovation Fund Denmark, and has been carried out as independent research at Copenhagen Business School. At the inception of this PhD project, Copenhagen was, and still is, working on their ambitious target of becoming the first Co2-neutral Capital before 2025. As a consequence of this transformative policy, the City of Copenhagen – like many other cities around the world – has initiated numerous pilot projects within the Smart City sector as they aim to reach this target. Realdania has recently presented the municipality with *Bloxhub*, 10,000 m2 of newly built quality office space dedicated to promoting sustainable urban innovation and aiming to be a vital arena for public, private and other stakeholders to meet and develop sustainable urban solutions. This forum now hosts 20 interdisciplinary PhD's and postdocs (including this one) as part of a Science Forum to promote further research within sustainable solutions and their implementation. Please see section 1.2 for in-depth ethical considerations of being part of this setup.

This introductory chapter will provide a brief literature review clarifying where the contributions of this PhD fit in and why the topic is so important at this particular time. This includes a section on Research Gaps, which situates the novel inputs from this dissertation. This dissertation answers one main research question and three related sub-research questions, which will guide the reader through the research process. Both these questions and the structure of the dissertation will be laid out in this chapter. Chapters two and three will explore the Conceptual and Theoretical framework of this dissertation, while Chapter 4 explores the Object of Study used in further detail. Chapter five will lay out the Research Design through a thorough description of the methods and data used to underpin the three research articles. Lastly, Chapter six, Conclusions, will answer the main and sub-research questions, reflect on the contribution of this PhD to both academia and practitioners, and suggest further lines of research.

1.1 Background

The 2008 financial crisis sparked renewed interest in the role of governments as facilitators of economic growth. This subsequently led to the mainstream breakthrough by both politicians and scholars in identifying the state as a main actor in driving the economy and innovation. This is especially true of the latter and is best exemplified by the popularity of Mariana Mazzucato's book *The Entrepreneurial State* (2013), which sought to 'put the state back in the driving seat for innovation'. Not only has this book made waves in academia, it has also influenced practitioners as a policy-maker's how-to guide to leverage governments' unique position to advance mission-driven innovation. Mazzucato's influence is evident from her appointment to several national innovation councils and her report '*Governing Missions in the EU',* which is based on her role as Special Advisor to the Commissioner of Science, Research and Innovation. The influence of mission-driven innovation can be seen in the rise of the US Green New Deal and the European Green Deal. Mazzucato and others (Borras & Edquist, 2019; Edler & Yeow, 2016; Edquist & Zabala, 2012; Kattel & Mazzucato, 2018; Mowery, 2009) have advocated holistic, mission-oriented and problem-based approaches to innovation policy, including the adaption of procurement practices as a demand side tool for promoting innovation that addresses societal agendas. Public Private Innovation Partnerships (PPIs) are an example of such a tool, which pools resources and capabilities beyond the public sector in order to serve collective goals.

Public Private Innovation Partnerships is a tool developed to actively stimulate the search for innovative solutions for the public sector through collaboration (Brogaard, et al. 2014; Evald et al., 2014; Dam, 2015; Hartley et al., 2013). PPIs distinguish themselves from traditional Public Private Partnerships by *striving explicitly for innovation* as an outcome and by ensuring that the public and private participants are *mutual development partners* (Hartley et al., 2013). This usually manifests with the public not only providing a testbed but also taking on the role of

lead-user and organizing stakeholders. On the other hand, the private partner provides the technology and "innovation" skills (Munksgaard et al., 2017; Brogaard, 2019). Despite their attractiveness to policymakers, the conditions under which such complex partnerships create public value have not been studied adequately (Brogaard, 2019). In particular, the subsequent outcomes of PPIs have not been adequately examined by the literature. PPIs are distinguished from other types of partnerships by their particular purpose of creating new solutions (Brogaard, 2019; Dam, 2015). As such, they deserve more scholarly attention for their potential to solve the wicked challenges faced by modern societies everywhere, particularly in urban contexts, and which is why they are the object of study in this dissertation.

In the hunt for sustainable transformations to address wicked problems, cities are increasingly at the forefront. This is due to their tendency to be politically progressive, as well as the fact that they are first in line when it comes to facing the impacts of global warming, rapid urbanization and increasing inequality. Cities all over the world are standing on a burning platform. Quality-of-life in cities is under strain from rapid urbanization, and resources like clean air and water are scarce. As a result, cities have united against global warming through organizations such as C40[1], which is a network consisting of more than 90 megacities, pledging to fight the effects of global warming by sharing sustainable solutions, knowledge and expertise across borders and continents. Cities are recognized for their role as growth engines in national economies, previously through heavy industries, but now through knowledge intensive industries and innovation capabilities. This not only makes them central to the experimentation of new solutions but also the arbiters of the direction and ambition of that growth. The pressure to maintain quality-of-life and public services in the context of national austerity policies represents another considerable challenge to cities (Drapalova & Wegrich, 2020). The promise of data-based solutions or *smart* solutions has seen the emergence of a

[1] https://www.c40.org/

'Smart City' industry, which seeks to assist cities in bringing their governance up to speed with technological developments. To leverage the potential of smart technologies, cities have initiated pilot projects in partnership with private firms, universities and citizens through living labs. Even so, it is becoming apparent that technological solutions will not easily address all of these challenges nor have immediate impacts (Meijer, 2018). Thus, questions remain with regard to what could scale up these pilot projects in order to achieve the desired impacts and what public value is created in that process and how. Smart City Projects are viewed as successful if they manage to scale up, yet it is unknown if scale implies public value creation. Whether or not it does, cities must learn how to navigate and manage cross-sector collaborations going forward. These pressing agendas need scholarly attention for practitioners to understand how to best govern, design and balance public value, transformative ambitions and sustainable economic, social and environmental development with everyday service levels and societal cohesion. Public Private Innovation Partnerships help deliver the desired results, but little is known about what outcomes they deliver and how.

1.2 Research Ethics

During the course of my PhD, I was employed by the City of Copenhagen, in the unit *Copenhagen Solution Lab.* My PhD project fell under the Danish Industrial PhD program established by Innovation Fund Denmark. It is a program that co-funds research, which focuses on innovation and development in private and public organizations. This PhD project was co-funded by three distinct sources: Innovation Fund Denmark, Realdania, and the City of Copenhagen. Realdania is the largest Danish foundation dedicated to supporting research related to the building, architecture and construction sector. My PhD was a frontrunner for a cohort of co-funded young researchers within the theme of *Smart Cities*, in which 10 PhD and

post-doc researchers (including this one) were co-funded in a partnership between Innovation Fund Denmark and Realdania.

As a PhD researcher, I was enrolled at Copenhagen Business School and attached to Susana Borrás as my academic supervisor. Through my enrollment at CBS, I conducted two Work-in-Progress seminars, where one internal and one external scholar provided feedback and guidance for the research project. The PhD consists of three papers and a synopsis. The three papers have all been reviewed through various paper seminars at the university, as well as a paper presentation of article I at EGOS in Edinburgh, 2019. As per the regulations I also had a company supervisor at Copenhagen Solutions Lab (CSL). While my time was divided between Copenhagen Business School and Copenhagen Solutions Lab, I did not carry out any work on behalf of CSL during this time. As CSL is a semi-autonomous unit within the City of Copenhagen, their offices are part of Bloxhub, which is a hub that houses businesses, NGO's and research organizations focusing on Smart City and the built environment. Following the continual arrival of other Smart City-focused PhD and post-docs, we were able to create a research environment at Bloxhub. This environment was institutionalized as the *Research Forum*, and was funded by Realdania. Within the Research Forum, we went on a study trip to London where talks were organized to discuss and provide feedback on each other's research projects. The industrial PhD's in the Research Forum were all co-funded by Realdania, affording us a further degree of independence and freedom from our employers as they were not financially invested to the same degree as conventional industrial PhDs. Furthermore, it was an important condition for the Realdania funding that we would be allowed to have full independence from our industrial organization.

Regarding my role as an industrial PhD student employed by the City of Copenhagen, it was important for Realdania that CSL indicated their support for an

open and independent research process along with their interest in receiving the results provided by my independent research. It is very important to state that CSL did not attempt to interfere with my data collection, research design or choice of cases. I presented my research findings to CSL and the City of Copenhagen five times during the course of the PhD. I also took part in research meetings and presented my research to a cohort of young researchers in the Realdania and Innovation Fund Denmark program. Any feedback I received from these presentations was critically assessed later and in cooperation with my academic supervisor to double check what feedback was useful and relevant for the research project.

As mentioned above, the PhD consists of three articles and a synopsis. While three of the cases that I use in my dissertation (see article II & III) take place in Copenhagen, the first article is a testament to my focus on global cases given that it compares 17 Smart City projects from Europe, North America and Asia. One of the important lessons learnt from my first article was the difficulty verifying information on Smart City projects from afar. At the time of my research, the Smart City industry was a rapidly growing and somewhat hyped industry, which made it difficult to assess whether these projects had realized their potential or not. This drove me to conduct my research closer to home, where I could more easily verify information and study the processes and outcomes of Public Value Creation from Public Private Innovation Partnerships on Smart Cities, which is the topic of paper II and III.

Innovation is a reiterative process of failing in order to succeed. This also applies to Smart City projects, and underlines the importance of examining cases that failed to create the anticipated impact. In the process of gaining familiarity with cases for article I, it became apparent that it would be very difficult to obtain interviews from failed cases, as partners are generally more reluctant to discuss them. Two of the cases I identified from article I had taken place in Copenhagen. Through my network I was able to establish contact with the private and public project

managers and ensure that I would be able to gather a variety of data from different sources. Importantly, I identified the interviewees through publicly available project descriptions rather than through consulting the City of Copenhagen. In the end, I was able to verify the sequence of the Public Private Innovation Partnerships both through in-depth interviews and written documentation. Since all interviews were anonymized, my relation to the City of Copenhagen did not influence the responses of the interviewees. Article II seeks to establish what empirical outcomes can be derived from Public Private Innovation Partnerships according to Public Value Theory. It does not aim to evaluate or judge the City of Copenhagen's involvement in these projects. As a result, there was no conflict of interest with my employers at Copenhagen Solutions Lab in relation to investigating these two cases, and at no point was the municipality involved in the collection, analysis or interpretation of this article.

In article III, I investigate the Copenhagen Street Lab project, which was officially administrated by Copenhagen Solutions Lab. However, by the time I did the interviews, collected the data, and carried out the research only *one* out of the nine interviewees were still employed at CSL. Moreover, the Street Lab had already been closed down prior to the initiation of the study. As with the other articles forming this PhD dissertation, the aim of the study was not to evaluate nor pass judgment on the project, but rather to establish how the presence of certain theoretically-established processes affected the public value outcomes.

Throughout my research, I enjoyed complete freedom of research without a single attempt by the municipality to affect my data or my results, direct my research design decisions, or influence my case selection. For a full description of my research design, please see Section 5 of the synopsis for an overview. In sum, I believe that my freedom of research was exhaustive throughout my industrial PhD and through rigorous academic methods I was able to robustly distance myself from the subject studied.

1.3 Literature Review

A normative shift in Science, Technology and Innovation policy (STI) is taking place (Uyarra et al., 2019) both in the literature and also amongst policymakers. One approach fueling both arenas has been the recent rise of Transformative Innovation Policy (TIP). TIP is a new way of framing STI policy, which goes beyond focusing on competitiveness and national systems of innovation indicators. Instead, it centers on the ability of policy and institutions to transform and induce socio-technical change, as this is considered key to overcoming the sustainability challenges societies are facing (Schot & Steinmüller, 2018). For advocates of TIP, the most significant characteristic of the framework is its emphasis on inducing change in the socio-technical system by designing policies that focus on anticipation, participation, experimentation and directionality. This shift has not only influenced the way the literature considers traditional supply-side innovation policies but it has also affected demand-side tools such as public procurement, which has been touted as an untapped potential for societally valuable innovation (The Aho Group Report, 2006; Edler et al.; Uyarra et al., 2019; Borras & Edquist, 2019). Public Private Innovation Partnerships (PPI) is a tool in the spectrum between supply and demand, which can realize the direction of innovation through experimentation and participation of non-government actors, ultimately using the needs and – where possible – the demands of the public sector instead of traditional procurement practices (Edler et al., 2016).

The literature on Public-Private Partnerships (PPPs) has been focused on the traditional use of partnerships as a vehicle to attract private capital for low-risk investments in infrastructure projects (Dam, 2015). Fewer studies have considered PPPs with the explicit purpose of creating public sector innovation, namely Public Private Innovation Partnerships. The push for the public sector to 'deliver more for less' in an environment pressured by calls for increased resource efficiency and

addressing grand challenges like climate change and rapid urbanization, has opened the door for using Public Private Innovation Partnerships to create public sector innovation (Osborne and Gabler, 1992; Sørensen & Torfing, 2011). This in turn has led the OECD (2011) to recommend the use of PPPs in creating innovation, which inspired the EU Commission directive on public procurement (EC, 2014) to develop a procedure on innovation in partnerships. The aim of this type of partnership is to remove the principal-agent structure entirely and use new combinations of knowledge, shaped between equal development partners, to create solutions to wicked problems (Brogaard, 2019). However, the popularity of this type of partnership in the public sector has not been adequately followed up by researchers, and a number of relevant questions surrounding the use of PPIs remain unanswered.

Public Value Theory (Moore, 1995; 2013, 2014; Bryson et al., 2015; 2017; Benington, 2009; Hartley, 2012) was originally designed as a strategy tool for the public sector. It has since emerged as a strong advocate of the public sectors' unique ability to create value towards a normative vision of a sustainable society and a fully-fledged academic theory. Public Value Theory (Benington & Moore, 2011; Moore, 1995; 2013; 2014; Bozeman & Jørgensen, 2007; Bryson et al., 2015; Hartley, 2013) holds that there are public values that must be developed, identified and addressed in order to ensure fair and just societies. Moore (2013; 2014) recently stressed the importance of *Recognizing Public Value* and has developed the Public Value Account in order to transparently assess the efficiencies and normative value created by the public sector. This provides a theoretically-founded framework through which to describe many nuances of the public value created, discovered and destroyed in a project. PVT has generally been skeptical towards the governance aspects of PPPs. The possible negative consequences of implementing New Public Management have alarmed some scholars of public administration about potential de-democratization and singular focus on efficiency by the public sector through partnerships. The literature thus provides critical

frameworks for studying public value creation, which this dissertation will build upon in Articles II and III in order to connect the study of PPIs to the concept of public value.

Realizing the potential from pooling resources and capabilities through PPIs is one possible path to satisfy economic, social and environmental sustainability, but only through scaling up. In various literatures (Complex Adaptive Systems, Business literature, Development literature, Sustainable Transitions), there is an expectation that this potential is realized by *scaling up* new solutions and thereby maximizing resource efficiency. Various authors (Kohl & Cooley, 2003; March, 1991, Lavie, Stettner & Tushman, 2010; Hartman & Lin, 2008) have explored this in the fields outlined above, however the paths to scaling up pilot projects of Public Private Innovation Partnerships have not before been investigated using governance conditions. Drawing on the above literatures by van Winden (2016; & van den Buuse, 2018) and von Wirth et al. (2019), scaling up in relation to Smart City projects has been conceptualized into three specific types (*Roll-out, Replication, Expansion*). Yet, these paths are overly simple and assume generic governance conditions to be in place while focusing on market and entrepreneurial conditions as the most important. This dissertation aims to identify the most relevant governance conditions and illuminate the complexities involved in the governance of scaling up Smart City Projects.

Finally, as the object of study in this dissertation are Public Private Innovation Partnerships carried out as Smart City Projects, a brief note on the state of the literature on Smart Cities is required. There are two opposing strands of scholars engaged in conceptualizing and theorizing Smart City, which have been growing in the last decade. The first has a technology-positive outlook equaling technology implementation with a smart city (Batty, 2013; Zuiderwijk, 2012; Drapalova et al., 2020). Technological innovations thus make "*cities safer, cleaner, more prosperous, more accessible and more innovative*" (Drapalova et al., 2020: 2). This line of research is influenced and convinced by the visions of problem-solving capabilities

frequently sold by major ICT players and international consultancies alike (Mora & Deakin, 2019; Meijer, 2018; Green, 2019). The other strand takes a more critical approach to smart cities and tends to view it as a neoliberal agenda set by private industry eyeing profits from pressurized municipalities. According to this view, strict austerity measures, resource scarcity or economic growth agendas put municipalities under pressure, forcing them into technological lock-ins and path-dependent solutions, and an overreliance on specific technologies (Hollands, 2008; Datta 2015; Mora & Deakin, 2019, Drapalova et al., 2020). These opposing normative strands about smart cities (either very positive or very negative) are slowly being replaced by a more nuanced approach. This emerging approach intends to deepen understanding by employing an empirical analysis of the political, societal and organizational implications of Smart City projects, treating them as an object of empirical study (Meijer, 2018; Drapalova et al., 2020; Lombardi and Vanolo, 2015). Using governance conditions and Public Value Theory this dissertation aims to contribute along these lines by developing comprehensive and theoretically founded empirical analysis to relieve the impasse in the Smart City literature, and therefore responding to the need of "*more critical engagement examining the existing smart cities, and demands an [empirical] analysis of their political and societal implications"* (Drapalova et al., 2020: 3; Meijer, 2018)

Considering cities will continue to move along the forefront of sustainable development, this PhD will attempt to further the theory on the subject of PPIs, by answering some of these questions. Through three Research Articles, three sub-RQ's will be answered and together they provide the basis for answering the main research question. The next section shows the research gaps that justify these research questions.

1.4 Research Gaps

The literature review revealed some of the unanswered questions surrounding urban sustainability projects and the tools with which they develop. This section will detail the research gaps outlined in the literature review, which this PhD addresses through three research articles. Ultimately this section serves to connect the literature review with the Research Questions in section 1.5 below.

This dissertation focuses on three gaps in the current literature. The first gap addresses the need to examine the governance conditions of scaling up smart city pilot projects developed in Public-Private Innovation Partnerships. As reviewed above, most of the literature is based on a normative discussion on the role of technology-only driven solutions. Likewise, the literature studying scale up has tended to focus on market or entrepreneurial conditions for scale up. Although these conditions are relevant, the market-only perspective has tended to disregard the governance context in which scale up of pilot projects takes place in municipalities. Furthermore, this has limited the possibilities for conducting solid comparative empirical analysis. The second gap that this dissertation aims to address is related to the literature of Public Value. Up until now, that literature contains a rather limited number of empirical studies vis-à-vis theoretical and conceptual frameworks of Public Value literature. In other words, it is a body of work that needs to engage in more empirical analysis. Theory-building needs to interact with solid empirical studies so as to confront its assumptions with evidence from empirical findings in order to move forward and provide more sophisticated theoretical frameworks. The third gap has to do with Public Value literature, which has overwhelmingly focused on processes rather than on outcomes. These three gaps are explained in detail in the rest of this section.

When looking at the first gap in more detail, the literature review above and in Article I have shown that a large body of literature has been devoted to the study of smart cities for almost three decades. This focus existed before the advent of the

concept of the smart city itself, when questions of how new solutions arise and generalize in the urban context were posed (Mora et al., 2019). The literature has gained traction as the consequences of climate change and a scarcity of resources are felt most urgently in cities and as rapid urbanization takes place across the globe (Contreras and Platania, 2019). The literature on smart cities ranges from empirical studies of types of smart cities (Nilssen, 2019), to more critical conceptual studies on what a smart city really is and aims to be (Hollands, 2008). The overemphasis on technology as a main component of the smart city, in both the literature and by professionals, has led to an expectation of "technology-driven problem-solving" where technology unilaterally affords opportunities without contestation or negative consequences (Drapalova et al., 2020: 2), and where market and entrepreneurial dynamics are the only conditions at play. Hence, the literature thus far has focused overwhelmingly on technology-only and market-only approaches, largely disregarding the governance context in which smart city pilot projects take place. Moreover, the critical Smart City literature has largely overlooked solid empirical comparative analysis and instead embarked on an ideological battle over the nature of cities and possible hostile private capture of public space. While uncovering the assumptions and motives of the actors pushing Smart City Projects is important, looking into the empirical impacts and outcomes of PPI's in this space must also be a priority. This is necessary to achieve a concrete and informed empirical analysis from which to discuss the future of the city (and possibly the smart city). This PhD aims to contribute by filling this gap. In so doing, it seeks to make a contribution by conducting an empirically solid comparative study that examines a series of governance-related conditions for the scale up Smart City Projects, which are urban-level PPIs.

The conditions under which smart city projects thrive and evolve beyond pilot projects have been studied earlier, albeit from a market, entrepreneurial or technology-based perspective and thus not using governance conditions. Essentially, part of this PhD aims to fill this governance-shaped hole by

investigating mechanisms that promote or hinder the scale up of smart city projects. What the existing studies (see van Winden & van den Buuse, 2017; von Wirth et al., 2019) largely overlook is the special governance dimensions involved in smart city projects, which go beyond the market-based and entrepreneurship-related conditions. By looking at some specific governance conditions in an encompassing comparative analysis based on a novel method (fsQCA), this PhD aims to address this gap. In so doing, it contributes by bringing the literature on smart cities into a less normative discussion about techno-utopias/dystopias and into an empirical and scientific analysis about the outcomes of complex urban governance.

This PhD dissertation further addresses two gaps in the Public Value literature; namely, a general lack of empirical analyses and a lack of focus on public value outcomes (second and third gap of this dissertation). The second gap was recently mentioned by Hartley (et al., 2017), who believes that despite a growing interest in the literature – prompted by Moore's (1995) seminal work — most of the published research on Public Value is "*theoretical, conceptual, scholarly, synthetic or descriptive*." (Hartley et al., 2017: 670). Critics of the theory (Rhodes & Wanna, 2007; Dahl & Soss, 2014) have helped develop it through a highly conceptual and theoretical debate. However, a well-developed and mature theory must be based on empirical research (Hartley et al., 2017). Hartley et al. stress the need to understand how value is created in partnerships with other stakeholders. Considering Public Private Innovation Partnerships form the context of this enquiry, this PhD dissertation is well-positioned to fill this gap. Furthermore, Hartley et al. (2017) stress that there is a need for research "*about the value created (or destroyed) in terms of legitimacy, trust, social justice (…)*".

This leads me to the third gap identified in this dissertation, namely the lack of focus on outcomes. Public Value Theory can be divided into different conceptualizations of public value (see Hartley et al., 2017: 671-674), yet studying public value outcomes from empirical research is particularly lacking in two of

these: *(i) Public value as a contribution to the public sphere* (see Benington, 2011; Moore, 2014) and *Public value addressed through specific actions in partnerships* (see Stoker, 2006; Denhardt, 2011; Bryson et al., 2014; Crosby et al., 2017). This third gap coincides with a similar gap within the PPI literature (Brogaard, 2019) and a growing interest in understanding the outcomes of innovation processes in the literature on public sector innovation and innovation policy (Uyarra et al., 2019; Kattel et al., 2018; Fastenrath et al., 2019; Weber & Rohracher, 2012; Ghosh et al., 2020). The remainder of this section will look into this more closely.

For Public Value to provide an adequate lens through which outcomes can be captured, it is vital that more attention is directed at identifying what outcomes result from the processes of public value creation. The existing literature has researched several aspects of public value creation, formation, etc., and these have tended to focus on *process* rather than *outcomes*. The focus on process is warranted, as processes are generally easier to identify than outcomes. Yet, it is very important to study outcomes, particularly because not all public sector innovation automatically creates public value. Public Value Theory has thus far not addressed this crucial point about the outcomes (Brogaard, 2019).

Kattel et al. (2018) review public sector innovation and identify Public Value Theory as a possible conceptual angle able to study and adequately capture the variety of outcomes, yet this will require the development of an analytical lens to capture outcomes. When addressing wicked problems (Rittel & Webber, 1973), the usual static performance dimensions "*make no sense*" (Kattel et al., 2018: 10). Public Value scholars (Torfing, 2019; Hartley, 2006; et al., 2013; Crosby et al., 2017; Brogaard, 2019) ignore this problem when they choose to focus on the independent variables affecting public sector innovation. Public Value scholars - willingly or not –reduce the parameter of success by relying on inadequate and static evaluations of whether innovation was created. As mentioned above, technology and innovation are not the same as Public Value outcomes. Therefore, Public Value outcomes are still largely understudied and need a new analytical and conceptual framework that

goes beyond 'the logic of efficiency'. Finally, this will challenge the uncontested assumption within the literature that public sector innovation and the use of technology in the provision of public services automatically implies positive Public Value outcomes.

There is a growing interest in the public sector innovation literature, to find new ways of understanding and identifying outcomes, especially since an empirical turn has taken place within the literature over the past decade (Uyarra et al., 2019; Ghosh, Kivimaa, Ramirez, Schot & Torrens, 2020). This turn reflects the difficulty of public sector innovation to address societal challenges such as poverty, climate change, economic inclusivity and pollution (Weber & Rohracher, 2012; Uyarra et al., 2019). This has sparked renewed attempts to understand what transformative outcomes look like and *how* to identify them (Kattel et al., 2018; Ghosh et al., 2020; Schot et al., 2019; Torrens et al., 2018). With its focus on citizen engagement, legitimacy, leadership and public management, Public Value Theory can inform direction-setting and experimentation and recognize outcomes (Kattel et al., 2018; Mazzucato & Ryan-Collins, 2019; Uyarra et al., 2019). Mazzucato & Ryan-Collins (2019) write "*to further develop this concept of public value creation will require research on how public value can be nurtured and evaluated*". This call is echoed by other innovation policy scholars (see Kattel et al. (2018); Kattel & Mazzucato; 2018; Uyarra et al., 2019)), since PVT is ontologically different from other public management theories, recognizing the public sector's ability to create public value and not limiting it to the role of passive facilitator.

The Venn diagram in Figure 1 illustrates the third gap in the literature that this dissertation aims at addressing.

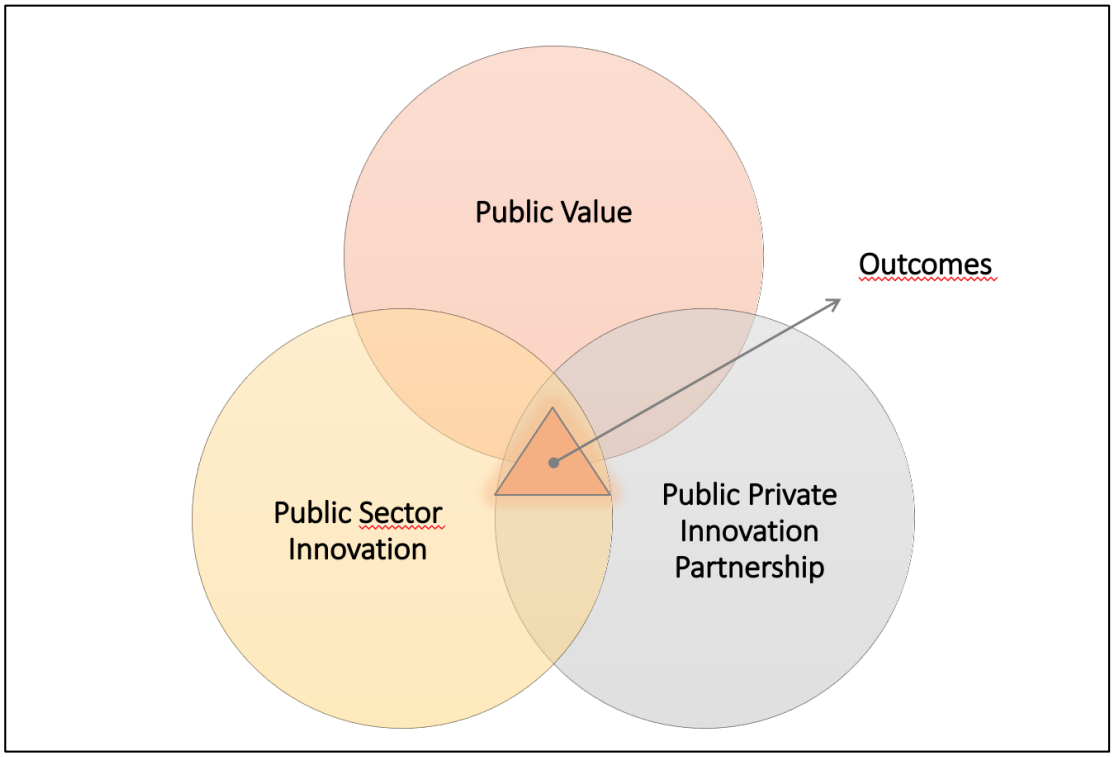

Figure 1: Research Gap

Source: authors' own elaboration

Using the theoretical, conceptual and ontological core of Public Value to address these issues provides this PhD dissertation with a unique opportunity to fill the gap with a contribution to several bodies of literature and to develop the understanding of the impacts of PPIs as Smart City Projects. The next section formulates the key research questions that guide this dissertation.

1.5 Research Questions

The previous section showed that in spite of the attention paid to innovation *as a process* by several schools of thought, there is still a lack of understanding under what conditions *scaling up* take place under and what kind of public value is created in Public Private Innovation Partnerships. Thus, in understanding how PPIs can contribute towards solving wicked problems, there is a need to understand what

pathways lead to the desired outcomes and indeed what those emerging outcomes look like. Thus, the *Main Research Question* of this dissertation is:

What outcomes do Public Private Innovation Partnerships lead to?

Answering this research question will enable this PhD dissertation to advance the knowledge of which pathways PPIs shape in order for pilot projects to scale up in urban contexts, while also critically examining what public value outcomes are created through the PPI process. Focusing on the outcomes of PPIs is important given that the literature thus far has been more concerned with the process. In the pursuit of developing new frameworks for identifying the outcomes of Smart City Projects, this PhD will revert to scale up and public value theory literatures. The dissertation is split into three research articles with each providing part of the answer to the main RQ by way of answering three sub-RQ's. The answer to the main RQ will be summed up from the articles and reflected upon in section 6 Conclusions.

*Sub-RQ I: 'Under **what** governance conditions do smart city pilot projects scale-up?'* investigates five conditions derived from the literature. Through 17 Smart City Projects – which are the same as PPIs, but in a particular context – this research article aims to understand how these conditions individually, and in combination with each other, relate to the scale up of Smart City Projects. Uncovering the combinations of conditions that enable pathways to scale up provides the empirical and theoretical platform for a discussion on how PPIs can be designed to scale up.

*Sub-RQ II: '**What** public value is created in Public Private Innovation Partnerships and **how** does it emerge?'* is dual in nature, as its main contribution is to combine the dynamic study of the *how* with *what* public value these processes lead to. In answering *how* the public value emerges, paper II uses the literatures' understanding of barriers and drivers in PPIs. In answering *what* public value, the

paper uses Moore's (2014) Public Value Account, to investigate the utilitarian and deontological outcomes of two PPIs.

*Sub-RQ III: '**How** can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?'* This third sub-RQ follows up on the previous question by building the conceptual and theoretical understanding of what outcomes, beyond the logic of efficiency, PPIs lead to. By using three concepts from the literature, this article captures their relation to specific outcomes from a single case study. The theory has, up until now, not only disregarded the resulting value from PPIs, but also tended to focus solely on the processual aspect. This has led to an oversimplification of the relationship between public value as a process and as an outcome. Answering this sub-RQ, develops an analytical framework for studying the public value outcomes of PPIs.

Type	Research Question	Articles
Main-RQ	What outcomes do Public Private Innovation Partnerships lead to?	1, 2, 3

Table 1: Main Research Question

Type	Research Question	Article
Sub-RQ I	Under what governance conditions do smart city pilot projects scale-up?	1
Sub-RQ II	*What public value is created in Public Private Innovation Partnerships and how does it emerge?*	2
Sub-RQ III	How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?	3

Table 2: Overview of sub-Research Questions

1.6 Main Contributions

This dissertation has aimed to provide three main overall contributions through three research articles. By answering the sub-RQ's, three novel contributions to the literature can be identified: first, the establishment of paths to scale up through governance conditions; second, to develop Public Value Theory through empirical analyses; third to contribute to the conceptual and empirical development of public value outcomes from Public Private Innovation Partnerships.

The first contribution is the discovery of two paths consisting of combinations of governance conditions that lead to the scale up of Smart City pilot projects (a form of PPIs). Article I contribute to the Smart City literature by applying a governance-based approach to the understanding the process of scaling up. This is a novelty seeing as governance conditions within this field have only been studied individually. However, my contribution shows that governance conditions function in combination to underpin scale up. By comparing 17 cases of Smart City Projects, two paths could be identified: *bureaucratic tailoring* and *low-uncertainty partnering*. The results have three theoretical implications:

- Smart City pilot projects can scale to city-wide solutions through differentiated pathways. The literature has previously not considered that scaling up Smart City projects from a few streets into entire city solutions could take place through differentiated pathways. The novel findings of this article underline the complexity and non-conformity of scale up processes;
- The role of the municipality and their capabilities vary across the different pathways of scaling up, and this variation is related to the presence of other governance conditions;
- The social perception of technological uncertainty is not static but fluid and is related to other governance conditions, such as the intensity of collaboration.

These findings do not replace the work done by other researchers on market and entrepreneurial conditions in scale up processes; it complements these studies,

providing practitioners with an added impetus to look beyond market mechanisms when attempting to scale up.

The second main contribution of this dissertation has been to develop a novel operationalization of Public Value Theory, which serves as an analytical framework for the study of public value outcomes and the conceptualization of Soft Public Value as a result of this analysis. As touched upon above, the theory's extensive discussions and approach have focused primarily on processes of public value creation and have disregarded the public value outcomes. As a result, some of the conceptual aspects of outcomes are underdeveloped. This dissertation contributes to this gap by developing the concept of Soft Public Value and with it, an operationalized framework of Public Value Theory that enables an analysis of outcomes from PPIs. *Soft Public Value* goes beyond the 'logic of efficiency' by extending an understanding of other possible forms of public value creation. This novel conceptualization is vital for understanding the overall relevance of PPIs in contexts of complex problems – such as grand challenges in urban settings – because it is exactly this type of value PPIs are likely to create. This latter point was also illustrated by the emphasis on *deontological* value found as the main outcomes of article II; however, the concept of deontological was found to be too vague and lacking in its ability to capture and categorize outcomes. In sum, this contribution allows future research to explore processes in combination with their outcomes and empowers the much-needed empirically driven theoretical development of Public Value Theory.

Finally, the third main contribution of this paper has been to bring forward novel empirical findings identifying the specific outcomes of public value created in Public Private Innovation Partnerships in urban contexts. In the literature on PPIs, outcomes have mainly been reduced to a binary question of whether innovation for the public sector was created (yes/no) and whether this was incremental or radical. By providing empirical evidence of the outcomes of PPIs in terms of Public Value this dissertation thus makes a novel contribution, which should inspire researchers

to look beyond the logic of efficiency when studying outcomes. Both article II and III develop a solid empirical analysis about this matter, following the operationalization and conceptualization mentioned above. Using Moore's Public Value Account, article II investigated outcomes in terms of *deontological* and *utilitarian* public value and found that deontological value outcomes were most prominent. Both PPIs investigated managed to create utilitarian outcomes; however, these did not have an immediate impact and depended on successful institutionalization in order to have an effect on public value in the long term. Article III identified Soft Public Value outcomes from analyzing three processes in a Public Private Innovation Partnership. Following the theoretically established processes, Soft Public Value emerged as the framework sought to only capture public value outcomes beyond the logic of efficiency. The article was successful in this and the empirical findings showed a broad range of public value creation from the three processes thus expanding the literature's understanding of what public value processes lead to.

Taken together, these empirical findings make a novel contribution in the literature by showing that public value outcomes from PPIs do not necessarily have immediate impacts on resource efficiency and optimization in the public sector. This means that public and private partners do not automatically have the same incentives to pursue public value outcomes. Both the former framework, built on Moore's Public Value Account, and the latter framework contributes to widening the empirical manifestations of Public Value outcomes. The fact that outcomes beyond the logic of efficiency can now be captured, represents a new contribution and a first step towards *recognizing* this type of value and legitimizing the pursuit for it.

1.7 Structure of the dissertation

Regarding the structure, this dissertation is made up of three research articles and this introductory synopsis. This book aims to provide a red thread through the various concepts and theories used in order to answer the main research question '*What outcomes do Public Private Innovation Partnerships lead to?*'. The three research articles have either been submitted to academic journals or are to be submitted and hence can be read and understood individually. Given that these articles form separate building blocks of the overarching goal of answering the main RQ, their conclusions are summarized in Chapter 6.1 alongside the main conclusion. The following chapters will guide the reader through the frameworks used in the research articles and pick up some of the unanswered questions this PhD and its articles pose for future research agendas. As a collaborative research project with funding from Innovation Fund Denmark, Realdania and Copenhagen Solutions Lab, and as a part of the City of Copenhagen, section 6.5 looks beyond the scholarly context and provide practitioners with key insights for how to approach the planning, design and execution of Public Private Innovation Partnerships.

	Title	**Research Question**	**Status**
Article I	Smart City Projects as Transformative Innovation for Urban Sustainability: Organizational Conditions for Scale Up	Under what governance conditions do smart city pilot projects scale-up?	Accepted by "Technological Forecasting and Social Change"
Article II	Creating Public Value from Public Private Innovation	What Public Value is created in PPIs, and how does it	To be submitted to "Public

	Partnerships: A Tale of Two Smart City Solutions	emerge?	Money and Management"
Article III	Soft Public Value in Public Private Innovation Partnerships	How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?	To be submitted to "Perspectives on Public Management and Governance"

Table 3: Research Articles

2 Conceptual Framework

In order to answer the research questions, it is important to understand not only what Public Private Innovation Partnerships, Public Value and the phenomenon of a Smart City entails but also what their relationship is. Thus, this section will explain some of the key concepts used in this dissertation and how I define them. First of all, it is important to understand that PPIs are a unique subset of PPPs (read below). In a similar vein, Smart City Projects are specific forms of PPIs in urban contexts.

2.1 Public Private Innovation Partnerships

This section will clarify the object of study of this dissertation — Public Private Innovation Partnerships — by defining the concept in relation to how it has grown out of the literature on Public Private Partnerships (PPPs). PPPs have been used as

Public Private Innovation Partnerships constitute partnerships in which public and private entities collaborate to develop new services or technologies for use in the public sector.

Box 1: Definition of Public Private Innovation Partnerships from Brogaard (2019: 2)

a policy tool for centuries (Dam, 2015), and yet it is continuously debated as to what is actually being studied when PPPs are researched (Dam, 2015; Brinkerhoff and Brinkerhoff, 2011). Public Private Innovation Partnerships are a subset of PPPs and are thus best understood within this context. Therefore, this section will go into some of the history of PPPs in order to adequately show why I use Brogaards' (2017; 2019: 2) definition, namely because it distinguishes PPIs from other types of cross-sector interaction. This underlines the need to develop theoretical and analytical frameworks that belong exclusively to PPIs.

Public Private Partnerships from a historical perspective

PPIs come from a tradition of studying cross-sector partnerships, namely *Public Private Partnerships*. Since the late 20th century this instrument has been a part of policymakers' toolboxes. Popularized by successive UK governments throughout the 1980's and 1990's, PPPs were becoming a globalized phenomenon (Dam, 2015; Hodge et al., 2010; Greve, 2003). Yet, the history of forming partnerships across the public-private divide can be traced as far back as the Roman Empire and the establishment of ancient infrastructure (Wettenhall, 2005). Nowadays, it occupies the busy solution space between nationalization and privatization strategies and has been celebrated as a *third way* (Conolly et al., 2008). While PPPs are often associated with large infrastructure developments, they are also used in an array of different policy areas (Wettenhall, 2005; Dam, 2015).

The modern understanding of PPPs come from the Private Finance Initiative (PFI), which was introduced in the UK in 1992 and was inspired by urban redevelopment projects in the US carried out between local governments and private capital in the 1970's (Weihe, 2008). The PFI contract was used by the then Conservative and subsequent Labor government, who rebranded the scheme as "Public Private Partnership" to attract private finance for public infrastructure and rebrand it as a new approach to government (Hodge & Greve, 2013). Yet, as the scheme spread

around the world, it developed beyond the simple financing of public infrastructure. In fact, Brinkerhoff & Brinkerhoff (2011) have created a taxonomy of the purpose of PPPs splitting them into five overall purposes[2]. Hence, the rationale behind PPPs changes over time and through local uses, which are based on the political and institutional context within which they take place (Dam, 2015). In Denmark, the Scandinavian corporatist tradition has favored informal interaction between the public and private, and thus a certain skepticism towards the formal structures of PPPs have persisted (Greve & Mörth, 2010). Interestingly, this informal approach seems to have fostered more Public Private Innovation Partnerships in Denmark, at least in terms of numbers. Brogaard and Petersen (2014) report 249 ongoing or finished PPIs, compared to 29 active or projected PPPs within Denmark in 2012 (KFST Report).

From a theoretical point of view, the diverse interpretation and uses of PPPs have not been adequately reflected in the literature. This is in spite of how different purposes require different organizational and policy tools and most of the literature has tended to assume a certain heterogenization within these varied fields (Brinkerhoff & Brinkerhoff, 2011; Dam, 2015; Weihe, 2008). This has led to a certain level of ambiguity between researchers, who argue vigorously over whether the concept of PPPs is used as a way of addressing societal challenges through utilizing broader capacities of the private and non-profit sector (Brinkerhoff et al., 2011) or to effectively privatize the public sector with another word (Linder, 1999). Weihe (2008) argues that the conceptual confusion can be boiled down to four different approaches that she identifies[3]. As a consequence of the attention directed at PPPs and their empirical developments, new forms of PPPs have emerged, like PPIs, making it a challenge to grasp and categorize the various forms (Greve & Hodge, 2013; Dam, 2015). The conceptual confusion surrounding PPPs have led to oversimplified assumptions and a one-size fits all approach, which fails to

[2] (1) Policy, (2) Service Delivery, (3) Infrastructure, (4) Capacity Building, (5) Economic Development.
[3] (1) Urban regeneration, (2) policy, (3) infrastructure, (4) development

appreciate the various types of PPPs' unique environments. This dissertation as a whole, seeks to address this gap in the theoretical development of PPIs.

From a public sector perspective, the rationale behind using PPPs is both instrumental *and* normative (Brinkerhoff et al., 2011). Instrumentally, it is seen as an important tool for realizing cost efficiencies as part of the New Public Management (NPM) management paradigm. Policymakers have taken to this rationale even if it means a possible trade-off between more efficiency but less oversight and accountability of public services and lessening the publics' ability to respond to public needs (Brinkerhoff, 2011; Bovaird, 2004). As Brinkerhoff & Brinkerhoff (p. 5) states: PPPs are '(…) *presented as an effort to improve efficiency and effectiveness, such an objective is also based on a normative belief that the private sector is inherently 'better' at management than the public sector.'* Thus, the search for efficiency through PPPs is not solely instrumental and rational but also part of a normative paradigm built on certain assumptions. This is a logic some scholars believe weakens governments' ability to provide value to the collective, which invites businesses in and creates a democratic deficit. Furthermore, it risks diminishing the public sector's ability to participate and fulfill strategic visions of public value by involving citizens and reacting to their demands (Rhodes, 2007).

Finally, a note on the concept of innovation within traditional PPPs: one of the more contested definitions in the literature concerns the 'partnership' aspect. Klijn & Teisman (2005) believe that most infrastructure PPPs are examples of 'contracting out' and regulating through a principal (public sector)-agent (private sector)-relationship. In this way, competitive contracting is favored over collaboration and genuine partnership. PPPs that target public sector innovation, inputs such as trust, collaboration and genuine partnerships are often cited as the reasoning (Brogaard, 2019; Evald et al., 2014). Conversely, the NPM rationale for innovation is through *competitive* contracting PPPs. Specifically, the only actual input into an innovation process is competition, aligning with neoclassical economics (Brinkerhoff et al., 2011; Bovaird, 2004; Osborne, 2000; Dam, 2015). Importantly, within Smart City

projects, cost-savings is not the only outcome of desire for municipalities. Cities use technology for diverse goals such as sustainable transformations within both the social, environmental and economic sectors and to fulfill strategic visions. Partnerships based on principal-agent relationships and competition perhaps lack the inputs to navigate such a complex and long-term challenge (Klijn & Teisman, 2005). Public-Private Partnerships that address societal challenges through innovation must develop within a new management paradigm; one that adequately appreciates the inputs shown to drive innovation processes (Hartley et al., 2013, Bryson et al., 2017).

Public Private Innovation Partnerships

According to Hodge & Greve (2013), most types of PPPs are justified on the assumption that it will encourage innovation in the public sector, even though this is not explicitly part of the aim. Others believe that the partnership, as an organizational form, is a 'governance' innovation in and off itself (Moore & Hartley, 2008; Dam, 2015). Yet, there is still no systematic empirical evidence to back the assumption of innovative outcomes as distinct benefits of regular PPPs (Dam, 2015). This part of the chapter will focus on Public Private Innovation Partnerships (PPIs), which, as we will see throughout this dissertation, holds potential beyond that of creating innovation for the public sector from simply inducing competition into the public sector through partnerships. There is at least theoretical potential for PPIs to create public value, as very little empirical research on the relationship between PPIs and public value has been generated (see Brogaard, 2019).

Apart from a few case studies, the literature has neglected studying PPIs (see Esteve et al., 2012 and Ysa et al. 2013), and has tended to include those under the umbrella of PPPs. However, in the past decade a body of literature has grown out of studies on collaborative governance and public innovation to focus exclusively on PPIs (Evald et al., 2014; Munksgaard et al., 2012; Sørensen & Torfing, 2011;

Brogaard, 2019; Klijn et al., 2010; Crosby, Hart & Torfing, 2016; Lember et al., 2018). This literature has largely consisted of conceptual reviews combined with single case studies. However, recently Brogaard (2019) systematically reviewed 33 peer-reviewed empirical studies of PPIs. The main distinction between PPIs and other types of public-private interaction is the explicit purpose of creating innovation (Dam, 2015). Furthermore, it is a key characteristic that the public and private are *genuine* development partners, collaborating, as per their exceptional skills and resources towards a common goal (Brogaard, 2019). While different scholars have sought to include partnerships on innovation in the study of PPPs, public procurement and the like, Brogaard (2019; Munksgaard, 2017) holds that the unique levels of collaboration, purpose and time-frame makes them unique organizational constellations that should be studied as such. Outcomes in PPIs are risky and uncertain in nature, which requires unique institutional and organizational capabilities to handle them (De Vries, Bekkers, and Tummers, 2016; Sørensen and Torfing, 2011; Emerson, Nabatchi, and Balogh, 2012; Bessant, 2005).

Innovation as an outcome of PPIs is often implied by sheer process, given that new combinations of knowledge are formed through the innovation process where the public can draw on technical expertise from the private sector (Brogaard, 2019). In her review of studies on PPIs, Brogaard (2019) creates an analytical framework based on the explanatory factors deduced (See figure below). It is noteworthy here that the drivers and barriers are separated into three main themes: Structural factors, Collaborative process factors and Participant-driven factors. None of these drivers refer to those emphasized by scholars of innovation in PPPs, namely business logics and competition. Instead, it is support, leadership and collaboration-based factors that are relied upon to drive innovation. When the factors explaining the process of creating innovation in an infrastructure PPP fail to have relevance for the explanation of innovation in a healthcare PPI, so too should the outcomes in PPIs differ from those in regular PPPs.

As the next part of the chapter on *Public Value* will discuss, it is more complex to move from innovative outomes for the public sector to "*Value creation for the public and private sector*" than Brogaard's figure implies (see below). Brogaard's framework (2019) names "innovation" as the frameworks' dependent variable and defines it "*as the development and implementation of new solution (…) including that the developed solution must be put to use in practice"*. Brogaard (2019) goes on to stress that innovation as an outcome does not automatically imply that a PPI has created Public Value. As mentioned earlier, all three articles in this dissertation explore outcomes of PPIs in depth.

It is important to keep in mind that innovation, scaling up and public value remain three separate concepts related to PPIs outcomes, which might overlap in certain instances, although further research should investigate this relationship more in-depth. Brogaard (2019) acknowledges that public value is not the focus of her review and that the bar for achieving this outcome can also be achieved without an actual innovation. Kattel et al. (2018) calls for improved conceptual understanding of what PPI outcomes imply. These authors argue that outcomes must at least be given the same level of attention and scrutiny as its explanatory factors – a gap that this dissertation addresses by looking into scale up and public value as PPI outcomes.

As with PPPs (Klijn & Teisman, 2005), there are some similar skepticisms from scholars towards PPIs, namely that PPIs resemble a tool for extracting value from the public rather than creating value for the public (Mazzucato & Ryan-Collins, 2019). As with PPPs, according to these scholars, the distribution of responsibility removes accountability in PPIs. Specifically, it removes the public sectors' ability to respond to citizen needs and co-creation, which some (from a democratic point of view) might believe ought to take place in the development of new solutions for the public sector, or, as advocates of Transformative Innovation Policy have stressed, as necessary to induce socio-technical change. Furthermore, the nature of wicked problems, as addressed by PPIs, is such that sheer cost and resource efficiencies are

not adequate to solve these problems – even if the latter is often an important part of the solution. It is thus important that PPIs can help achieve long-term goals that go beyond their expected project lifetime. This can be achieved by building important public value solutions of the future, which might hold valuable lessons for both the public and private partners. This is another reason why it remains very difficult to truly evaluate PPIs in the short-term (Brogaard, 2019; Kattel et al., 2018).

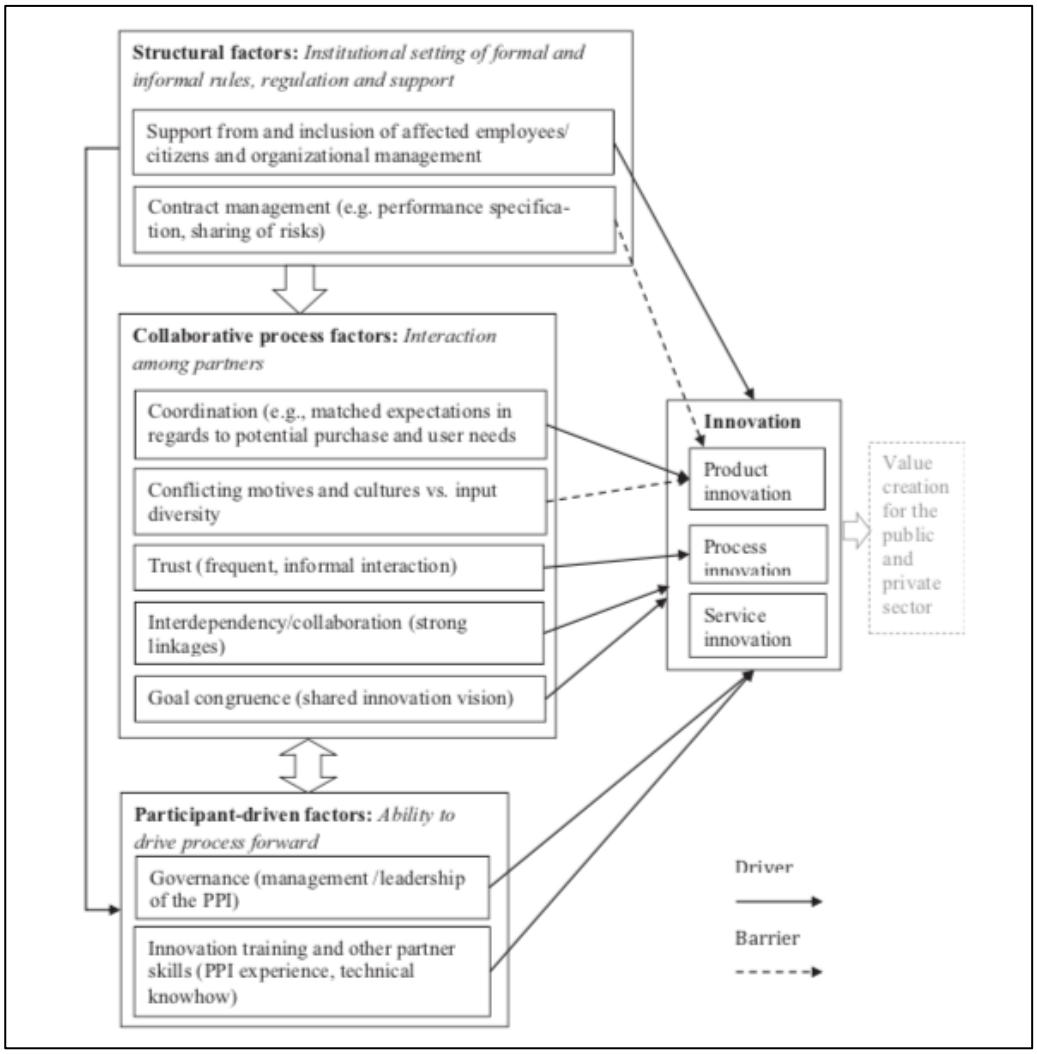

Figure 2: Drivers and Barriers of PPIs

Source: Brogaard (2019:17)

In sum, the factors from the analytical framework deduced by Brogaard (2019) in her comprehensive review of the literature on PPIs, reveals something integral to this study. Namely, that the concept of '*innovation in the public sector*' relies on different inputs and different outcomes than those associated with PPPs (Dam, 2015). Hence, instituting competition from the private sector is not a driver of outcomes in PPIs. This implies that the PPI processes and outcomes are perhaps better suited for an alternative management paradigm, one such has been conceptually and theoretically underway within the Public Value literature as I turn to next. In any case, thanks to the work of Brogaard (2019), the explanatory factors have been adapted to the purpose of this type of partnership, positioning this PhD to further develop the understanding of PPI outcomes as understood through *public value* (the next section) and *scale up* (see 2.4). In addition, bringing the factors of PPIs even closer to what the outcome of the processes entail could sharpen their explanatory power considerably.

2.2 Public Value

Since Moore's (1995) seminal book, a large and diverse body of literature has grown out of Moore's how-to approach to Public Value Creation. According to Hartley (et al., 2017), there are around 700 academic publications annually that make use of the concept of *public value*. The term, like many others within public administration, is ambiguous and contested in nature, not least owing to the wide range of disciplines that have made use of the concept (Hartley et al., 2017). In its most basic form, the term public value seeks to recognize the role of public managers in balancing efficient services and citizen engagement in the development of the public sector (Mazzucato & Ryan-Collins, 2019). The concept is not the first attempt to capture the desire of a collectively defined public but follows from the concepts of 'public interest' and 'public good', whose philosophical discussion can be traced back to Aristotle (Etzioni, 2014). A lack of empirical

research using public value has inhibited the development of the concept. Rather, its heavy philosophical heritage from Dewey (1927) and Habermas (1989) has come to dominate the theory-building. Conversely, even though Moore (2013; 2014 & others) frequently tackle this philosophical basis, the theory is mostly used as a praxis and approach to educate practitioners. This means empirical cases are usually examined for the purpose of teaching the concept rather than building theory (Hartley et el., 2017). The literature has developed in many directions, yet this part of the chapter will focus on the three main strands of public value research: (i) *The Strategic Triangle of Public Value* (ii) *Public Value & the Public Sphere* and (iii) *Public Value, Governance, Innovation & Partnerships* in order to make the concept and its history clear to the reader. While there are other ways to divide the literature (see Bryson et al., 2015), I have chosen this particular way, as each strand adds to this dissertations' definition of Public Value (see Box 2).

2.2.1 The Strategic Triangle of Public Value

Responding to growing individualism and a focus on individual needs in management literature and society, Mark Moore (1995) set out to make it clear that the public sector is capable of creating value for a *collective* public. This "public" articulates its normative values through "*(…) imperfect democratic governance"* (Moore, 2014: 466). To this end, Moore (1995) originally created the Strategic Triangle, which consists of Legitimacy and support, Operational capabilities and Value. The Strategic Triangle was supposed to enable public managers to focus on specific outcomes rather than output controls in order to ensure social value in the shape of a fairer, more democratic and sustainable public sphere. Moores' (1995) framework was a call for public managers to actively strive for public value creation, in much the same fashion as private managers maximize private value. The public manager should leverage his ingenuity, creativity and expertise and remain curious with regards to experimenting with solutions that could increase productivity, respond to citizens' needs, enhance justice and fairness and increase

the publics sectors ability to respond (Pang, Lee & DeLone, 2014). Moore's use of public value does not amount to a 'proper' academic theory (Hartley et al., 2017), but it is rather a prescriptive tool to enable public managers to act strategically. In any case, his approach inspired others (and himself) to engage in philosophical debates over the meaning of public value.

2.2.2 Public Value and the Public Sphere

John Benington (2009; & Moore, 2011) offers a different take on public value. He emphasizes the role of the *public sphere,* which draws on Dewey (1927; 1954) and Habermas (1989) in order to underline the importance of the "democratic space" (2011) in constituting and reproducing the values, opinions, rules, cultural norms and behaviors that guide the government and institutions' attempt to create public value. Benington (2009) believes this space needs to be prioritized in order to combat the neoliberal market focus on the individual, which has taken privilege over the community, the consumer over the citizen, since the 1980's. This space can be psychological, political, institutional and social (Bryson et al., 2015). In his 2009 paper, Benington defines public value as: (1) what the public values and (2) what adds value to the *public sphere*. This should be seen as a way of constructing value through the general public and what they contribute, as a collective, to the public sphere. The former shifts the notion of who determines value away from producers and professionals and towards the citizenry at large (Benington, 2009). This is an institutional perspective, which searches for what public value is and underlines its multifaceted nature (Davis & West, 2009). What adds to the public sphere counterbalances the first part of the definition by ensuring public value not only goes beyond individual interests but also enables an understanding of value for the long-term and for generations to come (Benington, 2009). Benington (2009) goes beyond market constructs and New Public Management concepts of the public such as 'public choice' theory, which sees citizens as clients rather than co-creators of the

public. Rather, he believes the public can handle and tackle challenges and uncertainties for the future through this conceptualization and by pursuing this type of value (Hartley et al., 2017). Yet, this conceptualization also reveals that these two types of public value can be in conflict with one another, and that public value is not a permanent state but rather evolves continuously (Hartley et al., 2017). Benington's definition enables this dissertation to understand what public value means and to whom, avoiding definitions such as 'what the public wants' as this will only reflect individual and consumerist desires, rather than collectively defined values across time and space.

This perspective is also headed by Bozeman (2007; & Jørgensen, 2007) who argue that in contrast to the private manager, the public cannot be reduced to being measured in singular economic measures (Davis & West, 2009). Bozeman's (2007) conceptualization focuses on public *values*, which he defines as "*those providing normative consensus about the rights, benefits and prerogatives to which citizens should (and should not) be entitled; the obligations of citizens to society, the state, and one another; and the principles on which governments and policies should be based*." (Bozeman, 2007: 17). If Moore's strategic triangle (1995) is focused on the public manager, Benington and Bozeman regard it as a political task to make sense of these values. One of Bozeman (2007) main points is that public values are not one-to-one the governments' values. For instance, government efficiencies and violations of civil liberties in exchange for security does not necessarily add public value, and thus it is important to draw a distinction when assessing what the bureaucracy values compared to what the public values.

2.2.3 Public Value, Governance, Innovation & Partnerships

Building on Stoker (2006) and Denhardts & Denhardts (2011), Crosby, Bryson & Bloomberg (2015) describe public value as an emerging paradigm of governance for public administration at large. This joins the various strands of public value

from management (Moore, 1995), social and policy (Bennington, 2009; Bozeman & Jørgensen, 2007), under a common paradigm that in practice should replace New Public Management and Traditional Public Administration, as these "*(…) are not up to the tasks of networked governance, leadership, and management when a variety of public values should be served, including, but hardly limited to efficiency, effectiveness and equity*" (Bryson et al., 2015). This strand of PVT has also been the most vocal in terms of addressing the relationship between public value and innovation as a process. In particular, this strand examines the leadership types and management of innovation processes, yet without fully concentrating on the relationship between public value and innovative outcomes. Conducting an innovation process is no guarantee for public value, unless of course it adds to the *public sphere*. As mentioned in section 2.1 on PPIs, there are a myriad of outcomes from partnership processes, yet all too often the literature on public value simplifies the relation between *innovation* and *public value*. Future research should look into how these are related, although it is briefly touched upon in section 2.5. Understanding public value through this approach means both using an organizational lens, searching for where value has been created and how, but also using different dimensions, such as political processes and mutual adjustment (Hartley et al., 2017). This is thus very much aligned with Benington (2011) and his point of using the authorizing environment to encapsulate the 'right' solutions, even if this builds on a slow democratic process (Moore, 2014).

2.2.4 Critiques of Public Value

Developing an ambitious new concept that not only goes beyond a theoretical critique of the dominant management paradigm (NPM) but actually replaces it, is difficult without attracting scrutiny and criticism. One of the most frequent criticisms of Public Value is evident by the three preceding sections as the numerous uses of the concept has left it ambiguous and open to (too many)

interpretations (Crabtree, 2004; Morrell, 2009; Hartley et al., 2017). Benington (2011) and Moore (2014) do not outright disagree with this assertion, but claim it is down to the theory's infancy.

A more severe critique is based on the potential democratic deficit caused by encouraging public managers to act on behalf of the public, giving unelected actors (both inside and outside government) indirect political power (Rhodes & Wanna, 2007; Soss & Dahl, 2014; Kattel et al., 2018). For Soss & Dahl (2014: 496), this is particularly worrisome as the governance paradigm of public value "*(…) aim(s) to displace neoliberal rationalities that privilege market solutions diminish democracy and serve private interests at the expense of the common good".* By replacing government with 'governance,' Dahl & Soss (2014) argue that Public Value scholars, particularly in the US, are undermining citizens' equal right to affect the use of authority. This is caused by failing to tackle the underlying neoliberal forces that are concentrating power and political influence with those who have 'material affluence' (in Dahl & Soss, 2014; Given, 2012). Thus, in their efforts to change the neoliberal management paradigm through better performance measurements and good governance (See Bryson et al., 2015, Stoker, 2006; Denhardt & Denhardt, 2011), public value scholars ignore dominant interests and institutionalized power biases. The fear is that rather than replacing undemocratic governance, the system will replicate it through the contest of procedures like cross-sector collaboration (Dahl & Soss, 2014: 500). Dahl & Soss (2014) further observe that Moore's (1995) original statement of designing a system to counterweight the private sphere's 'maximizing shareholder value' leads to copying, rather than replacing, market logics into the public sector. This is also visible through Bozeman's (2002) concept of 'public failure' as a mirror of 'market failure.' He goes so far as to summarize that Public Value Theory's stated goal should be "*to develop a model that is analogous in many respects to market failure (…)* (Bozeman, 2002 in Dahl & Soss, 2014: 498).

Similar critiques have recently been aimed at the concept from innovation studies (see Mazzucato & Ryan-Collins, 2019; Kattel et al., 2018; Uyarra et al., 2019), arguing that the concept has emerged from a neoclassical tradition where the public sector is reactive and serves to enhance economic efficiency of the private sector. This heritage of the concept has inhibited it and held it from developing into a force for collective value creation. Mazzucato & Ryan-Collins (2019) argue that the role of the public should reflect that markets are made between the public, private and citizenry and thus the public can and should take center stage in designing and demanding the solutions that the public values. In order to further establish Public Value as an alternative to dominant paradigms, it should, therefore, rid itself of its neoclassical understanding of the role of the public sector.

To mirror the developments within shareholder value, Moore (1995) positions public managers as accountable to shareholders, not citizens, in effect making public managers accountable to create shareholder value for citizens. Yet, the only type of value provided to shareholders traditionally comes in the form of monetary dividends, whereas public value, according to the theory, can be in the shape of other types of value, such as maintaining social institutions and shaping future public sphere's according to democratic processes and co-creation engagements (Moore, 2015; Benington 2011). Dahl & Soss (2014) hold that this is problematic since Moore's (1995) original aim was to "pay particular attention to corporate strategy" by copying their successful terms to the public sector (Moore, 2011; in Dahl & Soss, 2014: 498). Dahl & Soss (2014) hold that copying the form and logic from the market, inadvertently leads these public managers to pursue value in the same way as private managers pursue value and in effect constraining the actual content of Public Value and its outcomes. According to Dahl & Soss (2014: 498), while public value scholars often criticize the narrow concept of value in the private market, their own assimilation and use of the notion terms leads those same scholars to "*use it as a public-spirited frame for market-centered pursuits.*" These points would not be problematic were it not for Public Value scholars' intention to

pursue the concept of Public Value in order to displace neoliberal conditions that favor markets, diminish democracy and prioritize private value over common value (Dahl & Soss, 2014). It is exactly this narrow understanding of value as an outcome within the theory, which articles II and III seek to address and further develop by applying Public Value Theory in analyses of three Public Private Innovation Partnerships (two in article II and one in article III).

On a final note, by proposing Public Value as analogous to shareholder value, Moore (1995) implies that citizens are shareholders, passive recipients or "collective consumers" rather than citizens, thus denying them any real agency or privileges. Dahl (1982) refers to this practice as "stockholder democracy", which violates fundamental equalities by taking away the obligation and power of citizenship to participate in the creation of public value. Claiming to manage political organizations in the name of shareholders thus represents a distinct departure from managing these in the name of democratic principles (Wolin, 2008). The implications for democratic participation is clear: defining taxpayers as shareholders limits their interests to that of efficiently run public organizations rather than the more complex reality in which power is shared with citizens "that shape the direction of collective life" (Dahl & Soss, 2014: 502).

There is merit to this criticism of Public Value Theory, yet these issues can be overcome by an increased focus on public value *outcomes* through empirical enquiry and linking these to specific processes conceptualized by Public Value Theory. In this dissertation the theory is therefore operationalized as a lens to study, analyze and capture public value outcomes, especially those that go beyond the logic of efficiency. Although Public Value Theory can be seen as a drive to develop an alternative public administration paradigm, it is important to let these highly conceptual ideas be explored empirically to ensure its further development. Framing a theoretical alternative is a useful first step towards realizing the ambitions of public value scholars, to create a management and governance paradigm based on democratic participation and co-creation, and one that reflects

the appreciation of all types of public value. This dissertation cuts through the somewhat abstract theoretical discussions of possible discursive impacts and instead uses the theory to analyze empirically the creation and importance of concrete public value outcomes from Public Private Innovation Partnerships. By anchoring the use of Public Value theory in three case studies, I believe I can add to the development of the theory. Moreover, by anchoring this theoretical development in solid empirical analysis, I believe I can help discipline and widen its understanding of what public value outcomes are.

2.2.5 Studying Public Value in Public Private Innovation Partnerships

This dissertation uses Beningtons' (2009: 233) definition of public value (explained above) to define the concept of public value:

> (1) what the public values; and (2) what adds value to the *public sphere*

Box 2: Definition of public value from Benington (2009: 233)

This foundation of Public Value ensures that it can be either procedural or part of an outcome. This makes it possible to include bottom-up public value, as collectives can add to the public sphere and thereby create public value. This definition is also used because it is aligned with Moore's (2014) philosophical foundation of the concept; *"(1) the arbiter of public value is a collective public rather than individual customers; (2) the interests of that public include limiting the use of authority and ensuring the justice and fairness with which government operates as well as its efficiency and effectiveness; and (3) a democratic government cannot act legitimately, responsively, efficiently or effectively without a process that can call a public into existence that can understand and act on its own interests"*.

Essentially, this PhD leverages the possibilities provided by the concept of public value, clarifying the contributions that Public Private Innovation Partnerships can make to public value creation in a Smart City context. As Mazzucato & Ryan-Collins remark (2019: 1) *"(…) public value should be understood as a way of measuring progress towards the achievement of broad and widely accepted societal goals (for example, a rapid but orderly transition to a low carbon economy)".* Brogaard's (2019) review of empirical PPIs shows that just 50 % of all examined PPIs result in "innovation" and that some of those studies were intentionally selected successful cases. Given the definition laid out above, the question of *innovation* as an outcome is of less interest in this dissertation. This is because *public value* can be created in outcomes that are not necessarily classified as innovation (see Brogaard's definition in 2.1). Conversely, it is possible to create innovation in a PPI and not public value; reporting innovation as an outcome does not ensure public value, and vice versa.

Public Value literature tends to define normatively what *should* happen in a process and what *should* emerge rather than investigating the *actual* outcomes emerging from cases. Furthermore, it tends to focus more on processes of public value creation rather than on defining the outcomes of public value that result from those processes. In order to appreciate the process and outcomes, even when no innovative solution is developed and implemented, this PhD will seek to analyze empirically pubic value as an outcome that holds potential to become building blocks toward transformative changes. These changes, following Bozeman & Jørgensen (2007), are not necessarily valued equally between governments and citizens, and, thus, according to the definition, rely on a well-established *public sphere*, which is necessary to build long-term pubic value. Public value is not an aggregation of private interests and hence it might not be equal to the interests of private partners in a PPI.

2.3 Smart City (Projects)

Smart City Projects are being developed in cities all over the world to address the current and future lack of resources for rapidly growing urban populations. Growing inequality, aging populations and resource scarcities in cities along are putting a strain on municipal governments' ability to create sustainable communities, while also facing off the grand challenges posed by climate change and rising sea-levels. Smart City Projects then, are urban level Public Private Innovation Partnerships in which municipalities look to private firms, universities and citizens to create the solutions to these wicked problems. The literature on Smart City Projects has developed over nearly three decades, even before the advent of the concept of "Smart City" (Mora et al., 2019). A considerable factor accelerating the development of Smart City Projects is the increased pressure on social, environmental and economic sustainability in the face of aging populations, urbanization and global warming (Mitchell, 1995; Drapalova et al., 2020). The UN published the *New Urban Agenda* (2017), encouraging cities to "*(1) attain resource efficient, safe, inclusive and accessible urban environments; (2) sustain economic growth based on the principles of environmental sustainability and inclusive prosperity; and (3) provide equal access for all to public goods and high-quality services*" (United Nations, 2017 in Mora et al., 2019: 2) through harnessing the benefits of Smart City Projects.

The evolutionary process of urbanization has been consistently centered on the introduction of technological developments since the first industrial revolution (Mora et al., 2019; Mitchell, 1995). The literature on Smart City Projects is essentially split into two distinct strands, divided along what the purpose of technology in communities is and what it should be. From the first industrialization up until today, cities have been radically transformed by both the changing role of labor conditioned by technological leaps and also advances within transport and communication technologies (Ibid., 2019). The digital revolution is the latest leap, which once again changes the role of cities and public space. This furthers the

debate on the role of technology, as progress opens avenues for commercializing public space and significantly changes how cities are utilized by citizens and governed by authorities. Where basic infrastructure was seen as necessary to evolve into modern societies, some of the latest advances are even more normative, given that there is a trade-off in the direction and applicability of new urban technologies. For example, the current debate on the installation of 5G networks is arguably necessary for autonomous transportation to be enabled in cities. Whether or not increased efficiency for *individual* transportation is a public value remains a normative and political question.

As Mazzucato (2018: 803) holds "*innovation has not only a rate, but also a direction"* and this is one reason why the literature on Smart Cities has developed with deeply rooted divisions. With fundamental dichotomies and visions for how cities become smart, the concept of what a smart city is and how to become one is subject to contestation (Mora et al., 2019). This section will discuss how these different strategies are believed to enable successful Smart City Projects. One strand of the literature believes the development requires exclusive collaboration between the solution providers and municipal governments or through the direct procurement of proprietary technologies. This is a double-helix structure that enables an entrepreneurial type of networked governance, which will ultimately facilitate distributed responsibility encouraging businesses to pursue their own interests, while providing public value (Klievink et al. 2016: 67). This strand of the literature has been criticized for not adequately reflecting the collective intelligence needed to transform a complex socio-technical system (Malone & Bernstein, 2015). Instead, this strand understands smart city projects as necessarily "technology-driven problem-solving" (Drapalova et al., 2020: 2; Batty, 2013). This is in line with the interests and opinion of major ICT players in the smart city market who have advocated techno-centric visions. These researchers are, therefore, techno-optimistic and equate smart cities with more technology (Drapalova et al., 2020; Gil-Garcia, Pardo and Nam, 2015, Meijer, 2018). This is evident by their focus on

developing "smartness" metrics and other technology-specific evaluation schemes and rankings for cities, which largely ignores the complexity involved with developing and especially scaling innovation inside legacy sectors (Meijer, 2018).

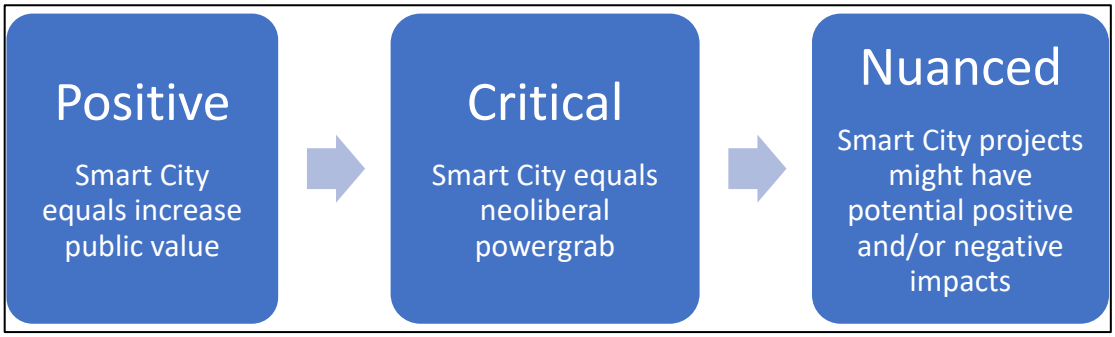

Figure 3: The development of Smart City Literature

Source: author's own elaboration

The other strand of the smart city literature does not consider Smart City Projects limited to technology fixing public sector challenges. Instead, this group views the Smart City from a holistic perspective, integrating political, economic, social factors *and* technology (Drapalova et al., 2020). This strand of the literature has criticized many Smart City Projects of being instruments of a neoliberal agenda that seeks to capture the smart city development with promises of resource efficiency from technology procurement (Drapalova et al., 2020; Green, 2019). These authors point to the highly centralized market of a few technology providers of smart city solutions and their aim to achieve standards for smart city technology, which continues to lead cities into lock-ins and path dependent digitization (Drapalova et al., 2020; Hollands, 2008; Kitchin, 2015; Greenfield, 2013). Others have pointed to the focus on economic sustainability in cities, rather than social or environmental, as a way of excluding citizens from decision-making and prioritizing double-helix collaborations rather than co-creation with citizens (Datta, 2018). The austerity measures forced upon cities, limited financial scope and continued search for efficiency measures have made cities easy targets to exploit for major ICT

companies (Hollands, 2008). While this part of the literature has excelled at pointing out the complexities involved in creating smart cities – the underlying power discrepancies in the sector and the dangers of lock-in – it has not provided a sufficient toolkit to understand varieties of smart city approaches, trajectories and constructive outcomes (Drapalova et al., 2020).

Between these two strands, a compromise between the critical examinations and tech-enthusiasm is under development (Drapalova et al., 2020). This strand calls for empirical examination of the societal and political implications of smart city projects' outcomes. Whether smart city is a neoliberal power grab or an important step towards creating sustainable cities and communities, it must first and foremost be considered a specific project (Drapalova et al., 2020). This entails looking at the differences and varieties of smart city processes and how outcomes differ over context — be they institutional, organizational or political as Smart City Projects, which PPIs are on an urban-level (Lombardi & Vanolo, 2015). In keeping with this new and nuanced approach, this dissertation defines a 'Smart City' or 'Smart City Projects' as:

projects, often technological in nature that aims to ensure resource efficiency while aiming to build economically, socially and environmentally sustainable cities. What makes a city smart will vary across contexts, and importantly, which actors drives and shapes the process has a bearing on the outcome

Box 3: Definition of Smart City projects, authors' own elaboration

In effect, this conceptualization of Smart City Projects differs in particular from the techno-optimistic part of the literature in that technological progress does not by default equal Public Value and dismisses the notion that the complexity involved can be reduced to a measurable numeral. For instance, Smart City Projects in some parts of the world, involve the use of increased surveillance of citizens and diminished civil liberties, such as the right to privacy, in order to increase efficiency in the public sector. As with most other policy tools and developments, their consequences and impacts are complex and ambiguous, and, thus, the outcomes

should be reflected upon and investigated to thoroughly understand the impacts of Smart City Projects.

Using this definition means that a Smart City Project becomes a tool that addresses the aim of policymakers. For example, in North America, policing and security are more prominent problems addressed by Smart City Projects than realizing economic and environmental sustainability, which tends to be the goal for European cities (EU Commission, 2014). What makes a city smart then, is a normative question, which only furthers the importance of developing frameworks to understand whether these developments produce the desired outcomes (and for whom?) to inform the public sector of its key role in orchestrating this development (Meijer, 2018; Cocchia, 2014). Using this definition of Smart City Projects means that its outcomes are inherently contestable and question the Public Value (as defined above) of Smart City Projects. This dissertation does not seek to pass judgment on whether a Smart City is good or bad. Instead, it focuses on the empirical aspects, using Public Private Innovation Partnerships (the preferred tool for much Smart City development) as a lens to study their outcomes.

2.4 Scale Up

Many Smart City Projects, as cases of PPIs, never pass beyond the pilot stage in a few streets. These innovative projects need to go through a complex organizational and governance process in order to fully have an impact across the entire city; they must *scale up* city-wide (Rogers, 2003; Mora et al., 2019). City-wide scale up is one possible outcome of pilot projects (as cases of PPI's). In order to understand exactly why it is so demanding this section will define what *scale up* entails.

Researching Smart City Projects, van Winden & van den Buuse (2017) have used definitions of scaling up from various literatures to conceptualize how Smart City Projects scale up. In this work they draw on different literatures (business studies, development literature, transition studies) and policy domains that have

conceptualized the term. Development agencies like the World Bank define scaling up as embracing new technologies, institutional arrangements and approaches and according to van Winden et al., (2017) this relates to spatial dimensions, intertemporal dimensions and influencing wider institutional dimensions. Within Development Studies, Hartmann & Linn (2008: 8) adopts a similar definition defining it as "*expanding, adapting and sustaining successful policies, programs or projects in different places and over time to reach a greater number of people*".

Since Uvin (1995) showed how scaling up can be used to cover many different domains, from policies to commodities and development programs, van Winden et al. (2017) have adapted the term and built three different types of scaling up, which are typically observed within Smart City Projects: (i) *Roll-out*; (ii) *Expansion* and (iii) *Replication*. These three have been adapted to fit this domain from Cooley & Kohl's (2005) initial typology of scaling up. Scaling up a Smart City Project thus manifests in three different ways: Roll-out through a market and/or organizational roll-out of a solution; Expansion by adding more partners to a solution either functionally or geographically and finally Replication by duplicating a process or a solution from a different geographical or organizational domain (van Winden et al., 2017). The first article of this dissertation examines 17 Smart City Projects and here, as in this dissertation and building on the existing literature, I have chosen to define city-wide scale up thus;

A Smart City Project that has scaled up city-wide, is one in it has been expanded from its initial application in few streets to enjoy city-wide deployment.

Box 4: Definition of Scale Up, authors own elaboration

This definition of scale up is used, since the organizational and institutional complexities that manifests through changes in urban governance are only experienced and problematic when an innovative technological solution is operating in an entire city. This is also aligned with von Wirth et al.'s (2019) definition of scaling when examining urban living labs.

2.5 Conceptual Conclusions

Looking back over Chapter 2, I have provided definitions of the four main concepts studied in this dissertation (see Box 1-4). A brief note here on the relationship between the four concepts: while PPIs are purpose specific (innovation), they are not context specific, meaning that they are employed by multiple levels of government and within various sectors (e.g. healthcare, infrastructure, education). Essentially this dissertations' object of study is PPIs, specifically in an urban context as Smart City Projects. Thus, Smart City Projects are to be understood as a subset of PPIs, where projects adhere to the definition of PPIs within the specific context of cities. The other two concepts *public value* and *scale up* are two different outcomes of PPIs. They are related, but there is no hierarchy between them, nor are they necessarily opposites. Both concepts are outcomes of PPIs, and a case might very well scale up without creating public value, just like a case might create public value without scaling up (Brogaard, 2019). This PhD does not aim to develop the relationship between the two types of outcomes (see section 6.3 on Future Research), but it does investigate what they mean in terms of impact and their overall usefulness in assessing outcomes from PPIs.

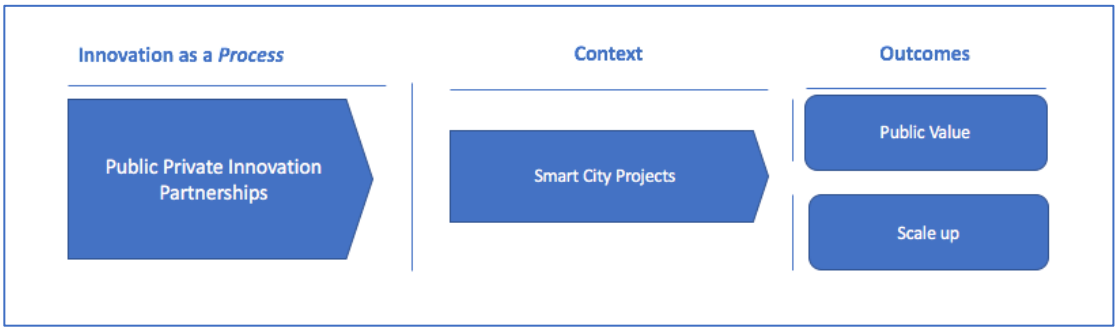

Figure 4: Conceptual Relationships, authors own elaboration

3 Theoretical Framework

This chapter lays out the theoretical foundations used in the Research Articles that make up this PhD dissertation. As explained earlier (see section 1.4), research

article I is informed by the literature on scaling up, while Article II and III are built on a framework of Public Value Theory. This chapter visits each in turn.

3.1 Conditions for Scale Up

The first article of this dissertation investigates the relationship between *scaling up* smart city projects and a non-exhaustive list of relevant organizational and societal conditions. These conditions have been theorized to impact the process of scale up in a context that involves Public Private Innovation Partnerships as Smart City Projects. Naturally, various literatures offer a wide range of possible conditions that impact such a complex process. However, by examining five different conditions in-depth, the first article attempts to show how these conditions – by themselves or in combinations – are sufficient or necessary for scaling up Smart City Projects. Qualitative Comparative Analysis (QCA) enables a qualitative examination of a medium-n of cases, however with the inclusion of just one additional sixth condition the theoretically possible combinations of conditions affecting scale up would expand from 32 to 64. As the method rests on the assumption of *equifinality,* this does not imply that other conditions or combinations of conditions do not affect scale up. See Chapter 5 on *Research Design* for an expanded explanation of the methodological implications in this particular paper.

Since the literature on scaling up is primarily focused on conditions for economic growth and market-creation (Rogers, 2003; Markard and Truffer, 2008), this PhD develops an insight into how the conditions affect PPIs, and the particular societal embeddedness of smart city projects (Mora et al., 2019; Appio et al., 2019). Generally, theories in social science offer imperfect guidance on precisely which conditions to select for further inquiry, however it is an integral part of QCA to refine and reduce the number of conditions through an iterative dialogue between theory and data (Schneider & Wagemann, 2012). In the selection of conditions, I have used the "*conjunctural approach"* first conceptualized by Amenta & Poulsen

(1994: 25). This approach usually involves using a mix of conditions from theories within various literatures, in this case the literature on Smart Cities and governance, but specifically theories that "*(…) are conjunctural or combinatorial in construction and that predict multiple causal combinations for one outcome."* (Amenta & Poulsen, 1994: 29). This ensures that the conditions potentially have explanatory power, especially in conjunctions (Amenta & Poulsen, 1994). This approach takes QCA's ability to create conjunctural results seriously, while providing the researcher with the capacity to see which combinations projected by theory lead to the outcome and which combinations unexpectedly lead to the outcome (Ragin, 1987; Amenta & Poulsen, 1994).

Using QCA as a method also implies using it *as an approach* (Schneider & Wagemann, 2010). This means conditions are not solely conceptualized from existing theories but are also formulated in a reiterative conversation between theory and the empirical material. Thus, according to Schneider and Wagemann (2010), when selecting conditions, it is important for the researcher to have familiarized himself with the cases and their *type,* meaning an understanding of the possible paths to the outcome. Through an extensive collection of archival data (see Section 5.2), a meaningful iterative dialogue between theory and data directed the research towards the following five conditions.

The first condition is *collaboration intensity,* assuming that scale up of smart city projects requires collaboration among the organizations involved. Since opportunities and challenges might be perceived and framed differently, there is a risk of accumulative decision dysfunctions in cross-sector partnerships that lead to 'halfway solutions' leaving nobody satisfied (Ungureanu, et al.; Brogaard, 2019). Thus, in cases where solutions have been successfully scaled, it is owing to the collaboration in the PPI having overcome the challenges described by the literature. The literature on PPIs at a local level has focused on a number of key issues. The most important of which is the issue of inequality among partners, the degree of engagement in the building of partnerships, the management of partnerships, as

well as issues of governance accountability and added value (Geddes, 2009; Brogaard, 2019; Hartley et al., 2014). A collaboration in which the partners are perceived to be on equal terms is a crucial dimension of the intensity of collaboration. This can be attributed to the non-hierarchical nature of interactions in open innovation processes (Bakici, et al., 2012). Strategies and levels of engagement are critical in PPIs, particularly when the participating partners have symmetric capabilities (Hardy and Phillips, 1998). Hence, when partners are perceived to be on equal terms, regular and highly engaged forms of collaboration (rather than conflict) might be linked to specific positive outcomes, in this case the scale up of smart city projects. The literature argues that external collaboration might enhance innovative solutions, in spite of higher transaction costs and conflicts owing to the different types of actors (Hagel and Brown, 2005). The higher level of diversity and heterogeneity of partners results in higher costs, but higher yields in terms of outcomes as well. From this perspective I conclude that issues of heterogeneity and collaboration with other firms is an essential part of *collaboration intensity*. Finally, the alignment of interests is of vital importance as well. Thus, the partners that enjoy similar incentives and positive prospects from *scaling up,* end up in a more intense collaboration through reconciling lesser differences (Brogaard, 2019).

The second condition concerns *the organizational and technical capacity of the municipality* as a condition for scaling up. Smart city projects are most often of a technological nature, adding significant pressure on the technical and operational capacities among the partners involved. This is particularly true of municipalities, the key operational partner in these projects, with the private partner usually chosen for their expertise on the topic (Brogaard, 2019). The question of the capacity of agents is crucial in processes of socio-technical change, particularly in terms of the ability of agents to understand and leverage new technologies (Borrás and Edler, 2014). This raises some possible challenges; some authors have linked issues of contract renegotiation between partners as a proxy for stability among

partner organizations (Soecipto and Verhoest, 2018). The ability of the municipality (as a bureaucratic organization) to demand or request technical amendments and ongoing changes to the solution being developed is an indicator of a public organization with strong capacities. Technically strong public organizations make detailed requests to tailor-make specifications and engage in active development rather than passively procuring path-dependent technology that increases the risk of lock-ins (Holland, 2008). Furthermore, it is widely acknowledged in the literature that PPIs are linked to intra-organizational processes of change and adaptation (Broggard, 2019; Arellano-Gault, et al., 2013), particularly in cases involving open innovative processes at city level (Kornberger, et al., 2017). Therefore, the extent to which the municipality has adapted its internal dynamics in order to accommodate and embed an innovative solution, is likely to be positively related to scaling up.

The capacities of the public organization are vital in terms practical project management (Bryson et al., 2017). Typically occurring problems associated with the management of Smart City Projects are a lack of manpower and technical knowledge, coordination problems across municipal departments involved, and lack of clear leadership in the implementation phase inside the municipal organization (Hartley et al., 2013). The fewer management problems encountered, the more likely the project will scale up. Capacity shines through within the public's innovative ambition, hence it is assumed that cases where autonomous administrative units are involved, the level of scale up will be higher than in hierarchically controlled units concerned within the daily operation. This refers as much to peripheral governmental agencies at national level, which enjoy more leeway to experiment and achieve scale up by strategic governmental purchasing, (Breznitz and Ornston, 2013), as is the case for innovation labs at the local and regional levels of government (Tõnurist, et al., 2017).

The third condition affecting scale up is the *articulation of public needs* of the municipal organization. The main assumption is that the scale up of smart city projects is related to the reconfiguration of previously existing organizational arrangements. These require a clear specification of the needs of the city and what urban issues must be solved. This is an important condition since smart city projects have the potential to create fundamental changes in the manner in which certain societal functions are carried out, and might even change those functions (van den Bosch and Rotmans, 2008). The literature concurs that there is a cognitive, intersubjective process of articulating needs into specific demands in order to promote the development and eventual scale up of a solution (Boon, et al., 2011). The articulation of public needs is thus a process that requires interaction with citizens and CSO's or end-users as co-creators. It is my assumption that the articulation of public needs is linked to at least two specific processes: Firstly, the extent to which the municipality has been actively engaged in identifying and assessing those needs; secondly, the extent to which the *citizens* or *end-users* have co-created the articulation of public needs.

The fourth condition concern solutions that are digital as these can be highly scalable in principle, but only if the technologies enjoy *social legitimacy*, and are ultimately citizen-centric (Sepasgozar, et al., 2019). Gaining social acceptance of new technologies is a complex process and in the context of rapid institutional change, organizations might seek to gain legitimacy of their decisions by reverting to specific rhetoric justifying specific choices (Patala et al., 2017). For this reason, the social legitimacy of technologies and their impacts from PPIs are an important condition related to scale up. This is particularly the case for digital technologies in smart cities, as these raise significant concern about who owns what data, and how that data is used regardless of the potential economic benefits. The potential rise of a surveillance state or indeed surveillance capitalism (see Zuboff, 2019), and the uninhibited data collection that takes place in public spaces, is the subject of much social contestation. In this context I have identified three items that are most salient

regarding social legitimacy. An obvious one is the degree of contestation among public opinion, in particular citizens, end-users, and CSO's. Another important item is the question about who owns the data that is produced through the solution. Thus, the more the business models of private firm's engaged in the project are related to the ownership of the data, the less social legitimacy of the projects is assumed. Lastly, social legitimacy is linked to participatory involvement of end-users in the PPI, as end-users or citizen participation in and of themselves provides the solution with social legitimacy (Voorberg et al., 2015; Brogaard, 2019).

Finally, the fifth and last condition involves the *perception of technological uncertainty* associated with the project. Scale up puts a strain on various dimensions tainted by uncertainty within the project and the participating organizations. Furthermore, there is inherently friction between the interface of technology and forms of societal organization. Parts of the literature examines the "uncertainty paradox" in which uncertainty is acknowledged, but the role of science and technology is expected to provide certainty rather than being exposed to uncertainty itself (Van Asselt and Vos, 2008). Using specific technologies to address challenging elements at city level makes the perception of uncertainty key, as it is a condition for scale up that whatever uncertainty was present is eliminated by the solution. This perception of uncertainty is not only related to economic or policy uncertainty (Contreras and Platania, 2019), nor just the technical maturity of the innovative solution, but also more fundamentally to the perception of scientific and technology uncertainty in its social context (Nowotny, et al., 2001). Hence, the more uncertain the nature of the solution, the less likely the solution will scale up.

Considering the theoretical framework on the Conditions for Scale up was developed entirely for the first paper of this dissertation, there might be some informational overlaps between this section and section 2.0 of Research Article I (See Appendix I).

3.2 Public Value Theory

Article II and III are draw on Public Value Theory through two distinct frameworks, namely the *Public Value Account* and a framework established by the author, albeit thoroughly substantiated in Public Value Theory. This section will visit each in turn, but first I will explain why Public Value Theory was selected. Eventually, this section will discuss the use of the Public Value Account and the authors own framework's ability to capture Public Value outcomes.

Since Moore's (1995) seminal book *Creating Public Value*, Public Value Theory has developed frameworks targeting both practitioners, but also the scholarly and philosophical development of the concept of Public Value. There is an abundance of potential within this theory to establish a counterweight to the neoliberal private value creation by focusing on understanding the processes that lead to collective value creation. While the theoretical core of Public Value Theory has moved in both normative and philosophical directions since Moore's (1995) '*Creating Public Value',* there have been attempts to create a fully-fledged theory of Public Value. As explained in the chapter on the concept of Public Value, the literature has evolved in predominately three different directions: (1) Moore's (1995; 2013; 2014) management focused framework; (2) Bennington's (2009; 2011) focus on the 'publics sphere' lending its notion from Habermas (1989) and Bozeman & Jørgensen's (2007) research on public values; and (3) Stoker (2006), Denhardt & Denhardt (2011) and Bryson et al. (2015) who aim to establish a public value governance framework. While the theory has developed in these numerous directions, it has failed to provide frameworks that enable the study of Public Value outcomes. As explained in the previous chapter, it has focused a lot of attention on processes and theoretical development, but without empirical evidence to mirror this development and without the necessary focus on complex public value outcomes.

The first theoretical framework used to study public value in this dissertation is Moore's (2014) Public Value Account framework, which is used in article II. It provides the theoretical – and even philosophical – basis of what public value outcomes are. Testing this framework on two cases and linking the outcomes to the processes of the Public Private Innovation Partnerships is a novel contribution to the theory. Drawing on the well-established processes of public value creation, the third article builds a framework for studying the emergence of public value outcomes that go beyond the 'logic of efficiency'. Public Value Theory underpins the theoretical frameworks used in this dissertation, and in turn articles II and III develop these concepts further by applying them to empirical cases. The purpose of this section is limited to explaining the origins of the two frameworks used in this dissertation, namely the Public Value Account, which is used in article II, and the framework built for article III, which is the authors own elaboration that seeks to establish a lens through which Public Value outcomes can be conceptualized beyond the logic of efficiency.

3.2.1 Public Value Account

In his 2013 book '*Recognizing Public Value',* Moore dives deeper into what constitutes public value and underlines the importance of accounting for value to inform managerial performances and develop strategies. Moore acknowledges that this account cannot rely on individual client preferences or an accumulation of citizen preferences (Moore & Benington, 2011) as in the private sphere. Instead, public value, when considered from a multifaceted philosophical perspective, involves justice, fairness and social outcomes, which cannot be captured solely by economic evaluation. Moore's (2014) definition of public value rests on three principles; *"(1) the arbiter of public value is a collective public rather than individual customers; (2) the interests of that public include limiting the use of authority and ensuring the justice and fairness with which government operates as well as its*

efficiency and effectiveness; and (3) a democratic government cannot act legitimately, responsively, efficiently or effectively without a process that can call a public into existence that can understand and act on its own interests". Basically, these principles make it clear that whether value is deontological or utilitarian, public value is normative in nature and prioritizing one over the other for its neutral value is not sound. Based on these principals, Moore creates a Public Value Account, inspired by the private sectors' neat accounting formulas that guide private managers in their pursuit of private value creation (Moore, 2014). Yet, as opposed to a simple account consisting of costs and economic revenue, Moore introduces a "deontological" aspect. Article II of this dissertation uses the Public Value Account as a lens through which to study the outcomes of two Public Private Innovation Partnerships and show the importance of being able to account for value that is not of an economic nature, especially when aiming to create new and innovative solutions for the public sector. The following sections will explain Moore's (2014) theory in detail and how it is put to use in the second article.

Public Value Account	**Cost**	**Value**
Utilitarian	1. *Financial*	2. *Mission Achievement*
Deontological	3. *Authority*	4. *Justice and Fairness*

Table 4: Public Value Account

Source: Moore (2014)

Financial & Authoritative Costs

It is not only the *value* side of the account that is separated into two. By distinguishing between *Utilitarian* and *Deontological* Value as well as *cost*, Moore

creates the matrix seen in table 4. The idea behind splitting the cost side into two is to better reflect the public and collective assets used by governments to create public value, and, as Weber observed, it is a defining characteristic of governments that they have a monopoly on the legitimate use of force, which can be a source of value creation (Gerth & Mills, 1991, in Moore, 2014). Naturally, financial costs are an important part of the Public Value Account, as financial transparency strengthens legitimacy from taxpayers and the political hierarchy, who are concerned with how their funds are spent (Moore, 2014). This is easily measured too, considering the financial inputs are transparently purchased at market prices, whether they are raw materials, labor or technology (ibid, 2014).

Authoritative costs, as opposed to financial costs, must be recognized by the citizens as arbiters of the authority imposed on them as a collective, much like citizens to Moore are the arbiters of the value side of the account (Moore, 2014). This is a consequence of the public sector and bureaucracy not necessarily regarding the use of authority in the same way. Moore (2014) recognizes that the cost of authority is highest when individuals are forced to do something they do not want to in order to create public value, for example sorting garbage to protect the environment or mandating the use of masks to prevent a deadly pandemic from getting out of control. While authority can be used to achieve utilitarian outcomes such as forcing heavy industries to stop polluting, it can also be used to force the "right" social relationships between various actors in society and, thus, create a basis for further public value creation (Moore, 2014). This might result in a more equal marketplace or a democratization of access to services and the freedom to choose, or in a worst-case scenario they might result in unwarranted surveillance and control. The simple reason that authority needs to be accounted for is that governments use it, whether for utilitarian or deontological ends, to create public value through changing social conditions.

The object of study in this dissertation is Public Private Innovation Partnerships that take place within a Smart City context, and, thus, it is appropriate to illustrate Moore's concept of authoritative costs within this context. The use of data collection within this sector is an example of the use of authority from local government. If governments decide to collect data in the public space, and if that data is to create outcomes of interest, this needs to be perceived as warranted in the eyes of the citizens who are surrendering privacy details. This value must then also be compared and measured up against this cost, whether deontological or utilitarian, to be warranted by citizens. Even then, few cities have an outspoken strategy on this topic, and public managers will need to guide their work and include the cost of authority. A second source of authority within smart cities, is forcing end-users – be they employed at the city or citizens themselves – into using new technologies that undermine their work processes or engage with the public respectively. Lastly, a use of authority within a sector that has had a deontological outcome is that of the *'Barcelona Model'*[4], which requires firms that pick-up data in Barcelona to automatically share this with the municipality to ensure democratic access; something that has scared away some of the major ICT providers (Politiken, 18/9/2019; Voss & Rego, 2019).

Conversely, Moore (2014) believes that the public is prepared to accept further use of both types of public assets if the government can demonstrate results that the public values and which create a normatively 'better' society. Thus, if citizens value security over privacy, they are likely to accept increased public surveillance. However, this is very difficult to measure and account for and must be dealt with through a somewhat imperfect democratic process. In any case, the guiding principle should be that the method that infringes the least on the sense of justice and fairness should be accounted for rather than the one that infringes on the cost side.

[4] https://eu-smartcities.eu/group/1855/description

Deontological & Utilitarian Value

When evaluating public value as received by the public, Moore (2013, 2014) makes a distinction between two types of public value: utilitarian and deontological value. These are two unique ways that value is received and perceived by the public, yet a full framework of how to account for it is missing. Utilitarianism focuses on the good rather than the just or fair and refers to Bentham's (1890) idea of utilitarianism, which was intended to guide policymakers as to what legislature to pass. A positive utilitarian value will be a process that results in the public achieving something they desire or need – as a collective or an individual – something that improves their material wellbeing (Moore, 2014). Utilitarian value is referred to as Mission Achievement, as it presents itself as the most measurable contributor to public value, making efficient and effective use of government assets. Empirically this type of value will consist of cost-savings as a result of the partnership or institutionalized learnings that lay the foundation for future cost-savings.

Deontological value removes the discrepancy between what governments and citizens value, and guides policymakers on how to best use public assets to create a more just and fair society. Empirically, this type of value is harder to observe than mission achievement, as the normative improvements can consist of creating transparency, democratizing access, co-creation and improved social relationships. As opposed to utilitarian value, deontological value is, to a higher degree, about facilitating a society that is *just* rather than the greatest good for the greatest number of people (Bentham, 1890). This is done through keeping the relationship between citizens, private organizations and the state healthy. Accounting for deontological value widens the concept of public value to reflect how citizens evaluate their governments on the value created.

Public Value Account	Cost	Value
Utilitarian	1. Financial As with any other account, it is important to recognize that different innovation faces different levels of uncertainty, thus making diversification important and the financial cost relative. Unintended Neg. Consequences	2. Mission Achievement The utilitarian focus on efficiency evaluated against expectations. Has the municipality changed its operations to leverage the new technology? Unintended pos. consequences
Deontological	3. Authority An assessment of the use of force or threats to personal freedom used in the project. Privacy	4. Justice and Fairness Individually affected: Citizens or organizations Collectively: Society Unintended pos. consequences

Table 5: Public Value Account

Source: Moore (2014) adapted by author

Soft Public Value

The work on the Public Value Account has paved the way for examining a wider variety of public value outcomes than merely those seeking to improve efficiency and effectiveness, namely *Soft Public Value*. Building on the second article of this dissertation, it became apparent that to truly appreciate and reflect the outcomes of Public Private Innovation Partnerships, a new type of framework had to be built; one that could conceptualize and build-theory abductively between the existing Public Value Theory and empirical cases. This was especially necessary since the existing literature has consistently focused solely on the theoretical *processes* of cross-sector collaborations rather than the outcomes associated with those. Thus, this section lays out the framework used in article III, which uses three processes from Public Value Theory to capture outcomes beyond 'the logic of efficiency' in PPIs. Cost-benefit analysis and other metric-based measurement systems and evaluations exist in abundance (Kattel et al., 2018). Hence, this framework is dedicated to discovering other and softer types of value created in a PPI, through studying the processes of (I) *Learning*, (II) *Transparency* and the (III) *Public Sphere,* all well-established concepts in Public Value Theory. This is aligned with the overall purpose of this PhD and the demand for a more nuanced investigation into the effects of Smart City projects, namely for new ways of assessing the actual implications of Smart City Projects (Drapalova et al., 2020; Meijer, 2018; Mora et al., 2019). By providing a framework for understanding the public value outcomes that can be captured through PPIs, the third article of this dissertation uses an explorative case study.

I. Learning

Public managers create public value through PPIs by stimulating interaction and mutual learning between public and private actors to *"(…) harvest the experiences, ideas and competencies of multiple stakeholders*". Opening the innovation cycle to

more collaborative partnerships with private and nonprofit actors strengthens the capacity of organizations to address societies' wicked problems. Yet, the nature of *wicked problems* is such that performance measurement systems are not applicable when it comes to understanding the processes and resulting outcomes in the search for solutions (Kattel et al., 2018). Hartley et al. (2013) hold that understanding wicked problems and their solutions is easier when a plethora of different actors with their experiences and capabilities are brought together to work on a problem. Through this, the process of *Learning* takes place as the selection, prototyping and testing are enhanced by collaboration, when resources are mobilized, exchanged and shared through dialogue (Brogaard, 2019). This is not just pertinent in the problem formulation and development phase, but implementation and diffusion are also facilitated as '*external actors become ambassadors for these new ideas and practice*' (Hartley et al., 2013). Learning is a reiterative process that takes place throughout a PPI. Even if the innovative solution is not fully generalized at the end of a PPI, this process leads to Public Value outcomes (Evald et al., 2014). If the associated outcomes are institutionalized by the public sector partner, they can potentially become stepping stones towards other Public Value outcomes and future direction-setting (Head & Alford, 2015). The process of Learning then, follows Moore's (2014) claim that the arbiter of public value is the public itself, which means the outcomes that *Learning* leads to are more important that the inputs that go into that process. Thus, this attribute captures the public value outcomes accumulated through *Learning* inside the public sector organization.

II. Transparency

In Public Value Theory, *Transparency* is more than a mere tool for securing external oversight, rather it is an approach and a process for collaborating with stakeholders (Sørensen & Torfing, 2012; Talbot, 2010; Douglas & Meijer, 2016. If a PPI pursues *Transparency* it is actively leveling the playing field for stakeholders' involvement and creating an awareness that disciplines the focus and thereby creating Public

Value outcomes through publicizing and communicating results. Moore's (2014) concept of deontological public value partly represents outcomes of maintaining "right" social relationships, which is one of the possible outcomes I expect *Transparency* to lead to. Transparency enables procedural value creation if it succeeds in animating public and private actors to perform on behalf of the collective rather than as individuals with particular private interests (Sørensen & Torfing, 2005). Generally, this type of value increases the more inclusive, deliberative and imaginative the policy-making process is, and accurate insofar as realizing the intended consequences of the call to action. This attribute captures the extent to which a PPI has equal access to participation in the innovation process, to its direction and to its results. Conversely, the extent to which a partnership has achieved the opposite and excluded certain partners or allowed private interests to seize the agenda will diminish public value outcomes attributable to *Transparency*.

III. Public Sphere

John Benington (2009; & Moore, 2011) first introduced the notion of the *public sphere* when he aimed to shift the focus of practitioners and academics investigating public value from the individual level to the collective level. Public value, according to Benington, is *what the public values and what adds to the public sphere*. The former focuses on individual interests of users, citizens and communities, while the latter counters this focus by including a collective interest; interest that goes beyond the needs of current (individual) users to long term public value, for future generations, similar to Dewey's notion of 'pragmatic idealism' (Benington, 2009; Dewey, 1954). Thus, and as inspired by Habermas (1989), the public sphere is a space where public values are contested and established through continued dialogue.. Ecological, political, economic and social outcomes are inherently questioned, complex and subjective, but these spark a dialogue that adds to the public sphere and accentuates important perspectives from the bottom up; ones that help set the *direction* for public value creation. This

attribute is a process from which outcomes emerge; a process that strengthens social relationships, networking from the bottom up and makes citizen engagement a public value outcome.

	Description of attributes	***Core references***
Learning	Learning is a process by which mutual exchange takes place in the search for solutions. By discovering and utilizing competencies from other actors, learning supplies key insights into technical, organizational and challenges.	Hartley et al., 2013 Crosby et al., 2017 Brogaard, 2019 Stoker, 2006 Moore, 1995
Transparency	Transparency is a process that levels the playing field for stakeholder organizations' involvement, creates awareness that disciplines the focus on public value and comes from publicizing and communicating results.	Douglas & Meijer, 2016 Moore, 1995 Sørensen & Torfing 2005; 2012
Public Sphere	Public Sphere is a process that creates a context where public values can be debated and contested by an informed public.	Habermas, 1989 Benington, 2009, Dewey, 1954 Moore, 2014

Table 6: Analytical Framework for Soft Public Value

Source: author's own elaboration

Public Value Account & Soft Public Value: As frameworks and theories

The reluctance for public value theorists to engage with the empirical identification of the actual public value outcomes is the gap that this dissertation aims to address. Moore (2014) points out that focusing on the collective as the arbiter of value means that outcomes beyond the logic of efficiency need to be considered. The two frameworks laid out above and operationalized in articles II and III, represent a humble beginning of attempting to connect the processes (drivers and barriers) of public value creation in PPIs with their specific outcomes. Using a total of three case studies, these articles help illustrate what processes are connected to what outcomes. And but so the findings of both articles provide concrete theoretical and policy implications (see section 6 or appendix II & III).

The two frameworks in the two articles are used in slightly different ways. The Public Value Account is used to understand the impact of certain barriers and drivers of specific public value outcomes (see article II). While Moore's (2014) PVA established an important philosophical basis for accounting for public value creation, its practical use as either an analytical framework or guidance to practitioners is somewhat limited, especially for PPIs. The second framework builds on Moore's concept of deontological value, and in article III the analysis uses empirical evidence to develop a full framework for studying the process attributes that lead to soft public value outcomes beyond the logic of efficiency.

4 Object of Study

As the object of study in all three articles are Public Private Innovation Partnerships, naturally the same goes for the cases used in the three Research Articles. The next chapter will dive into the methods used; however, it will be apparent to the reader in this section that the first article is notable for its 17 cases, while articles II and III use two and one case respectively. The next section will go into a slightly more general description of the cases in article I, and afterwards a

detailed account of the three remaining cases will follow. Please note that the two cases in article II are also part of the 17 cases used in article I.

4.1 Cases

Article I: Seventeen Global cases

The 17 cases that make up the empirical foundation of Research Article I are comparable from a conceptual, methodological and theoretical perspective. All 17 cases subscribe to the abovementioned definition of Smart City Projects, which makes them conceptually relevant for the study. The core features of the cases involving pilot projects of digital technology applications, whether they are IoT's, data platforms or both, make them theoretically relevant. Cases #1, 3, 5, 8, and 14 involve the replacement of existing streetlights with LED lights in order to save energy and realize sustainability goals. The replacement is combined with data gathering on everything from air quality and traffic to security and law enforcement, primarily through IoT devices and sensors. The installation of multi-purpose sensor technology is the subject of cases #2, 6, 9, 10, 13, 16, while the remaining six cases, #4, 7, 11, 12, 15, 17, concern data platforms, often in association with sensor technology. These latter projects aim to obtain, distribute, exchange and/or process big data. The samples span a considerable geographical area with eight cases in North America, seven in Europe and two in Asia.

Selecting cases and defining the conditions and the outcome is a reiterative process, which necessitates a certain amount of within-case knowledge (Rihoux & Lobe, 2009; Schneider & Wageman, 2010). In QCA, cases are chosen purposefully on the basis of displaying certain common background features (Rihoux & Lobe, 2009). The cases share the overall *objective* of addressing urban-level challenges by innovating products or processes in Public Private Innovation Partnerships. From a methodological point of view, the sample of 17 cases follow a "*diverse case selection*

strategy" (Ritchie et al., 2003), which "*requires the selection of a set of cases—at minimum, two—which are intended to represent the full range of values characterizing X and Y*" (Seawright and Gerring, 2008: 300). This strategy is particularly fitting to the aim of article I, as the search for possible paths to scale up requires diversity in terms of the presence and not-presence of various conditions relating to a particular outcome, in this case scale up. Thus, there are cases displaying diverse values within the five conditions and the outcome (see table 3, Article I Section IV). Four of the 17 cases did not scale up, and the inclusion of these cases is very important, as it ensures that there is no positive bias for scaling up in the case selection. This makes the sample highly relevant for the research objective of studying paths to scale up.

The 17 cases used in this sample was determined based on four criteria, as suggested by Ritchie et al. (2003), namely their comparability (digital technology applications in smart city pilot projects);), the heterogeneity in the variation of X and Y, the type and quality of the data collected (see below concerning survey responses' data completeness), and method-related considerations about fsQCA, given that this method is based on Boolean algebra and is therefore suitable for a maximum number of small-n comparisons. This comparative study of a maximum number of small-n cases, complements existing single case studies, which are predominant in the smart city literature (Scuotto et al., 2016; van Winden, 2016).

The case-selection itself was carried out in two steps. In the first step, 38 possible cases were identified, which represented a "large pool" of possible cases, and it involved the observation of international smart city practitioners associations, conferences and programs as well as two of my professional contacts[5]. The second step consisted of selecting a purposeful sample of cases following the four criteria mentioned above.

[5] Following the two sources: The 2018 Smart50 Awards (https://spring.smartcitiesconnect.org/Smart50Awards/) and the *National Institute of Science* and Technology's (NIST) Global City Team Challenge program https://pages.nist.gov/GCTC/. We further investigated each of these cases, seeking additional available information and contact persons.

Case	Name	Initial identification	Technology	Respondent
1	Smart Cities Through Smart Lighting, Brussels, BE	Smart50	IoT* and LED Lights	Private Project Manager
2	Underground Infrastructure Sensing, Burlington, US	Smart50	IoT	Project Consultant
3	Smart Public Lighting Control Project, Montreal, CA	Smart50	IoT and LED Lights	Public Project Manager
4	Transforming household waste in Austin, US	Smart50	Platform	Public Project Manager
5	Wireless Iot ConnectivityPlatform, San Leandro, US	Smart50	IoT and LED Lights	Public Project Manager
6	Smarter Streets with Video Analytics in Las Vegas, US	Smart50	IoT Surveillance Sensor	Public Project Manager
7	OneTransport Initiative,	Smart50	IoT and Data Platform	Private Project Manager

	Watford, UK			
8	IoT sensors on smart lighting, San Diego, US	Smart50	IoT and LED Lights	Public Project Manager
9	Smart Shuttle, Columbus, US	NIST	Autonomous Vehicle	Private Project Manager
10	EnvyPorto air quality, Porto, PT	NIST	IoT Air Quality Sensor	Project Consultant
11	Smart City Platform, A Coruna, ES	NIST	IoT and Data Platform	Private Public Manager
12	Copenhagen City Data Exchange, Copenhagen, DK	Desktop Research	Data Platform	Private Public Manager
13	Smart Bins, Copenhagen, DK	Desktop Research	IoT Waste Sensor	Public Project Manager
14	SmartPoles, San Jose, US	Desktop Research	IoT Surveillance Sensor and LED Lights	Private Project Manager
15	Smart City Living Lab – Government as a platform, Taipei, TW	NIST	IoT and Data Platform	Public Project Manager

16	Smart Waste Management & Logistics for Municipal Solid Waste Collection Operations, Goyang, KR	NIST	IoT Waste Sensor	Private Project Manager
17	Sensor City, Assens (NL)	Desktop Research	IoT and Data Platform	Public Manager (Regional level)

The second article uses two of the seventeen cases to investigate another dimension of PPIs, whether or not they create public value.

Article II: Copenhagen City Data Exchange & Clean City

Both cases in article II take place within the City of Copenhagen. As in article I, they represent the different streams of technology within Smart City Projects, capturing the diversity and complexity of Public Private Innovation Partnerships within the Smart City context. As defined above (see section 2.3), Smart City Projects give cities new options both for collecting data and also for stimulating economic, social and environmental sustainability through the creation of new solutions for the municipality itself or the market. Clean City, an IoT-based solution, and the City Data Exchange, a data-sharing platform, roughly represent the population of Smart City Projects. Both cases are represented in article I together with case 13 (Smart Bins) and 12 (Copenhagen City Data Exchange), and were partly chosen since follow-up case studies from an initial QCA, can provide further insights into new conditions and, in this case, a new outcome (Schneider & Rohlfing, 2016). The two cases appear in a comparative case study research design (see section 5.1), and according to this the cases should be selected "*because they exhibit or are likely to exhibit variations under scrutiny (…)"* (Ackroyd, 2009: 539). While this is important for case selection, the generative mechanism must in essence be similar across the

cases (ibid.) These are the circumstances for Clean City and the City Data Exchange, as they are both from Copenhagen and both ascribe to the same *public value* context. Furthermore, we know from article I that they are both Smart City Projects (see appendix I).

The City Data Exchange was a data-platform designed to be a one-stop shop for buyers and sellers of data in the Capital Region of Denmark. The partnership was between the City of Copenhagen, Capital Region of Denmark and the major ICT conglomerate Hitachi. It was intended to make public data available for citizens and firms alike at no cost, while also selling private firms' data to interested parties such as firms from other sectors, universities etc. Breaking down data silos between private firms and public data platforms was intended to accelerate the innovation of data-based solutions in Copenhagen. Furthermore, it was decided that a practical output from the partnership would be the delivery of two apps for citizens to use, by leveraging data from the platform. This PPI was initiated by the local cleantech cluster organization CLEAN, who believed, like many others at the time, that data was the new oil and amassing it and combining it would lead to economic growth as well as a new breed of sustainable urban solutions.

The Clean City project is one part of an initiative focused on ensuring that two thirds of all Copenhageners consider the city streets *clean* by 2025. This particular part of the project leverages sensor technology by providing waste collectors with an estimate of how full a particular waste bin is, while software uses the information to create an optimized route for the collectors. Employing this technology is intended to facilitate a more efficient emptying schedule, and also avoid overfilled waste bins, which keeps the city cleaner in the process. The Smart City Project was initiated as a considerable workflow efficiency and, thus, cost-saving was the expected outcome.

Article III: Copenhagen Street Lab

The third article revolves around a single case study of the Copenhagen Street Lab, a Public Private Innovation Partnership between the City of Copenhagen, Cisco, Citelum and TDC. It is an example of an Urban Living Lab, which is a common type of Smart City Project. It is a space itself designed to encourage cross-sector collaboration. According to the European Network on Living Labs, these labs are present in almost all EU27 countries and the network has 450+ members. The case is a typical PPI because it involves technology (product innovation amounts to 42 % of the PPI cases accounted for by Brogaard's (2019) review of PPIs). Furthermore, the case's focus on infrastructure is the second most typical topic for PPIs and the Street Lab is further representative by facing a high level of complexity, uncertainty, multiple stakeholders, participants acting as equal development partners, continually transferring ideas and knowledge (Evald et al., 2014). Furthermore, the Copenhagen Street Lab can be said to be typical since as an ULL it is a common and widespread type of PPI across cities (Bulkeley et al., 2016) and thus is typical as it "*(…) exemplifies a stable, cross-case relationship"* (Seawright & Gerring, 2008: 299). This this case study was not chosen on the premise of generalizability (Wynn et al., 2012). Instead, it was chosen to the extent that a detailed and focused study can provide *"(…) an explanatory theory as close to the facts as possible*" (Wynn et al., 2012: 804). The causal explanation provided by article III is thus context specific, but the phenomena I am attempting to explain is represented in this case (ibid.) (see section 5.1).

The project was born from an MoU[6] between the City of Copenhagen and Cisco Systems, and it aimed to accelerate the smart city development in the city. As a material output of the MoU, it was decided that a living lab in the area surrounding City Hall would become a test lab for new solutions. This was decided at a time when the promise of data-fueled innovations loomed large, and establishing living

[6] Memorandum of Understanding

labs providing connectivity to Internet-of-Things sensors was a practical first step. Cisco would provide the routers necessary to test new sensor solutions; Citelum was brought in owing to their expertise in electronic installations in urban spaces; and TDC provided connectivity. Theoretically reflecting the literature's understanding of partners in Public Private Innovation Partnerships being chosen for their complementary capabilities (Hartley et al., 2013; Brogaard, 2019). The latter two firms traditionally associated with the street lighting and telecommunications industry respectively. However, it has long been a trait of the smart city industry that firms beyond the traditional technology provider sphere are keen on establishing new revenue streams from a compelling high growth market. The four partners proceeded to build a living lab on the two roads surrounding Copenhagen's City Hall in the center of the city. The lab was opened in connection with a Smart City conference in Copenhagen June 2016. The initial partnership was scheduled to last until 2019, when it was concluded and the living lab was dismantled.

5 Research Design

This chapter focuses on the research design and methodology of the three articles that together with this synopsis form this dissertation. All three articles are qualitative in their methodology although different methods were used to suit the purpose of the analyses. Rather than specifying each articles' method and the type of data used, the subsections represent the various methods used respectively and these will also specify what articles made use of which methods.

5.1 Methods

The methods used in the articles of this dissertation belong to a qualitative methodology. This choice was made on the basis of the nature of the research questions (see section 1.4), coupled with the availability of certain types of data.

These two conditions are also mutually dependent because qualitative methods are best suited to research questions that investigate processes, organizations and outcomes, and this methodology fits well with the overall research agenda (Cassel & Symon, 1994). Furthermore, studying emerging concepts like Public Private Innovation Partnerships and Public Value, qualitative, rather than quantitative, research is likely to provide the researcher with less restrictive a priori classifications of the data (Cassell & Symon, 1994). This leaves room for inductive explorations, which, in article I, with its medium-N cases, attempts to do by informing an analytical framework of scaling up.

Essentially, qualitative research is the search for patterns and identifying regularities and relationships between concepts by rigorously analyzing data (Højlund, 2015). According to Thomas & Magilvy (2011), "*the Oxford Dictionary (2007) defines rigor as the quality of being extremely thorough, exhaustive, or accurate"*. Applying rigor in this project has led me through data collection on three different continents, the application of various methods to fit to purpose and exhaustive scrutiny of the existing literatures in order to develop these further. Practically speaking, the process of conducting qualitative research consists of disintegrating the collected qualitative data and fitting it back together to detect specific patterns (Bernard & Ryan, 2010; Dey, 1993). There are different methods to use for this process but the general process of qualitatively analyzing data remains: 1) data reduction; 2) data display; and 3) conclusion (Miles & Huberman, 1994). This is what the dissertation has aimed to do in three different articles consisting of three different sets of data. One of the benefits of using qualitative methods is that it allows the researcher to come much closer to the cases and thus facilitates a less abstract journey from data collection to the conclusions. This allows the reader to be part of each step along the way (Miles & Huberman, 1994). This is particularly helpful when uncovering meanings and assumptions in complex organizational process, and it helps when the research concerns abstract terms such as *Public Value* and *Scale up*.

Some of the criticisms aimed at qualitative research is the lack of transparency (Moravcsik, 2014) and standardized procedures that makes it difficult for peers to replicate the research, which ultimately leads to issues of trust and reliability (Miles & Huberman 1994; Højlund, 2015). In particular, the process of disintegrating and breaking down the collected data involves interpretations and calls into question the subjective sentiments of the researcher. Thus, where applicable, I have decided to use inter-coder reliability to counter the risk of a lack of transparency in the qualifications of the classifications used. This is especially the case in article I, where the primary data consists of a questionnaire. Lastly, a common criticism aimed at qualitative research is the difficulty researchers face when attempting to draw generalizable conclusions (Højlund, 2015). To the extent it is reasonable to generalize from a case study (one case in the population of cases), this can be addressed by producing parsimonious and robust research (see the next sub-section on exploratory case studies) (Eisenhardt & Graebner, 2007).

The next section will go through the methods Qualitative Comparative Analysis (article I) and comparative and single case studies (article II & III), in order to show how these methods have enabled me to answer the research questions, but also to discuss their limitations in the face of the criticism aimed at qualitative research.

Qualitative Comparative Analysis

The first article in this dissertation uses QCA to investigate and analyze how 17 Smart City Projects have fared in the process of scaling up. As an explorative study, it attempts to identify how theoretically defined organizational and social conditions unveil pathways to scale up (Schneider & Wagemann, 2012). This does not exclude the possibility that other combinations of conditions not investigated here might provide a pathway to scale up (like economic and market-creation conditions), as indeed QCA relies on *equifinality, which* means that multiple pathways can lead to an outcome. Similarly, the QCA method relies on *conjunctural causation*, meaning that specific combinations of conditions, instead of single

conditions, are likely to lead to an outcome (Schneider et al. 2010: 251). Through meticulous calibration (see article I), the raw data on conditions and outcome of each case has been translated into a *fuzzy* score between 0 and 1. This enables me to uncover necessary and sufficient conditions (and combinations thereof) for the outcome. Basically, QCA allows for a moderate number of cases and investigates a moderate number of conditions. This ensures that the method is qualitative and that the scores can rely on in-depth analysis and data, ensuring diversity of the cases selected (Gerrits & Verweij, 2018: 18). The study of qualitative conditions, as opposed to numerical, is facilitated through the use of QCA, as the researcher can capture the complexity of causation across medium-n cases.

Qualitative Comparative Analysis (QCA) was first suggested by Charles Ragin in 'The Comparative Method' (1987) as a "third way", which could go beyond the rash divide between qualitative and quantitative research and create a method that gathered the best features from both types of research (Gerrits & Verweij, 2018). By combining the ability of the case-based approach to discover nuances, complexity and diversity, with quantitative methods' ability to generalize conclusions and their high level of reliability, Ragin (1987) envisioned a third way to successfully mediate between the trade-off of breadth and depth (Sayer, 1992; Ragin, 1987; Gerrits et al., 2018: 16). The method provides transparency for the researcher, as each case is defined in terms of its belonging to a set of conditions or not and a certain outcome (or not) (Gerrits et al., 2018). This conceptual clarity is part of the reason why QCA contains both inductive and deductive elements in the research process (Ragin, 1987). Moreover, this explains why article I made use of QCA to both test and refine existing theories and to use the empirical data to establish relationships between the conditions and the outcome (Gerrits et al., 2018). This is essentially done by qualitatively assessing whether a case belongs to a set or not. Thus, analyzing multiple configurations of conditions with the purpose of uncovering *necessary* and/or *sufficient* conditions or configurations of conditions (Gerring, 2012). For the purpose of studying multiple Public Private Innovation Partnerships, there is a

precedence shown by Gerrits et al. (2018: 19-21), who not only use the method to investigate infrastructure PPPs themselves but who also provide an extensive list of scholars that have used the method for similar purposes. Brogaard (2019: 19) encourages researchers of PPIs to apply QCA in order "*to analyze which specific configuration of, e.g. governance, goal congruence and contracts, is more likely to increase innovation."*.

Fuzzy score QCA (fsQCA) is a particular version of QCA, which facilitates a calibration of the data into values between 0 and 1. This is helpful given the lack of absolute values to be expected for each condition as it materializes in the empirical data. The complexity of the cases makes it more suitable for fuzzy values, as these reflect the complexity better than binary crisp-sets. With fsQCA, article I goes beyond binary membership/non-membership and assigns all values between 0 and 1 with 0.5 acting as the qualitative divider as to whether a case is more in (>0.5) than out (<0.5) of a set. Thus, we can capture a more nuanced set-membership score than crisp-set QCA (which uses binarized data of 0 or 1).

One of the main benefits of using QCA is the enhanced ability of generalization stemming from the reliability of using a higher number of cases. This is unlike most other qualitative studies of Smart City Projects examining scaling up, which have centered around case studies in just one city (see van Winden & van den Buuse, 2017). The theoretical pathways to scale up within Smart Cities have been rather vague and shallow usually induced using single cases rather than reliant on the vast and diversified literature on scaling up. This is reflected in the slightly overlapping typology of *roll out, expansions and replication* (see van Winden et al., 2017). The same problem is often encountered within the study of Public Private Innovation Partnerships, considering much of the theory developed, stems from single positive case studies (Brogaard, 2019). Hence, QCA enables a study of multiple conditions and a medium to larger number of cases, increasing the generalizability of the findings and thus providing the study of scale up with a comprehensive empirical foundation. Using a set-theoretic method like QCA, I implicitly advocate that the

phenomenon of interest, *scale up*, is best understood in set-theoretic terms, which I believe both the outcome and its relationship with the conditions are (Schneider & Wagemann, 2012).

Article II & III

This section will explain the methods used in article II and III. The former relies on comparative case studies and the latter a single case study. First, this section will provide an understanding of why case studies are used in these two articles, second it will provide a comment on the logic of abduction, which informs the way of reasoning in these two papers, and finally there will be a few notes on the research design of each paper.

According to Gerring (2012: 411) a *case study* is "*The intensive study of a single case for the purpose of understanding a larger class of similar units (a population)*". Although it might appear in singular, it is not uncommon to use *Case Study* as a research design to include several case studies in a comparative fashion (ibid.). The case study is used to a greater extent in qualitative research designs, especially in the case of organizational studies (Hartley, 2004). Both article II and III dive into a variety of organizational aspects within the three PPIs that are explored in total. This is a departure from the fsQCA used in article I; however, proponents of QCA believe this is a valuable initial method to use in order to understand the excess of factors influencing particular outcomes before diving in deeper through case studies or Process Tracing (Schneider & Wagemann, 2012; Schneider & Rohlfing, 2013; Beach, 2018). Case studies are empirical inquiries that examine data in a specific real-life context and provide an in-depth understanding of complex social phenomena (Yin, 2003; Flyvbjerg 2006). The aim of the case study is not absolute generalization; rather it seeks to shine light on a mechanism within a certain context in the absence of *"universal and predictive"* theories in the face of the social science's intrinsic complexity (Flyvbjerg, 2006 in Højlund, 2015). Both article II and III use the abductive logic of discovery, which will be presented next.

The case studies used in research article II and III are explorative case studies, used here to provide an in-depth understanding of the actual outcomes of Public Private Innovation Partnerships (Zainal, 2007). According to George and Bennet (2006: 17), an explorative case study is "*an instant of a class of events*". PPIs qualify as just that and especially the study of their development and implementation, as their complexity and context-bound experience are best understood through case studies (Dam, 2015). As the next section specifies, Article II & III are based on interviews and archival data, which is appropriate for this type of research design (Yin, 2009). Following the logic of abduction, an explorative case study method is ideal for building theory, as these provide '*holistic and meaningful characteristics of real-life events*' (Yin, 2009: 4; Eisenhardt and Graebner, 2007). According to Eisenhardt & Graebner (2007 from Dam, 2015: 120) this is one of the advantages of an explorative case study, as it allows the researcher to '*recognize patterns of relationships among constructs within and across cases and their underlying logic'.* Following the logic of discovery in abduction, it has been important to conduct in-depth literature reviews to thoroughly understand the concepts involved and their proposed relationship (Public Value and PPIs) (Dam, 2015). Yet, the explorative analytical process has ensured that it has been an iterative process between theory and data, adjusting the concepts accordingly.

Pierce (1931) was the first to use the concept of abduction as he laid out induction, deduction and reduction from Aristotle, referring to the latter of these as *abduction.* Abduction is a logic of discovery, just as induction and deduction, and these should not be viewed as separate forms of logic, but instead three connected stages of research (Reichertz, 2013; Pierce, 1931). The logic was originally designed for the natural sciences but has since been modified, emerging as an important process for the advancement of knowledge within the social sciences (Blaikie & Priest, 2019). Scholars usually break down the process of abduction into three, where the elements of deduction and induction play a role (Pierce, 1931; Reichertz, 2013). The starting point for abduction is empirical data and the discovery of a curiosity

(Reichertz, 2013). This is true of articles II and II, which start with the desire to understand the outcomes of PPIs. Abductive reasoning, according to Pierce (1931), aims at explaining something that was previously unclear. In order to explain the process of what PPIs lead to, it was necessary to combine this curiosity with theory and concepts in order "*to describe a generative process*" (Ackroyd, 2009: 538), which is the process of discovery within abduction. The third part of abduction is the process of knowledge construction wherein the basic process is built into a generative process that plays out (Ackroyd, 2009).

Article II analyzes two Public Private Innovation Partnerships through a comparative case study design. Such a design allows the researcher to develop new knowledge about the mechanisms at work by observing, analyzing and comparing the differences and similarities across the two cases (Ackroyd, 2009). By comparing the two cases (described in section 4.1), the aim of this research is to draw out a pattern that increases our understanding of the underlying social mechanism at work (ibid.). This choice of method is suitable to discovering how certain factors influence the creation of public value outcomes, as I can observe two empirical contexts in the development of PPIs. Any variation found in the cases on what public value they create, and how this emerges, can therefore facilitate an explanation of what factors impact this process.

Article III relies on a single explorative case study to develop an understanding of public value outcomes beyond the logic of efficiency. Using this research design, article III aims to reveal the underlying mechanisms that enable certain processes in PPIs to develop these outcomes. Explorative single case studies can uncover complex social phenomena like these, where the relationships between processes and outcomes as of yet are not fully defined (Yin, 2009). By identifying the generative mechanisms through the logic of abduction, I am able to build theory by applying empirical evidence and existing theories (Ackroyd, 2009). By mutually reinforcing theory and empirical data, I will attempt to develop a scientific account of the events that unfolded in the case (ibid.). According to Ackroyd (2009), case

studies are apt at studying process-focused attributes in specific organizational contexts, which is appropriate in the context of the Copenhagen Street Lab. Relying on the logic of abduction, the selection of an explorative case study allows me to further develop more fine-grained concepts (Sayer, 1992).

5.2 Data

Article I

The data on the 17 cases was collected through a survey and compiled by gathering archival data. First off, I used a 24-question survey that was developed and distributed to the 53 original cases. The questionnaire was distributed in English because most respondents had English as their first language and all non-native English speakers among the respondents were fluent in written and spoken English (as communicating at conferences and subsequent e-mail correspondence laid bare). The survey was returned fully completed by all 17 cases of smart city projects. Initially 21 respondents completed the survey, yet four were deemed invalid since the respondents failed to provide answers to all of the questions. Contact to the respondents had been established either in-person at the Global City Team Challenge conference organized by NIST (National Institute of Standards and Technology) in Washington D.C. in February 2018, or at the Smart City Connect conference in Kansas City, MO, in March 2018. For case representatives that were not physically present at either, contact was made through telephone or e-mail, whereby the research project was introduced. Finally, each respondent was sent an e-mail containing a link to the survey, which was carried out using Survey Xact. The majority of respondents were senior project managers with direct knowledge from participation in the case. This was important, as intimate knowledge of the processes was a requirement for the respondent to answer the questions posed in the survey. The specific role of each respondent can be found in Table 7 (see Section 4).

Secondly, I used archival data from desktop research, which was based on a number of different documents compiled for each of the 17 cases. In total, 156 documents were gathered from different online materials (incl. blogs, reports, news articles, social media posts, etc.) that were directly significant for the cases. My co-author, Susana Borrás, along with a research assistant and myself carefully read, summarized and interpreted the documents and assigned specific raw values for each of the conditions and the outcome. Several rounds of reiterative interpretations ensured inter-coder reliability. QCA is apt for utilizing archival data, especially in what is described by Schneider & Wagemann (2010: 3) as *"QCA as an approach mainly refers to the process of data collection as part of the process of: moving "between ideas and evidence" Ragin 1994: 76, Ragin 2004: 126) (...); case selection and re-conceptualization of conditions and outcome;".* Thus, the archival data was used to further conceptualize the conditions and outcome, and further enable the researchers to assign specific raw values for the latter in each case (Nishant & Ravishankar, 2020).

An important part of the QCA approach is the calibration of raw data on both conditions and the outcome (Schneider & Wagemann, 2012). The outcome of interest to our study, or what inference statistics is termed the dependent variable, is scale up. The calibration process translates the raw data into fuzzy scores between 0 and 1, and this has to be done through striking a balance between theory and empirical data (Ragin, 2000: 150). *1* can be interpreted as a full member of the set of scale up, while a case receiving a *0* is considered fully out of the set. Using the raw data from the respondent and the researchers' assessment of the cases based on the archival data it was possible to triangulate the data sources in order to provide an elaborative and reliable score for each case in terms of the outcome. In order to capture the organizational and complex problems associated with scaling (city-wide deployment) of new technological solutions into public organizations, we made sure that each case that has the outcome has gone through this extensive

calibration. Thus, Q5 from the questionnaire was posed to both the respondent and the inter-coder expert panel consisting of both authors and a research assistant.

(0) A- Has not been deployed

(1) B- Has been deployed in a few streets

(2) C - Has been deployed in an entire neighborhood

(3) D - Has been deployed city-wide

(3) E - Has been deployed as in A, B and C, but in more than one city

Box 5: Question 5 of the survey, measuring the outcome

The raw data scores were added together into a final raw data score, which is a value between 0 and 6, which is then equivalent to the stage of scale up. The raw score was then calibrated into a fuzzy score between 0 and 1 to be used in the QCA. The reason behind considering a case in E as scaled up to the same level as cases in D (both answers scoring 3), is that E encompasses D, which is the focus of analysis. The calibration of raw scores into fsQCA scores involves setting a level of maximum ambiguity (0.5), where cases are neither in nor out of the set (Schneider & Wagemann, 2012: 32). Furthermore, for the outcome, as well as each condition (see below), we set two anchors for when cases are more out than in (0.33) and more in than out (0.67). Within the calibration of the outcome, these were set at 2, 4.5 and 5. Thus, a case could only be considered more scaled up than not if it scored 5 when both the respondent and the researchers' raw scores were added up.

The five conditions in our study, were measured using one or more questions in the questionnaire. Using several indicators for each condition, I ensured that diversity and more reliable empirical foundations for calibrating the data. The questions represent sub-dimensions rather than alternative qualifiers. Below is an overview of the questions assigned to each condition and the important anchors of calibration signifying qualitative differences.

1. ***Collaboration Intensity***

Based on the measurements outlined above this condition received scores from questions 9, 10, 21 and 24 in the survey, making each case eligible for a score between 2-13. In the calibration of this condition we set the three anchors as follows:

0.33 = 3

0.5 = 5

0.67 = 9

Q9. Is the project the result of a collaborative partnership between equal partners?

Q10. How would you describe the intensity of the collaboration among partners in the project?

Q21. Did the partnership require the private firm to collaborate with other firms?

Q24. How did you perceive the similarity of the incentives towards scaling up across public and private partners?

A. *The partners had very similar incentives to scaling up.*
B. *The partners had similar incentives to scaling up.*
C. *The partners some dissimilar incentives to scaling up.*
D. *The partners had completely dissimilar incentives to scaling up.*

2. ***Capable Municipality***

This condition was calibrated using data from four different questions in the questionnaire: 11, 12, 13 and 20. These four questions made it possible for cases to theoretically score between 3 and 12 on this condition. In calibrating this condition, we set the anchors as follows:

0.33 = 4

0.5 = 5.5

0.67 = 9

Q11. Did the municipality require technical amendments to the solution?

Q12. To what extent has the municipality adapted its operations in order to fully capitalize on the benefits from the solution?

Q13. Three organizational problems have been associated with the level of difficulty of projects:

1. Problems in the practical management of the project due to lack of organizational man-power and competences

2. Coordination problems across various municipal departments involved in the implementation

3. Lack of clear leadership in the implementation phase. Please rate the level of difficulty associated with the project in question

Q20. What part of the municipality was the main point of contact in the partnership?

3. Articulation of Public Needs

The membership scores on this condition were accumulated through question 14 and 16 and the theoretically possible final scores were thus between 2-8. The conditions three anchors were as follows:

0.33 = 2

0.5 = 4.5

0.67 = 6

Q14. Did the municipality conduct a needs assessment and feasibility study of the project regarding the technical, organizational or social requirements of the solution?

Q16. To what extent do the citizens or end-users understand the need for the solution provided by the project?

4. Social Legitimacy

Each case membership in the set of Legitimacy was calibrated using the responses from question 17, 18 and 19 which theoretically made it possible for the scores to land between 3 and 12.

0.33 = 5

0.5 = 7

0.67 = 9

Q17. Does popular opinion contest the solution introduced by the project?

Q18. To what extent is the private firms? business model based on ownership of data created through the solution?

Q19. To what extent were end-users of the solution involved in the project?

5. Uncertainty

Each case membership in the set of Uncertainty were calibrated using the responses from question 6, which enabled the cases to score from 1-4. This condition was calibrated directly, meaning that the scores were calibrated as follows:

1 = 0

2 = 0.33 3 = 0.67 4 = 1 *Q6. Please indicate the level of uncertainty faced by the project in the beginning?*

Table 7: Calibration of the five conditions of Scale up

Article II & III

The primary data for article III consists of nine semi-structured interviews gathered in February and March 2020. Furthermore, archival data, including the partnership contract and internal municipal documents showing the process from idea to initiation were used for background. Using an explorative case study method, it is important to secure data from multiple sources (Creswell et al., 2007). This is done to illuminate the case from several perspectives in order "*to cover the contextual conditions*" (Yin, 2003: 13). Similarly, primary data for article II was collected through in-depth semi-structured interviews with both public and private managers from the two PPIs. The interviews for the Clean City case were conducted in November and December 2018 and consist of eight interviews. Five interviews from the City Data Exchange were conducted between March and August 2019. All interviews were semi-structured, and the respondents were selected to ensure representation from participating organizations at several levels of seniority to form a comprehensive depiction of the process.

In the design of the interview-guide (see appendix II for article II, III for article III), a comprehensive review of best practice conducted by Kallio et al. in 2016 was employed. Hence, Kallio et al.'s five-step process was used to develop the

questions[7]. Semi-structured interviews are the most common data collection method for qualitative researchers and especially with regard to case studies (Kallio, Pietila, Johnson & Kangasniemi, 2016; DiCicco-Bloom & Crabtree, 2006). This is down to the methods' versatile and flexible nature, which enables a reciprocal conversation between researcher and interviewee, permitting the researcher to ask follow-up questions based on the interviewees' response (Kallio et al., 2016). While this style is based on an interview-guide structures dialogue, it still permits interviewer and interviewee to digress into related questions that might arise during the session (Holloway & Wheeler, 2010). In this manner, each interviewee is better able to reflect their unique experiences by covering the research topic slightly differently (Kallio et al., 2016). According to Kallio et al. (2016) this is a particularly suitable method when studying complex processes, and, thus, it is intuitively suitable to the object of study in this dissertation's cross-sector collaborations on innovation (Hartley et al., 2013). Interviewees for both articles were selected from different organizations and at different hierarchical levels in order to use the method optimally and enable diverse perceptions to be reflected in across organizations (horizontally) and hierarchies (vertically) (Cridland et al., 2015).

Kallio et al.'s (2016) first step is to identify the prerequisites for using semi-structured interviews. This is done by determining the areas of interest based on existing knowledge and by deciding whether those areas could be enlightened by using several the perceptions and opinions of interviewees (Barriball & While, 1994). The complexity of PPIs with representation from multiple municipal units and/or private partners can be addressed by having interviewees from each organization shed distinctive light on key aspects of the partnership. Following the second step ensures that the researcher has prior knowledge of the topic before the

[7] The five steps: "*1) identifying the prerequisites for using semi-structured interviews; 2) retrieving and using previous knowledge; 3) formulating the preliminary semi-structured interview guide; 4) pilot testing the interview guide; and 5) presenting the complete semi-structured interview guide*" (Kallio et al., 2016: 10).

interview is conducted (Turner, 2010; Rabionet, 2011). Prior knowledge creates a conceptual basis for the interviews and a comprehensive literature review has been carried out. This aspect complements the theoretical background, which is the third step of the interview guide. In the fourth step, the researcher tests the interview-guide. This was done with municipal employees working on unrelated projects in order to test the composition of questions on the main theme and follow-up questions to ensure these were not leading (Maxwell, 2013). The fifth and final step is to present the interview-guides, which can be found in appendix 8.5 for Article II and 8.6 for Article III.

6 Conclusions

This chapter concludes the PhD dissertation. The first chapter laid out my main research question and a set of sub-questions in order to guide and structure the examination of Public Private Innovation Partnerships in the urban context. The following section will provide answers to the three sub-questions, which informs the answer to the main research question in section 6.2. This is followed by a brief look at the PhD's novel contributions to various fields of study. Lastly, an outline of policy implications and recommendations for policymakers can be found in section 6.5.

6.1 Answering the Sub-Research Questions

The use of Public Private Innovation Partnerships as a tool both to stimulate innovation in society and also to address society's wicked problems is steadily rising (Brogaard, 2019). Climate change is an existential threat to socio-economic systems and quality of life everywhere. The search for solutions to make societies and communities sustainable is ongoing, especially in cities where increased urbanization, rising sea levels and growing inequality is only increasing the urgency (Drapalova et al., 2020). Within municipal governance, solutions based on IoT and

data-driven platforms are attracting attention for their potential as Smart City Projects, as urban-level PPIs, which can bring about environmental, economic and social sustainability. However, a lack of scale up or concrete proof-of-value among the solutions has slowed the spread and diffusion of these technologies. Likewise, a lack of empirical investigations into the process and particularly the resultant outcomes of Public Private Innovation Partnerships have left the literature unable to underpin the tools' growing popularity among policymakers with a proven method.

This dissertation has attempted to provide the reader with an answer to the *main* research question: *What outcomes do Public Private Innovation Partnerships lead to?* This has been done through three qualitatively founded articles investigating 17 different cases through a Qualitative Comparative Analysis (article I), a comparative case study (article II) and a single case study (article III). Three separate sub-questions were asked as part of the research articles; these will be answered in turn in this section and will lay the foundation for an answer to the main research question.

RQ-I: Under what combinations of governance conditions do smart city pilot project scale up?

An initial exploration through speaking to experts and practitioners showed that both public and private partners seemed puzzled and troubled by the lack of scale up among smart city pilot projects. Consensus had formed that a key sign of successful impact would be the scale up of pilot projects. An in-depth look at the literature showed that the main conditions considered relevant for scaling up were based on *market* and *entrepreneurial* factors (Rogers, 2003; Markard and Truffer, 2008; van Winden et al., 2017). Little attention had been paid to governance conditions and how these could potentially form paths to scale up. In order to find out if and how Smart City Projects scale and what outcomes they indicate

significant for Public Private Innovation Partnerships I asked: "**Under what combinations of governance conditions do smart city pilot projects scale-up?"** I identified five governance conditions from the literature that could potentially form pathways to scale up for PPIs: *I. Collaboration Intensity; II. The organizational and technical capacity of the municipality; III. Articulation of public needs; IV. Social Legitimacy; and V. Perception of Technological Uncertainty*. Using Qualitative Comparative Analysis (QCA), the article aimed to establish through which combination(s) of governance conditions, Smart City Projects appeared to be scaling up.

From the investigation of 17 cases, two pathways were identified:

1) **Bureaucratic Tailoring**: *Capable Municipality*NOT Articulation of Needs*Social Legitimacy*
2) **Low Uncertainty Partnering:** *Collaboration Intensity*Social Legitimacy*NOT Uncertainty*

The cases attached to path (1) *bureaucratic tailoring,* showed that municipalities capable of mobilizing resources and capacities are central to achieving scale up. Creating a mandate inside the municipality is part of what drives scale up in PPIs. The path suggests that an articulated *need* of a solution acts oppositely the theoretical expectations such that *not* having articulated a need is part of the pathway. Looking at the individual cases that form the empirical data used by software to arrive at this conclusion, it was clear that this part of the solution term was attributable, in large part, to two of the seven cases which scored very low on the articulation of needs but still scaled up. This finding suggest that needs must be 'tailored' ex-post in collaboration between partners, rather than serving a function when predefined ex-ante. It is no coincidence that this condition appeared in the same path as a Capable Municipality was found. Scale up of complex data-driven projects in cities, if shaped by an ineffective administrative apparatus, has already been observed to be sparse (Ranchod, 2020). Summing up, this path can be

followed in instances where the municipality has the necessary capabilities and an ability to define or "tailor" public needs flexibly.

The second path (2) *low uncertainty partnering* provides a path to scale up Smart City Projects that are less complex and experience less technological uncertainty. This, in combination with an intense collaboration, creates a path where the allocation of liability is less of a potential threat to the partnership. In sum, the low level of uncertainty facilitates a close collaboration between partners, which leads to scale up.

Finally, both paths contain social legitimacy, however, our findings reveal a certain level of indeterminacy. Hence, although there is some trivialness to the finding of this condition as a necessary condition, it is part of the two expressions of sufficiency we find in both these paths.

The results suggest several key findings when considering which governance conditions lead to scale up. First, cases that scale up require an active municipality, which may materialize in different ways depending on the pathway. The *bureaucratic tailoring* path mobilizes municipal capacities, naturally assuming a leadership role in processes of scale up. This resembles the general roles of 'promoter' and 'enabler' identified in recent studies about experimental governance at the urban level (Kronsell and Mukhtar-Landgren, 2018). *Bureaucratic tailoring* uses a form of urban governance that requires a formally coordinated approach to scale up. Alternatively, in the *low uncertainty partnering* path, the role of the active municipality is more fluid. Here municipalities mobilize their own capacities less but that of the private partner more. This displays a more heterarchical approach to scaling up, engaging with other organizations in an intense form of collaboration made possible by the solutions' low technological uncertainty. It is noteworthy that a capable municipality is only part of one of the two expressions given that recent literature has focused on the public sector's role in pro-actively shaping scale up (Ranchod, 2020). Summing up, the role of the municipality should be differentiated

according to what other governance conditions are at play in the process of scale up, and, therefore, should be differentiated according to the pathway that scale up takes.

A limitation to the study of scale up, which was revealed through the work on research Article I, is that a focus on scale up does not guarantee the creation of public value. Scale up is important because it moves experimental projects out of their initial urban laboratory context of a few streets and places them into entire city-wide contexts. This means, scaling up does not mean that Smart City projects automatically generate public value. This limitation inspired the remaining two Research Articles and sub-RQ's, and shifted the direction of the research to understand outcomes in terms of Public Value creation rather than scale up.

RQ2: ***What public value is created in Public Private Innovation Partnerships and how does it emerge?***

Given that article I indicated that scale up could not adequately represent impact, the second article explores the role of public value as a lens through which to understand the outcomes of PPIs. It was my expectation that Public Value Theory might be able to divulge a clearer picture of what PPI outcomes look like in addition to answering how these outcomes are formed. Answering this sub-RQ, I conducted semi-structured interviews in a comparative research design with two of the cases selected among the 17 cases used in the preceding research article. I believed these would serve to provide suitable insight into first of all, *what* Public Value outcomes PPIs create, and second *how* these outcomes emerge. Article II successfully links the study of the process of PPIs with the study of outcomes, underlining its novel contribution to the literature.

Using Moore's (2014) framework for the Public Value Account to answer the first part of the sub-RQ, the analysis showed that both cases had created some type of Public Value, in spite of not delivering utilitarian value that could be measured in increased efficiency. This was surprising given the technological nature of the

solutions (a IoT sensor and a data platform). However, this underlines how PPI's and collaborative innovation processes do not always result in innovative solutions for the public sector, nor do they generate the value they intend to create (see Brogaard, 2019). A key assumption behind using PPI's is the potential solution space that provides both the public and private partner with value. However, the deontological value created in these two PPIs suggests there is a vast space for public value creation that does not necessarily overlap with private value creation, considering deontological value is difficult to sell or measure. This presents a fundamental challenge of the structure of PPIs, as they are not necessarily capable of satisfying both private value and public value in cases where outcomes are mostly deontological. The analysis further showed that the utilitarian value created, mostly served to inform future project planning by avoiding investments into technological dead-ends. Both of these outcomes are valuable to the public but drive a wedge between the solution space where the private partner is able to extract private value from a PPI.

The second analysis showed the importance of knowing what outcomes have materialized in order to understand *how* they materialize. The drivers and barriers of "innovation" identified by the literature were operationalized to study the emergence of the public value outcomes observed in the preceding analysis. Changing the dependent variable from *innovative solution* to *Public Value outcome,* offered nuances to the theory. In contrast to the theory's expectation, the direction of *leadership* within a PPI, whether directed by the public or the private partner, has an effect on public value outcomes. An overreliance on *networked governance* in PPIs should be critically examined to ensure that it does not neglect public value in favor private interests. Finally, the analysis showed that *needs* play a central role within the two cases, and that there was a considerable difference between their needs, which may have had an effect on the directionality of the projects during the process. Working from the basis of a specific need led to a considerable *increase* in public value creation for the Clean City case. Specifically, an administrative and

political mandate resulted in several iterations of the solution until an optimal one was arrived at.

In sum, the two cases show that the process of Public Private Innovation Partnerships are more apt to the pursuit of deontological rather than utilitarian public value. This article showed that the complexity of the dependent variable deserves much more focus if Public Value scholars are to create reliable frameworks for understanding the processes of value creation. Furthermore, this research should prompt more investigation into understanding *how PPIs create public value*, since the factors provided by the literature have not yet managed to make this connection explicit beyond innovation. In conclusion, if PPIs are to be appreciated for the public value they produce, a more imaginative and conceptually coherent framework should be built to capture this type of value. These findings led to the third article of this dissertation:

RQ3: How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?

In answering the third sub-RQ, the research focused on discovering what public value outcomes – beyond the logic of efficiency - could be observed from an analysis of three process-focused attributes: (I) Learning, (II) Transparency and (III) Public Sphere. Analyzing these three processes served as a means to identify the concrete public value outcomes that emerge through them. Hence, to answer the research question, an analytical framework was built from these theoretically established attributes. These were applied to the Copenhagen Street Lab, which is itself a PPI. In essence, the answer to the research question is that by applying the three attributes to a PPI, it is possible to coherently identify, analyze and conceptualize specific *soft* public value outcomes beyond the logic of efficiency.

Looking at the literature, it was obvious that there was a gap between the concept of public value, its theoretical and philosophical foundations (see section 2.2) and how narrowly it has been applied to identify public value in empirical cases. The

analytical framework consists of three attributes: (I) *Learning* (II) *Transparency* and (III) *Public Sphere.* The case showed specific soft public value outcomes (see Table 9 below). Importantly, the case also illuminated the relationship between these processes, as a balance must be struck between them to maximize public value. Focusing attention on (I) and (II) rather than attribute (III) for example, might have a negative overall effect. There is a potential juxtaposition between some of the outcomes, for instance between the outcomes (II) *open dialogue and trust between partners* and (III) *Co-creation and co-ownership of the PPI through citizen engagement*. Noticeably, the case illustrated that the outcomes generated by attribute (III) helped ensure that the outcomes generated by attributes (I) and (II) were directed towards public values. In situations where direction-setting and the discovery of public values are essential outcomes, which are used to guide public policymakers towards environmentally sustainable solutions, it is important to be aware of the need to focus on the processes that lead to this type of outcome.

The three attributes (I) Learning, (II) Transparency and (III) Public sphere were found to define certain public value creation processes, beyond the logic of efficiency, which lead to public value outcomes. When PPIs create contexts that allow for these three processes, specific public value outcomes can be created. If attributes are under-developed or infra-utilized PPIs will create only partial or limited outcomes, which is one of the main findings of the analyses. The top half of the table below, elucidates the outcomes that – as illustrated by the case – are made possible by the three attributes. The "(X)" identifies which of these outcomes were present in the Copenhagen Street Lab case.

Soft Public Value	**(I)** ***Learning***	**(II)** ***Transparency***	**(III)** ***Public Sphere***
What are the specific outcomes of public value creation?	New technical Knowledge (X)	Open dialogue and trust between partners (X)	Co-creation and co-ownership of the PPI through citizen engagement ()
	New organizational knowledge (X)	Clear and desired narrative (X)	Explicit incorporation of values to ensure direction-setting ()
	Intra-organizational capacity-building ()	Experimental spaces for future innovation in the city ()	
When is it created?	Short & Long-term	Short & Long-term	Long-term
Who creates it?	Participating partners in PPI	Participating partners in PPI, Stakeholder organizations & Translocal replication	Citizens & Stakeholders
Who benefits?	Public sector organization	Non-active stakeholders, Public sector organization	Citizens & Future citizens
How is it created?	Through interaction & collaboration	Through dissemination & network creation	Through establishing directionality
What is the nature of this value?	Micro, Organizational	Micro/Meso, Organizational/Interorga-nizational,	Macro, Citizenry

Table 8: Soft Public Value Outcomes
Source: Authors' own elaboration

This paper has addressed the absence of a coherent framework for studying public value outcomes from PPI processes. Through the application of the three attributes, a framework that identifies the processes that lead to Public Value outcomes beyond the logic of efficiency has emerged. Each of the three attributes created outcomes not captured by the logic of efficiency; however, these were still, according to the participants, steps in the direction towards solving wicked problems. The analytical framework showed that by embracing these outcomes, it is possible to highlight what drives the process of public value creation and what potential barriers exist, which should be studied further in detail. Considering the *softness* of the public value outcomes that are potentially created by focusing on all these processes, they capture a common type of value, which can be termed *Soft Public Value* (SPV). This concept enables an analysis that moves beyond binary dependent variables such as efficiency gains/no efficiency gains, to more fully reflect other outcomes that the public values. Finally, conceptually developing soft public value uncovers the possible discrepancy between outcomes of interest for public partners and those for private partners; a discrepancy that should be studied further to understand what solution space, beyond the logic of efficiency, exist between citizens, the public sector and third parties.

These three sub-RQ's have guided a path toward providing the reader with an answer to the Main Research Question, which the following section will address.

6.2 Answering the Main Research Question

Inspired by the development of Smart Cities and the expectations and potentials attached to these emerging solutions, this PhD set out to understand what outcomes develop through Public Private Innovation Partnerships. Globally, cities have organized through C40, 100 Resilient Cities (and other intermediaries) and positioned themselves as progressive frontrunners in the pursuit of creating sustainable transitions to reach the goals of the Paris Agreement. In the meantime, cities are also adjusting to the post-industrial era and becoming knowledge centers for both industry and higher education. Municipalities are providing spaces for experimentation with new technologies, actively supporting the development of solutions through partnerships and other innovation policies. Cities are facing threats from aging populations, rapid urbanization, global warming, rising inequality and strict national austerity policies, which has created the impetus and hastened sustainability transformations. Yet, most of these problems are wicked in nature and challenging in the long-term, which means new solutions must not only address present resource scarcity but also provide long-term directionality towards a sociable and equitable society. Having identified cross-sector partnerships as a preferred tool to address these developments, this dissertation has attempted to answer the **Main Research Question:**

What outcomes do Public Private Innovation Partnerships lead to?

Conferring with the literature, it became clear that PPIs have been largely overlooked by scholars. This is not surprising since *collaborative innovation, open innovation, and public innovation* make for a crowded field of study when it comes to the public sector's tools for innovation. Scholars traditionally studying Public-Private Partnerships have largely ascribed the same underlying dynamic to PPIs even though its purpose, timeframe, organizational setup and dynamic are distinct from PPPs (Dam, 2015; Brogaard, 2015; Brinkerhoff et al., 2011). In order to then

answer the research question, I set out to understand what outcomes PPIs lead to. I decided to specifically understand PPI outcomes through the lens of *scale up* and *public value*. The existing literature on Public Private Innovation Partnerships showed that it was unclear, both empirically and theoretically, what type of impacts that manifest at the end of a project (Brogaard, 2019). What is apparent, however, is that, in terms of outcomes, no universal understanding of an impactful PPI exists. This type of understanding only exists in terms of processes. By answering the Research Question, this section will attempt to shed some light on what success might look like in terms of outcomes.

To *scale up* is regarded as key for new solutions to have a lasting impact on the problem they address. However, scaling in the public is vastly different to scaling private solutions, as scaling in a private context occurs organically through the market mechanism and individual demand. Scaling up the use of a new solution developed in PPIs for the public sector is complex. Through studying 17 Smart City Projects, I was able to identify two pathways to scale up through governance conditions. The analysis showed that through the path *bureaucratic tailoring,* strong municipalities could scale up Smart City Projects. Through the *low-uncertainty partnering* path, it was observed how municipalities could draw on partner's capabilities and an intense collaboration to scale up, seeing as the absence of risks created trust. Looking at the cases that scaled up and seeing that some of these failed to have an impact, provoked the question as to whether scaling up necessarily implied public value creation. It was clear that to thoroughly understand *what outcomes PPI lead to*, there were nuances that needed to be addressed through a different framework. Yet, scaling up to city-wide solutions remains important for ensuring impact of Smart City Projects, even if it is no guarantee of value.

By employing Public Value Theory, this dissertation moved on to develop a lens through which outcomes of PPIs can be understood from a public value point of view. Using Public Value Theory facilitated an understanding of the complex

processes at play in a PPI, yet there was a gap in the theory's ability to capture outcomes beyond the logic of efficiency.

By developing and operationalizing the concepts and existing frameworks from Public Value Theory, it was possible to observe more nuances in terms of outcomes in Article II and III.

The second research article showed how *deontological* value outcomes were the most prominent out of two Copenhagen based PPIs. I found that using *deontological* as a concept for empirical analysis was difficult, due to the normativity and rather loose definition. Therefore, article III used a framework solely built on three Public Value processes to analyze the public value outcomes of the Copenhagen Street Lab. The analysis showed how PPIs are well positioned to create *soft public value*, providing knowledge, direction-setting, transparency and enabling co-creation of public value and understanding what the public values. Applying this theory made it possible to capture the outcomes of PPIs that go beyond the logic of efficiency and from the case-studies used in this dissertation. The suggestion, therefore, is that these outcomes are the bulk of what PPIs lead to.

In asking this research question the goal has not been to pass a normative verdict over Public Private Innovation Partnerships as a policy-tool nor over Smart City Projects as inherently good or bad for society. Instead, the question has focused this project on a critical and empirical pursuit of understanding what outcomes are relevant to the public. This dissertation can conclude that *Public Private Innovation Partnerships* lead to outcomes mostly beyond the logic of efficiency; outcomes that are not necessarily complete products or services once the PPI is completed or scaled, but rather outcomes that form a work-in-progress towards establishing sustainable communities. These are outcomes that require more research and cannot necessarily be categorized as innovation. The findings of this dissertation indicate that rigorous processes of organizational and institutional change are necessary in order to fully exploit the outcomes of PPIs. Citizens and end-users

might contest solutions. This implies that PPIs might benefit from making citizens part of the partnership structure to ensure public value is created. The various outcomes of soft public value show the advantages of an inclusive approach to create public value and to provide direction-setting and inputs for future processes. Without appreciating this type of value and focusing only on value as it relates to an increase in efficiency, PPIs risk becoming irrelevant because they lack a measurable end-product. In the end, creating innovation for the public sector is a reiterative process, which sometimes leads to improved efficiencies and cost-savings and sometimes provides public value through learning, transparency and adding to the public sphere.

Scale up remains an important factor for PPIs to create the desired utilitarian impact within the public sector organization. However, one of the important assets/liabilities for a public sector organization is that citizens are not passive individual clients to whom efficiency and cost-saving is necessarily a primary value. Citizens form a complex collective, one that expects public institutions to safeguard normative values and visions of a just and fair society. Citizens receive the outcomes of PPIs as a collective, rather than an aggregated sum of individuals. Outcomes go beyond *scale up;* they may be in the shape of democratic conversations ignited by the formation of a data-sharing platform, or social cohesion provided by a solution that improves working conditions for waste collectors. These types of outcomes can be difficult to measure, and they can also be difficult to value by the private partners who pursue PPIs to improve their bottom line. Yet, this does not disqualify the *raison d'être* of PPIs. Given that *soft public value* outcomes are not necessarily equally appreciated across the public/private divide, this does asks questions about the fundamental applicability of PPIs, unless incentives are designed to benefit both private firms and public values. In the end, an important question becomes *what is public value,* and, as per our definition, it is '*first, what the public values; second, what adds value to the public sphere*' (Benington, 2009: 233). The latter, in particular, requires a strengthened bottom-up

element of PPIs, and it requires public managers and policymakers to look beyond election cycles in order to actively design socio-technical change that transforms urban systems into socially, economically and environmentally sustainable ones.

The concepts of *scale up* and *public value* are outcomes of Public Private Innovation Partnerships, and they may create impact, even when just one is part of the outcome. Both concepts may overlap within cases and are not mutually exclusive; they are two distinct outcomes that normatively impact societies in different ways. While scale up is apt for realizing Bentham's (1890) utilitarian vision of "*the greatest good for the greatest number*" (in Moore, 2014: 472), public value outcomes can be many more things, including what adds to the public sphere. The Research Articles shows that in order to emerge from a Public Private Innovation Partnership, *scale up* can be achieved in a controlled manner through handling top-down governance mechanisms. In contrast, public value outcomes beyond the logic of efficiency require the ability to work bottom-up, co-creating public value. An important driver for public value is the presence and disciplining that *needs* provide, while the opposite holds true for *scaling up* (see Section 6.1). Yet, both scale up and public value seem to benefit from collaboration and the new combinations of knowledge PPIs provide. Further research should look into the relationship between these two types of outcomes and how they relate to outcomes of '*innovative solutions for the public sector*'. This dissertation has shown that different outcomes require different processes.

This PhD should set off a discussion of what the aim of PPIs is beyond innovation, so that partnerships can be designed and analyzed accordingly. If the goal is to realize sustainability transformations, designing for long-term public value and leaving room for co-creation should be taken into consideration when considering what outcomes are valuable. If the priority is to create public sector innovation, then the paths to *scaling up* could help guide the partnership, while keeping in mind that scale does not ensure public value creation.

6.3 Novel specific contributions to the Research Fields

This dissertation has made three specific contributions to the various research fields involved. **First**, it has identified two separate pathways to **scale up**. The sparse literature on scale up in Smart Cities has previously studied the importance of market, entrepreneurial and technological conditions for scaling up (van Winden and van den Buuse, 2017). This dissertation has provided two novel pathways to scale up by focusing on governance conditions and in what combination they lead to scale up. In identifying these two paths, I have shown that there are (at least) two differentiated paths to scale up city-wide while previous studies have claimed this to be the unique process of "replication" (van Winden and van den Buuse, 2017). Furthermore, contrary to recent studies, the role of the municipality is versatile, meaning in only one of the two paths are strong capabilities needed to scale up. In the other, the municipality can rely more on closely collaborating with external partners to scale up. Finally, the first article provided a more nuanced view of the role of uncertainty in scaling up by showing that it is not a static quantity depending on the technology, but rather that it is influenced and can be managed through other governance mechanisms.

Second, this dissertation has made another novel and specific contribution, which was to apply Public Value Theory to three empirical case studies, enhancing the empirical anchorage of theoretical development in this field. The theory has a long history of theoretical development through highly abstract and philosophical debates around its central concepts, however, with very little, if any, empirical analysis. Therefore, operationalizing the PV theory to examine empirical cases is an important and specific novel contribution. This is particularly evident, considering Harley et al. (2017) underlines the need to empirically examine how public value is created in partnerships with stakeholders and my cases are Public Private

Innovation Partnerships. While article II uses an existing framework, the Public Value Account, a novel contribution has been to link this framework to various processes from the literature on cross-sector collaborations. Article III also provides a novel contribution in the shape of an analytical framework that enables an examination of Public Value outcomes.

The above is related to the **third** novel and specific contribution of this PhD dissertation to the field of PV. Specifically, Articles II and III contribute to the field by increasing the focus on outcomes within Public Value Theory, and by underlining the importance of accounting for public value outcomes beyond the logic of efficiency and utilitarian goals. Moreover, this contributes further to a similar gap within the PPI literature (Brogaard, 2019) and public sector innovation studies, as these are searching for frameworks that allow policymakers to evaluate a broader set of outcomes beyond efficiency gains (Uyarra et al., 2019; Kattel et al., 2018).

In sum, by linking the literatures on Public Private Innovation Partnerships, Smart Cities, Public Value and Scale up, this dissertation has opened the conversation on *outcomes*. It further does this by linking them to theoretically underpinned processes, and comprehensively analyzing them through empirical cases. The next section provides the reader with suggestions for future research within each field.

6.4 Future Research

Public Private Innovation Partnerships

Given that PPIs are the object of study in this dissertation, naturally a lot of the findings are relevant for further research within the field of PPIs. A novel contribution from this PhD has been the development of outcomes from PPIs. Brogaard (2019) investigates the conditions that have been studied within this field, albeit with the aim to understanding how PPIs create innovation, and the

findings in this PhD suggest that perhaps it is time to look further into the conditions affecting outcomes of Public Value rather than public sector innovation outcomes. Such a change would help scholars as well as practitioners understand the wide variety of outcomes that can be obtained through a PPI and perhaps also better manage expectation vis-à-vis the public and private partners. This PhD has largely studied PPIs from a public perspective, but more research should be done to recognize the important role private partners play in PPIs with their expertise, and how to appropriately reward non-opportunistic behavior. The research in this dissertation suggests that partnerships have an important role to play in creating sustainable futures. Therefore, future research could pay particular attention to the way in which the public sector draws on private capabilities, and how this is negotiated with citizens and their needs in ways that ensure that direction-setting is democratically founded. Likewise, further research could focus on the organizational capacity of public actors in PPIs and so targeting the solution of grand challenges. PPIs have the potential to foster transformative changes in society. Therefore, another possible future avenue for research could be how to design processes that induce change in complex socio-technical systems, delivering outcomes and solutions for grand societal challenges.

Public Value Theory

As established above, this dissertation has addressed Public Value Theory's lack of empirical investigations. Engaging with empirical cases has led to the development of the theory's understanding of outcomes and especially *soft public value* outcomes. In the process of building a unified theory of public value, the process of innovation should be coupled with the outcomes through further empirical investigations. Using the findings from article III and the established framework for studying outcomes beyond the logic of efficiency, further research should be dedicated to categorizing and further conceptualizing these outcomes so that they can be identified in other PPIs or innovation processes involving the public. Public Value Theory has an excellent theoretical backbone from which to provide insights

into the normative nature of outcomes from public sector innovation processes, and the normative turn in innovation studies should make use of this ability to sharpen the literatures' ability to inform innovation policy according to desirable public value outcomes.

If Public Value scholars have not given up on the ambition to establish an alternative governance paradigm, the concerns of Dahl & Soss (2014) regarding the lack of research into public-private power relations in collaborations, should be addressed. While this dissertation found that the power mostly resides within the public organization in PPIs, it was evident that public value outcomes were affected whenever leadership took place in the private organization. Public Value Theory cannot uncritically assume that networked governance and cross-sector partnerships will automatically lead to solutions for the common good. All technological development has a direction, and so methods to ensure that there is no democratic deficit in the setting of such a direction must be mitigated by safeguarding what the public values.

Smart City

The main contribution to the Smart City literature has been the development of new frameworks from which to study the impacts of Smart City Projects. This dissertation has provided tools that future research could use to shed light on the impacts of Smart City Projects. This would add to a more nuanced approach to studying Smart Cities, by addressing them with the knowledge that neither public value nor scale up are easy to achieve through the application of technology in an urban setting. Research Article I's contribution of the organizational conditions for scale up should be complemented by similar studies into what *other* conditions affect scale up. More importantly, these should be applied to an understanding of *what* the actual impact of scale up is in terms of public value creation. Furthermore, it would be worthwhile to develop indicators based on Public Value Theory to assess the same governance conditions but for the outcome of Public Value rather

than scale up. Qualitative research should be the focus within this literature because, and as shown in this dissertation, further rankings of cities according to technological devices per capita does not reflect the true complexity or public value of these developments.

6.5 Policy Implications

As this PhD was carried out with support from both the City of Copenhagen and Realdania, within the urban sustainability hub Bloxhub, this section will elaborate on some implications for policymakers and practitioners. Public Private Innovation Partnerships are suitable for particular purposes, especially within the field of Smart Cities. Yet, it is important for policymakers to be aware of the outcomes these lead to in order to appreciate the resultant public value.

If policymakers aim to *scale up*, in order to secure impact of a new solution, research article I identified two paths to scale PPIs in a Smart City context (see section 6.1). Policymakers however, should be aware that scale up is not a simple task, as revealed by the five governance conditions. The findings provide policymakers with the ability to anticipate and design a PPI for the path most suitable for their solution to scale up. The research suggests that it is important for practitioners to look beyond market mechanisms when attempting to scale up a Smart City Project, as governance mechanisms provide (at least) two alternative paths to this outcome. Finally, practitioners should be aware that scaling up does not necessarily imply that public value is secured. Indeed, scale up is potentially important if new solutions are to have a city-wide effect but scaling up is now something to pursue independently of creating public value.

If policymakers aim to use Public Private Innovation Partnerships to create public value, it is worth considering how to appreciate and institutionalize the *soft* public

value outcomes that might arise during or at the end of a PPI. This dissertation has shown that policymakers risk losing crucial public value from PPIs unless the processes of *Learning, Transparency* and *Public Sphere* are prioritized throughout the partnership. Furthermore, where PPIs are used in the expectation of a future need or demand, it is important that the municipality remain dedicated to letting the solution be driven by *needs,* which might develop or be discovered through the process. The literature on cross-sector partnerships for innovation has long stressed the importance of the leadership required to guide the process. However, article II shows how leadership inside the public partner carries more weight than leadership within the private partner. Using the three attributes of soft public value, public managers can ensure that public value is created even if the innovation does not scale.

Policymakers should regard PPIs as an open process; one where the possible outcomes are unknown and where the public sector has the opportunity to exercise leadership that directs the process towards collective value creation, rather than be a passive receiver of a solution. Creating new solutions means working on the frontier of knowledge. New practices must be accepted by end-users and citizens in order to both scale up *and/or* create public value. It is a question of managing expectations for both public managers and elected officials. If sustainable transformation is the long-term goal, it is important to remain dedicated, considering this requires a holistic approach to policymaking - the ship cannot be turned by a single PPI – and failures to provide utilitarian value must be acceptable. One of the key findings from this research has been the importance of public sector organizations in institutionalizing learning, knowledge and the networks created through PPIs. This is important when it comes to relying on these resources and capabilities in future projects while adding to the public sphere.

Finally, policymakers should look into whether New Public Management (NPM) is a management logic suitable for governing Public Private Innovation Partnerships. Public Private Partnerships are recognized for their role in popularizing the NPM paradigm and furthering the logics of the private sector into the public by enhancing competition and control to create efficiency with great success. However, wicked problems cannot be addressed through the logic of efficiency. Furthermore, the solutions required to create sustainable urban agglomerations or the Smart City requires something more than NPM's regulation of inputs. Perhaps Public Value Governance can provide a management regime for the challenges of the 21st century, through a focus on outputs and outcomes and managing according to what the public values, beyond the logic of efficiency. As shown by Mazzucato (2013), a public that mobilizes resources in the face of uncertainty and directs technological development towards what the public values is not a novel phenomenon.

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Appendix I: Research Article 1

City-Wide Scale-Up of Smart City Pilot Projects: Governance Conditions

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Abstract

The research objective of this article is to study the combinations of governance conditions under which smart city pilot projects scale up to an entire city. This is highly relevant for delivering city-wide urban solutions to grand challenges. The combinations of conditions (factors) for scale-up remain understudied. This paper contextualizes the research within the theoretical literature of governance, innovation, knowledge management, and smart city. It compares 17 smart city pilot projects in North America, Europe, and Asia. The cases were selected according to the research objective and are analyzed using fuzzy set qualitative comparative analysis (fsQCA). The findings show two paths of city-wide scale-up, which we term "bureaucratic tailoring" and "low-uncertainty partnering." This article makes three important theoretical contributions. First, smart city pilot projects have differentiated possible paths for scaling up to the entire city. Second, there is a need to differentiate the role and capability of the municipality in these different paths and in relation to the other governance conditions. Third, the social perception of technological uncertainty is not static; it is fluid and highly related to other governance conditions. Future-oriented policy makers might find these two paths useful in order to anticipate how projects might scale up.

Keywords: smart city, governance, grand challenges, sustainability, innovation diffusion, transformative innovation, mission innovation.

I. Introduction

Worldwide, many cities collaborate with private actors to develop smart city pilot projects. These pilot projects are innovative and entrepreneurial and usually confined to a few streets (Kummitha, 2018). If these projects are to solve the challenges of urban sustainability beyond a few urban spaces and streets (Graham and Marvin, 2001), they must scale up and operate in the entire city. However, many pilot projects never scale up. It is paramount for academics and practitioners is to understand the combinations of conditions (factors) that are conducive to scale-up. This is the main focus of this paper. Studying processes of scale-up requires a conceptual framework based on the state-of-the-art theoretical background about the various conditions (factors) at play, and a robust comparative study of multiple cases. Consequently, the research objective of this paper is to study the combinations of governance conditions (factors) under which smart city pilot projects scale up to the entire city.

From the perspective of the innovation literature, we consider the city-wide scale-up of these pilot projects as cases of innovation diffusion at the city level. The diffusion of innovation has normally been associated with the introduction of new technologies into the market (Rogers, 2003) and with the creation of frameworks conducive to market-creation (Markard and Truffer, 2008). Relevant strands in the smart city literature have applied that approach, analyzing cases of scale-up from the perspective of the market and entrepreneurial conditions (van Winden and van den Buuse, 2017; von Wirth, et al., 2019). Although market-creation and entrepreneurial conditions are highly relevant, a growing literature has highlighted the need to acknowledge the governance embeddedness of smart cities (Kummitha, 2018). Hence, we ask the following research question: Under what combinations of governance conditions do smart city pilot projects scale up from innovative experiments on a few streets into city-wide solutions?

To answer this question, we develop an analytical framework contextualized in the literature of governance, innovation, knowledge management, and smart cities. From this theoretical contextualization, we deduct five conceptually distinct governance conditions (factors), and investigate how they combine to facilitate scale-up. The five conditions are: Collaboration Intensity among partners, the Municipality's capacity, Articulation of Public Needs, Social Legitimacy, and the perceived Technological Uncertainty.[8]

We compare 17 cases of smart city projects in different municipalities around the world (eight projects in North America, seven in Europe, and two in Asia). Empirically, all cases concern digital technology applications, either related to Internet of Things (IoT) in areas like LED lights, air quality, or garbage collection; and/or related to data platforms for similar smart city purposes (see the list in Table 1). The cases are highly theoretically relevant, exhibit diversity in their X (the conditions, factors) and their Y (whether they have scaled up/not), and were carefully selected according to four specific methodological criteria following the "heterogeneous sample" approach (see Section 4 for more detailed information about the cases and their selection). We assume that the initial market conditions of these cases are similar and, everything else being equal, the originality of this paper is the analysis of how these five governance conditions combine in processes of scale-up. The cases are also relevant from the perspective of practitioners because they are real-life projects that aim to provide city-level digital solutions to specific challenges, like energy-saving, efficient transportation, and waste management problems.

Another important aspect of this paper is the use of the fuzzy set qualitative comparative analysis (fsQCA) method. This method is particularly robust in small-n qualitative analysis because it identifies specific combinations of necessary and sufficient conditions for a given outcome (a scaled-up or not-scaled-up pilot

[8] We capitalize these concepts so that it is easier for the reader to identify them as the five governance conditions under study (referred to in other contexts as the "independent variables").

project). Section 2 reviews the literature on the state of the art in order to contextualize the focus of this study. Section 3 provides the specific theoretical background of the study: it conceptualizes each of the five governance conditions one-by-one according to the literature, and in order to guide the analysis. Section 4 explains the case selection, the data sources, and the method. Section 5 conducts the fsQCA analysis in the 17 cases. Section 6 explains the findings, namely the two paths for scale-up. It also discusses them in relation to the existing theory and brings forward the three theoretical implications of the results of our study. Section 7 concludes by summarizing the results, drawing some practical implications for anticipatory and future-oriented urban governance, and suggesting future lines of research.

II. Literature Review: Contextualizing the Focus of the Study

The literature on smart cities has been developing for nearly three decades. Even before the advent of the concept of a "smart city", the literature was concerned with questions on innovative solutions in urban contexts (Mora, et al., 2019). The literature about smart cities now ranges from discourse-focused conceptual studies on what characterizes smart cities (Hollands, 2008), to more empirical studies that examine variations of smart cities (Nilssen, 2019) and their managerial dynamics in urban contexts (Nam and Pardo, 2011b). There is widespread acknowledgment in this literature that the practical development of smart city projects are entrepreneurial and innovative, and aim to find workable solutions to social, environmental, and economic sustainability challenges in the face of aging populations, rapid urbanization, and global warming (Contreras and Platania, 2019). For that reason, the literature on smart cities has generally emphasized the opportunities afforded by technological breakthroughs, developing an understanding of smart cities as "technology-driven problem-solving" (Drapalova et al., 2020: 2).

For the abovementioned reasons, the focus on processes of open innovation and entrepreneurial dynamics at urban level is important in empirical studies of smart cities. Some of these studies have emphasized the need to create new frameworks for open innovation promoting smart city solutions (Schaffers, et al., 2011). Other studies have investigated the need to break down siloes within local governments to allow new problem-solving approaches (Appio, et al., 2019). Yet other studies have emphasized the knowledge management aspects of smart city projects by examining aspects like the ambidexterity of organizations (Bresciani, et al., 2018), public–private interactions (Lam and Yang, 2020), the role of universities (Ardito, et al., 2019), knowledge gatekeepers in networks (Messeni Petruzzelli, et al., 2010), the role of SMEs (Martinez-Conesa, et al., 2017; Scuotto, et al., 2017), or processes of collaborative innovation community capacity building (Bai, et al., 2014).

In parallel, a recent strand in the governance literature has investigated governance aspects of smart cities (Drapalova and Wegrich, 2020). The governance approach suggests considering governance conditions in the analysis of smart cities, advancing beyond strictly technological perspectives (Meijer, 2018). Overemphasizing the role of technology and economic conditions could neglect the relevance of governance conditions at play (Green, 2019; Kitchin, 2015). The recent literature on the governance of innovation has observed smart city projects as cases of a "primus inter pares" governance mode, where public actors (mainly municipalities) have a prominent role in shaping the context for creating innovative solutions while interacting with private firms (Borrás and Edler, 2020). The notion of "primus inter pares" refers to the network-type relationship between public and private actors in contexts, where public actors are responsible for defining important aspects for the generalization of these innovations.

Despite this increasing attention to governance, a gap remains in the literature: investigations that study the governance conditions in the scale-up of smart city

pilot projects. The present article aims to cover this gap from a governance perspective, focusing on combinations of governance conditions. The few existing studies on scale-up processes have focused on market, entrepreneurial, and technological conditions, not on governance conditions. Two studies in particular are directly relevant in this regard. Van Winden and van den Buuse studied the following set of conditions for the scale-up of three cases of smart city pilot projects: "prospects of reaching economies-of-scale; the presence of knowledge transfer mechanisms and incentives; management of ambidexterity in exploration-exploitation activities; the presence of enabling regulatory, legal, and policy frameworks; interoperability between systems, data, and standards; and the inclusion of standards to measure returns on investment" (van Winden and van den Buuse, 2017: 66). Another recent study, by von Wirth et al., analyzed the different strategies for the scale-up of urban living labs to city-wide solutions. These authors identified the strategy for "scaling up" living labs as a strategy for scaling up "business models of start-ups by promoting entrepreneurial growth in the lab and beyond" (von Wirth, et al., 2019: 244). These two studies have provided good insights into market, entrepreneurial, and technological conditions, but have underplayed governance conditions.

The literature of governance, innovation, knowledge management and smart cities offers highly relevant insights on governance conditions in urban contexts, which are key for studying processes of scale up. However, these have been studied in isolation rather than in combination. The next section digs deeper into the literature in order to conceptualize five key governance conditions (factors) in processes of city-wide scale-up.

III. Theoretical Background: Five Governance Conditions

Scaling up smart city pilot projects from a few streets into city-wide solutions is a complex process that involves a series of relevant governance conditions. We refer

to the clues offered in the theoretical literature and identify five key governance conditions: Collaboration Intensity among partners, the municipality's capacity, the Articulation of Public Needs, Social Legitimacy, and the perceived technological Uncertainty.

The first condition is *Collaboration Intensity,* which assumes that scale-up of smart city projects requires collaboration among various actors (Kummitha and Crutzen, 2019). Opportunities and challenges in smart city projects might be perceived and framed differently (Scuotto, et al., 2016), risking accumulative dysfunctional decision-making that leads to "halfway solutions" that leave nobody satisfied (Ungureanu, et al., 2019). Thus, in cases where pilot projects have been successfully scaled up, this could have occurred because the collaboration between public and private partners was able to overcome collaboration challenges. The most important of those challenges are inequality among partners, diverse levels of engagement in the partnership, and the alignment of partners' interests (Geddes, 2009). A collaboration in which actors are perceived to be on equal terms is a crucial dimension of the intensity of collaboration. This can be attributed to the non-hierarchical nature of interactions in open innovation processes (Bakici, et al., 2012), particularly in specific neighborhoods (Dezi, et al., 2018). The level of engagement is critical, especially when the participating partners have symmetrical capabilities (Hardy and Phillips, 1998). Hence, when partners are perceived to be on equal terms, regular, and highly engaged in forms of collaboration (rather than conflict), this might be linked to positive outcomes (the scale-up of smart city projects). The literature has argued that collaboration might enhance innovative solutions despite higher transaction costs due to the different types of actors (Hagel and Brown, 2005). Higher levels of diversity and heterogeneity between partners might result in higher costs, but also in greater yields. Finally, the alignment of interests is vital for Collaboration Intensity. Thus, the partners who have similar incentives and positive prospects from *scaling up* might engage in a more intense collaboration (Brogaard, 2019).

The second condition concerns Capable Municipality, which is *the organizational and technical capacity of the municipality* as a governance condition for scaling up. Smart city projects are technological in nature, which could put pressure on the technical and operational capacities among the partners involved. This phenomenon is particularly true for municipalities, the key operational partner in these projects, because the private partner is usually chosen due to their expertise on the topic (Brogaard, 2019). Ranchod (2020) demonstrated how a lack of skill and capability within municipalities harms negotiations with private actors. The question of the capacity of public actors (municipalities) is crucial in processes of sociotechnical change, particularly in terms of the ability of public actors to understand and leverage new technologies (Borrás and Edler, 2014). Some authors have linked issues of contract renegotiation between partners as a proxy for stability (Soecipto and Verhoest, 2018). The ability of the municipality to demand or request technical amendments and ongoing changes to the solution is an indicator of a public organization with strong capacities. Technically strong public organizations make detailed requests for specifications and engage in active development rather than passively procuring path-dependent solutions with the risk of lock-ins (Holland, 2008). Furthermore, public–private innovation partnerships have been linked to intraorganizational processes of change and adaptation (Arellano-Gault, et al., 2013), particularly in cases involving open innovation processes (Kornberger, et al., 2017; Ferraris, et al., 2018; Papa, et al., 2020). Therefore, the extent to which the municipality has adapted its internal dynamics to accommodate and embed an innovative solution will probably be positively related to city-wide scaling up. The capacities and attitudes of the public organization to conduct smart city knowledge management and project management are also key (Bryson et al., 2017; Alassaf, et al., 2020; Gold, et al., 2001). Problems associated with the management of smart city projects typically include a lack of manpower and technical knowledge, coordination problems across

municipal departments, and/or a lack of leadership in the implementation phase inside the municipal organization (Hartley et al., 2013). The fewer management problems encountered, the more likely it is that the project will scale up.

The third condition is the *Articulation of Public Needs* by the municipality. Scaling up projects to city-wide solutions requires specification of the needs of the entire city (beyond specific urban spaces) and the identification of whole-city problems that a novel smart city solution must address. This is because smart city projects potentially create fundamental changes in the nature of problem solving and how certain societal functions are conducted (van den Bosch and Rotmans, 2008). The literature concurs that the municipal task of identifying and formulating such needs is basically a cognitive intersubjective process (Boon, et al., 2011). Thus, from a governance perspective, the Articulation of Public Needs is a process that requires the municipality to interact with citizens, civil society organizations (CSOs), and end-users as co-creators. Therefore, we assume that the Articulation of Public Needs is linked to two specific processes. The first is the extent to which the municipality has been pro-actively engaged in identifying and assessing those needs, and the second is the extent to which the *citizens* or *end-users* have been invited by the municipality to participate in the process of articulating the public needs.

The fourth condition holds that although smart city solutions (particularly digital) can be highly scalable, these technologies must have *Social Legitimacy* (Sepasgozar, et al., 2019). Gaining social acceptance of new technologies is a complex process and, in the context of rapid institutional change, organizations might seek to gain legitimacy of their decisions by reverting to specific rhetoric justifying specific choices (Patala, et al., 2019). For this reason, the Social Legitimacy of technologies and their impacts form an important condition to scale up. This applies especially to digital technologies in smart cities because these raise significant concerns about who owns what data and how that data is used. The potential rise of a surveillance state or surveillance capitalism (Zuboff, 2019) and the uninhibited data collection

that occurs in public spaces are the subjects of much social contestation. Following from this, we have identified the three most salient characteristics of Social Legitimacy. The first is the degree of contestation among public opinion about the smart city project. Secondly, another important question concerns who owns the data produced by the solution. Thus, we assume that the more the business models of private firms engaged in the smart city project are related to the ownership of the data, the less Social Legitimacy exists in the projects. Thirdly, Social Legitimacy is linked to the participatory involvement of end-users or citizens in the smart city pilot project (Voorberg, et al., 2015; Brogaard, 2019). Notably, in the present study, participation regards the involvement of end-users and citizens *during the lifetime and the unfolding of the pilot project*. This is different from the third condition above, which is related to the participation of citizens in the definition of public needs *before launching the pilot project and in the planning phase.*

The fifth and final governance condition involves the *perception of technological Uncertainty* associated with the project. Scale-up puts a strain on various dimensions tainted by Uncertainty within the project and the participating actors. Furthermore, friction is inherent between the interface of technology and forms of societal organization. Parts of the literature have examined the "uncertainty paradox," in which Uncertainty is acknowledged, but the role of science and technology is expected to provide certainty rather than being exposed to Uncertainty itself (Van Asselt and Vos, 2008). Using specific technologies to address challenging elements at the city level makes the perception of Uncertainty important as a condition for scale-up. This perception of Uncertainty is not only related to economic or policy uncertainty (Contreras and Platania, 2019); more fundamentally, it is related to the perception of Uncertainty about particular technologies in the urban context. Hence, the more uncertain the technical nature of the solution, the less likely it is that the solution will scale up. It is worth noting that the fourth condition, on Social Legitimacy, is related to the overall social acceptance of a project; thus, this fifth condition is different and more technical in nature

because it is related to perceptions of whether a particular technology will be technically feasible or not.

This research focuses on understanding the combinations of these governance conditions under which smart city pilot projects scale up to the entire city. With this purpose in mind, an empirical analysis is designed and conducted in the following sections.

IV. Case Selection, Data, and Method

In accordance with the literature review, we defined the scale-up of smart city pilot projects as a specific form of city-wide diffusion, with the generalization of an innovative technological solution that is used for the whole city. Our definition corresponds to "city-wide scaling up", as defined by authors in the field of urban innovation (von Wirth, et al., 2019). We consider these smart city projects to be examples of transformative innovation at the urban level. They are innovative because they experiment with new technologies (usually digital), relying on state-of-the-art knowledge and hence on knowledge management (Appio, et al., 2019). They also aspire to be transformative because their innovative solutions aim to change sociotechnical systems at the urban level (Coenen, et al., 2012), to achieve sustainable public goals (Zhang and Li, 2018).

We selected 17 cases that are comparable and highly relevant from conceptual, methodological, and theoretical perspectives. Table 1 specifies the name of the smart city project, the city, the main technology, and the profile of the survey respondent for each case. All 17 cases comply with the abovementioned definition of a smart city pilot project and are therefore conceptually relevant. We describe these cases briefly below, and then explain both the specific methodological and theoretical criteria for their selection.

Table 1: The 17 Cases Selected: Project name, city, technology, and the profile of the survey respondent

Case	Smart City Project Name	City	Technology	Respondent
1	Smart Cities Through Smart Lighting	Brussels, BE.	IoT* and LED Lights	Private project manager
2	Underground Infrastructure Sensing	Burlington, USA	IoT for underground infrastructure	Project consultant
3	Smart Public Lighting Control Project	Montreal, CA	IoT and LED Lights	Public project manager
4	Transforming household waste	Austin, USA	Data Platform	Public project Manager
5	Wireless IoT Connectivity Platform	San Leandro, USA	IoT and LED Lights	Public project manager
6	Smarter Streets with Video Analytics	Las Vegas, USA	IoT for security and law enforcement	Public project manager
7	OneTransport Initiative	Watford, UK	IoT and Data Platform	Private project

				manager
8	IoT sensors on Smart Lighting	San Diego, USA	IoT and LED Lights	Public project manager
9	Smart Shuttle	Columbus, USA	IoT and Data Platform for Autonomous Vehicle	Private project manager
10	EnvyPorto air quality	Porto, PT	IoT for Air Quality Sensor	Project consultant
11	Smart City Platform	A Coruña, ES	IoT and Data Platform	Private public manager
12	Copenhagen City Data Exchange	Copenhagen, DK	Data Platform	Private public manager
13	Smart Bins	Copenhagen, DK	IoT Waste Sensor	Public project manager
14	SmartPoles	San Jose, USA	IoT Surveillance Sensor and LED Lights	Private project manager
15	Smart City Living Lab –	Taipei, TW	IoT and Data	Public

	Government as a platform		Platform	project manager
16	Smart Waste Management & Logistics for Municipal Solid Waste Collection Operations	Goyang, KR	IoT Waste Sensor	Private project manager
17	Sensor City	Assens, NL	IoT and Data Platform	Public manager (regional level)

The sample is theoretically relevant for the objectives of this research due to the core features of the cases. All cases are about digital technology applications, either related to the IoT, digital data platforms, or both. Five of the 17 cases (Cases # 1, 3, 5, 8, and 14) are related to replacing existing streetlights with LED lights to save energy and achieve sustainability goals. The replacement of LED lights is often combined with the installation of various types of IoT devices and sensors with the purpose of gathering data on everything from air quality, traffic, underground infrastructure, and/or security/law enforcement. A further six cases (Cases # 2, 6, 9, 10, 13, and 16) concern the installation of multi-purpose IoT devices and sensors. The remaining six cases in the sample (Cases # 4, 7, 11, 12, 15, 17) are about data platforms, often with IoT sensors as well, which relate to obtaining, distributing, exchanging, and/or processing big data in cities, with the goal of more intelligent use of municipal resources or new business opportunities. The sample of the 17 cases has a solid geographical coverage, with eight cases in North America, seven in Europe, and two in Asia. It also covers cities of different sizes, as well as capital and non-capital cities.

Methodologically, the sample of 17 cases follows the "diverse case selection criteria" or "heterogeneous sample" (Ritchie, et al., 2003), according to which the purposefully selected cases "are intended to represent the full range of values characterizing X and Y" (Seawright and Gerring, 2008: 300). Our sample includes cases with diverse values regarding the five conditions (X) under study (see Table 3 with final fuzzy scores on the five X conditions). Likewise, the sample includes cases with and without scale-up (Y).

If we want to investigate which combinations of conditions lead to scale-up, we need a sample that includes cases that have scaled up and cases that have not scaled up. Four out of the 17 cases in the sample (Cases # 2, 9, 13, and 14) did not scale up; see Table 3. The inclusion of non-scaled cases in the sample is extremely important because it ensures that there is no positive bias towards scale-up. For these powerful reasons, the sample selected is highly relevant for the research objective of studying the combinations of conditions in processes of scale-up.

More concretely, the sample size of 17 cases was determined based on four criteria, as suggested in the methods literature (Ritchie, et al., 2003): their comparability (the cases are about digital technologies applications in smart cities and are pilot projects); the heterogeneity in the variation of X and Y; the type and quality of the data collected (see below concerning survey responses' data completeness); and method-related considerations about fsQCA, given that this method is based on Boolean algebra and is therefore suitable for a maximum number of small-n comparisons. It is also worth mentioning that our comparative study of 17 cases complements existing single-case studies in the smart city literature (Scuotto, et al., 2016; van Winden, 2016).

The process for case-selection followed two steps. In the first preliminary step, we identified a "large pool" of 38 possible cases. We reverted to international smart city practitioners' associations and programs, as well as professional contacts.[9] Only cases with sufficient detailed information were considered in this "large pool" of 38 possible cases. In the second step, we selected our purposeful sample of 17 cases out of the 38 possible cases following the four criteria mentioned above.

The data for these 17 cases were gathered from two different sources. First, we collected data using a specific 24-question survey (using Survey Xact) offering a complete dataset on these 17 cases. The survey respondents mostly comprised senior project managers with direct knowledge of the smart city pilot project under study. The second source of data was archival data from desktop research, comprising written documents (such as reports, blogs, news articles, social media) directly relevant to the 17 cases. We gathered 156 different written documents, which were read, summarized, and interpreted by the three researchers: the two authors of this paper and one research assistant employed and trained for the purpose. These three researchers assigned specific raw values to the outcomes of the 17 cases. Several rounds of iterations and interpretations among the researchers secured intercoder reliability. This procedure is normally used in the QCA method (because of its qualitative nature), which reiteratively shapes the understanding, content analysis, and qualitative interpretation of the cases until the researchers can assign a specific value (Nishant & Ravishankar, 2020; Ragin 1994: 76).

This paper uses the fsQCA method to identify what combinations of governance conditions (X factors) lead to city-wide scale-up (the Y outcome) among the 17 cases studied (Schneider & Wagemann, 2012). This does not exclude other combinations of conditions that were not investigated in this study from providing

[9] Mainly the following two sources: The *2018 Smart50 awards* https://spring.smartcitiesconnect.org/Smart50Awards/ and the *National Institute of Science* and Technology's (NIST) Global City Team Challenge program https://pages.nist.gov/GCTC/. We further investigated each of these cases, seeking additional available information and contact persons.

a pathway to scale-up (for example, economic and market-creation conditions) because QCA relies on *equifinality*, which means that multiple pathways can lead to an outcome. Similarly, the fsQCA method relies on conjunctural causation: specific combinations of conditions, not single conditions, lead to the outcome (Schneider et al. 2010: 251).

It is widely acknowledged that QCA is a particularly relevant method for the analysis of small-n (Gerrits & Verweij, 2018: 18). In the present study we use fuzzy-set QCA (fsQCA) instead of crisp-set QCA because the complexity of the cases under analysis makes it more suitable for fuzzy values, as these reflect the complexity of the cases better than binary crisp sets do.

An important part of the QCA method concerns the calibration of raw data (the survey responses and written documents' information) into specific scores suitable for undertaking the mathematical set-theory analysis that is the backbone of the fsQCA method (read below). The process of calibration is the translation of raw data scores into final fuzzy set scores between 0 and 1. Technically, the raw scores and the final fuzzy scores indicate a qualitative difference between the cases (Schneider & Wagemann, 2012: 34). The outcome of interest in our study (or what is termed in inference statistics as the dependent variable – the Y) is whether or not a smart city project has been scaled up to the entire city. We used the raw data from the survey responses and the researchers' assessment of the cases based on the archival data. This served to triangulate the data sources while providing elaborated, reliable scores. Thus, Q5 from the questionnaire was posed to both the survey respondent and the researchers.

Box 1: Question 5 of the survey, measuring the outcome (scale up or not) – raw scores

(0) A – Has not been deployed

(1) B – Has been deployed on a few streets

(2) C – Has been deployed in an entire neighborhood

(3) D – Has been deployed city-wide

(3) E – Has been deployed as in B, C, and D but in more than one city

The numbers on the left in box 1 (in brackets) represent the individual raw data score that is equivalent to different stages of scale-up, which in this case includes city-wide scale-up. The final raw score for each case (Table 2) is the addition of the raw scores provided by the survey respondents and the researchers. This raw score (between 0 and 6) was then calibrated into a fuzzy score between 0 and 1. We considered that the cases in E were scaled up to the same level as the cases in D (both answers scoring 3) because E encompasses D (our focus of analysis).

When calibrating raw scores into fuzzy set scores, we had to define the level of maximum ambiguity (0.5) where a case cannot be said to be either more in than out of the set, or vice versa (Schneider & Wagemann, 2012: 32). In addition to the point of maximum ambiguity, we had to define the anchors for "more out than in a set" and for "more in than out of the set" of scale-up. Thus, the anchors (0.33, 0.5, and 0.67) were set at 2, 4.5, and 5, respectively, within the raw data scores, meaning that a case must score at least 5 to be considered more scaled up than not.

The five conditions in our study[10] were measured using one or more questions on the questionnaire. When a question had four answers, the answer signifying the most likely set membership was awarded a raw score of 4, and the answer contradicting membership was assigned a raw score of 1. When a yes/no question was asked, the response that signified "mostly" in the set was assigned a raw score

[10] Outcome is defined in other contexts as "independent variables", the "X".

of 1, and the opposite was assigned a score of minus 1. Thus, several indicators formed the raw scores for each condition, ensuring a more reliable empirical ground for calibrating the data into fuzzy scores (Appendix). Table 2 contains the raw scores and Table 3 shows the final fuzzy scores.

Table 2: Raw data scores on the five conditions and the outcome

Case	Collaboration Intensity	Capable Municipality	Articulation of Public Needs	Social Legitimacy	Uncertainty	(Outcome) Scale-Up
1	6	9	5	10	2	5
2	7	5	3	10	3	2
3	6	6.5	3.5	9	3	6
4	6	3	3	9	2	6
5	8	7	4	8	2	6
6	6	7	3.5	9.5	1	4
7	7	9	5	11	2	5
8	8	6	3	10	1	5
9	9	7	5	9	4	1
10	6	7	6	10	2	6
11	10	7	4	8	2	5
12	4	6	4	8	4	6
13	7	10	6	10	4	4

14	7	7	5	6	1	2
15	8	7	6	11	2	5
16	6	5	5	8	2	5
17	3	6	2	8	4	6

Using the R software and the abovementioned level of maximum ambiguity criteria, the raw scores were calibrated into fuzzy scores (Table 3).

Table 3: Final fuzzy scores on all five conditions and the outcome[11]

Case	Collaboration Intensity	Capable Municipality	Articulation of Public Need	Social Legitimacy	Uncertainty	(Outcome) Scale-Up
1	0,67614458	0.9080554	0.72740171	0.98806954	0.1866055	0.95
2	0.8133945	0.05	0.14595776	0.98806954	0.8133945	0.05
3	0.67614458	0.65798325	0.23545239	0.95	0.8133945	0.99985423
4	0.67614458	0	0.14595776	0.95	0.1866055	0.99985423
5	0.90099499	0.72740171	0.35689009	0.8133945	0.1866055	0.99985423
6	0.67614458	0.72740171	0.23545239	0.97541074	0.01193046	0.35689009
7	0.8133945	0.9080554	0.72740171	0.99723757	0.1866055	0.95
8	0.90099499	0.58106817	0.14595776	0.98806954	0.01193046	0.95

[11] Note that Cases 2, 9, 13, and 14 score below 0.5 on the Outcome, which means that they have not scaled up.

9	0.95	0.72740171	0.72740171	0.95	0.98806954	0.01595005
10	0.67614458	0.72740171	0.95	0.98806954	0.1866055	0.99985423
11	0.97541074	0.72740171	0.35689009	0.8133945	0.1866055	0.95
12	0.1866055	0.58106817	0.35689009	0.8133945	0.98806954	0.99985423
13	0.8133945	0.95	0.95	0.98806954	0.98806954	0.35689009
14	0.8133945	0.72740171	0.72740171	0.1866055	0.01193046	0.05
15	0.90099499	0.72740171	0.95	0.99723757	0.1866055	0.95
16	0.67614458	0.05	0.72740171	0.8133945	0.1866055	0.95
17	0.05	0.58106817	0.05	0.8133945	0.9880695	0.9998542

V. fsQCA analysis

We used QCA analysis to search for the necessary and sufficient conditions (the five governance conditions) that lead to the outcome (city-wide scale-up) of pilot projects. Sufficiency and necessity are terms from formal logic and are used to describe the relationship between a condition and the outcome. For instance, if we state, "if Y then X," this expression means that X is necessary for Y, and we will be unable to find instances where Y is present if X is not also present (Gerrits & Verweij, 2018: 11). Similarly, the statement "X is sufficient for Y" implies that when X is present, Y will always be present, but if X is absent, this does not imply that Y is not present. In reality, however, because of the complexity in the social world, we are much more likely to uncover INUS conditions rather than outright necessary and sufficient conditions (Schneider & Wagemann, 2012; Gerrits & Verweij, 2018: 86). An INUS condition is "*Unnecessary* but *Sufficient* for the result" (Ibid.: 88). Thus,

when we produce a truth table, the combinations of conditions usually consist of INUS conditions that, in conjunction, make up the expressions of sufficiency.

The analysis proceeded as follows. First, we examined whether any of the conditions are necessary for the outcome (Table 4), because this would also imply their sufficiency. Thereafter, we produced the truth table (Table 5) using the specialized software R. The truth table translates our calibrated scores, where each row represented a case (Table 3), into a truth table where each row represents a logical combination conditions (Table 5), indicating whether this combination leads to the outcome, and an overview of which cases belong to which combination of conditions. We then analyzed the truth table with regard to consistency and coverage and critically assessed it using the minimization method in order to obtain our intermediary solution term (Table 6) (Gerrits & Verweij, 2018: 94).

Analysis of Necessary Conditions

In the first step of the QCA analysis, we identified any necessary conditions among our five conditions. The software yielded Table 4, and the first test a condition must pass to be necessary is its "consistency" score. This measured the consistency with which a specific condition is necessary across all cases and, as a rule of thumb, the consistency score must be above 0.9 to be considered necessary. Our results show that only the Social Legitimacy (Legfs) condition had sufficient consistency to be considered necessary for the outcome.

In the second step, we examined the trivialness of Social Legitimacy as a necessary condition. Coverage captures any trivialness arising from the relation between the condition and the outcome, and measuring the relevance of necessity (RoN) informs us about whether a condition is near constant and thus trivial (Schneider & Wagemann, 2012: 234–237). Values of both measurements are between 0 and 1, and the *lower* the score, the *higher* the trivialness.

As shown in Table 4, only the condition of Social Legitimacy scores higher than 0.9, and its coverage score of 0.7716 is also acceptable because it is above the rule of

thumb of 0.6 (Schneider & Wagemann, 2012: 147). However, when we measure its relevance, it decreases to 0.3668, meaning that there is a certain source of trivialness to Social Legitimacy. Thus, Social Legitimacy is a necessary condition in our analysis. However, given the features of our dataset where Social Legitimacy is almost a constant, it is limited how conclusive this finding is (Schneider & Wagemann, 2012: 147). Thus, in our 17 cases, if the condition of Social Legitimacy is present, the outcome will also necessarily be present. Due to the constant presence of Social Legitimacy in the data, there is a degree of trivialness to this finding. Future studies should investigate whether this trivialness is significant or not in order to determine with more exactitude the extent to which Social Legitimacy is invariably a necessary condition for scale-up (see conclusion section of this article).

Table 4: Testing for necessary conditions

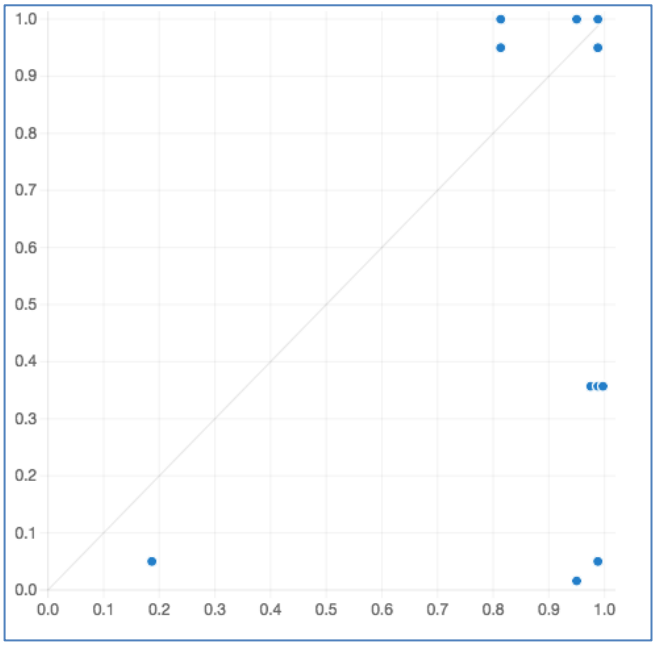
Conditions	Abbreviations	Consistency	Coverage	Relevance (RoN)
Collaboration Intensity	Colfs	0.7114	0.7321	0.5966
Capable Municipality	Capfs	0.6893	0. 7579	0.6701
Articulation of Public Need	Needsfs	0.5139	0.7560	0.8033
Social Legitimacy	Legfs	0.9246	0.7716	0.3668
Uncertainty	Uncerfs	0.3784	0.6670	0.8069
NOT Collaboration Intensity	~Colfs	0.3606	0.9363	0.9754
NOT Capable Municipality	~Capfs	0.363	0.8122	0.9154

NOT Articulation of Public Needs	~Needsfs	0.5422	0.8007	0.8343
NOT Social Legitimacy	~Legfs	0.0949	0.5985	0.9496
NOT Uncertainty	~Uncerfs	0.6504	0.8237	0.8030

Figure 1 plots each individual case along the XY axis according to the scores of Social Legitimacy (X) and of scale-up (the outcome Y). Case 2, Underground Infrastructure Sensing (in the bottom right quadrant of Figure 1), is the only case that is completely out of the Capable Municipality and Articulation of Public Needs set, while the outcome is more in than out of the Collaboration Intensity set and completely in the Social Legitimacy set. That this case scores high on Social Legitimacy and is completely out of the scale-up set (our outcome) shows that the Social Legitimacy set is larger than the scale-up set and almost universal, making Social Legitimacy a necessary but trivial condition. This case (Case 2) involves a technology that is far from mature and thus far from able to scale up, but it is still a member of Social Legitimacy.

Figure 4: XY plot of Social Legitimacy and Scale-Up

Y – Scale-Up (the outcome)



X – Social Legitimacy

Analysis of Sufficient Conditions

A condition or a combination of conditions X can be considered sufficient if X is present when the outcome Y is also present (Schneider & Wagemann, 2012: 57). This does not mean that we can conclude anything for cases that do not have condition X, as equifinality means that other conditions might be sufficient for outcome Y. Practically, we uncovered sufficient conditions by observing whether cases have a lower fuzzy score in the condition than in the outcome for each case, but higher than the point of maximum ambiguity (<0.5) (Ragin, 2000: 235).

Examining the truth table (Table 5), the logically possible number of rows is 2^k, with k being the number of conditions investigated; thus, we can observe 2^5 = 32 rows. Because we have 17 cases, there are inevitably *arithmetic* remainders because the maximum number of truth table rows we can observe that have at least one case is 17. To generate the truth table, we only accepted rows with a

consistency level of 0.8 across the cases (Schneider et al., 2010: 255). Our 17 cases are related to nine out of the 32 mathematically possible truth table rows (Table 5). Only six of these nine rows (rows 31, 12, 23, 19, 27, and 28) have a consistency level above our cut-off point of 0.8. Consistency and coverage scores are not an end in themselves (Gerrits & Verweij, 2018: 112); hence, we only included rows in the minimization process with a consistency above 0.8 to ensure that the cases attached to each row were consistent with the combination of conditions they represent.

Row #	Collaboration Intensity	Capable Municipality	Articulation of Public Needs	Social Legitimacy	Uncertainty	Scale Up	# of cases	Consistency	Cases
31	1	1	1	1	0	1	4	0.95	1; 7; 10; 15
12	0	1	0	1	1	1	2	0.93	12; 17
23	1	0	1	1	0	1	1	0.92	16
19	1	0	0	1	0	1	1	0.9	4
27	1	1	0	1	0	1	4	0.86	5; 6; 8; 11
28	1	1	0	1	1	1	1	0.82	3
20	1	0	0	1	1	0	1	0.65	2
32	1	1	1	1	1	0	2	0.64	9; 13
29	1	1	1	0	0	0	1	0.54	14

Table 5: Truth table

Truth table rows 27 and 31 are notable because they contain the highest number of cases across the table. Row 31 also has the highest consistency score across all cases and is in line with all of our theoretical expectations. Notably, the cases in row

27 are set members of three of the four conditions for which we expected to scale-up (Collaboration Intensity, Social Legitimacy, Capable Municipality), and members of the outcome (scale up). However, they are *not* members of the Uncertainty set nor of the Articulation of Public Needs set, as the theory expected. Looking more specifically at the cases in row 27, we can see, for example, that Case 8 *IoT sensors and Smart Lighting*, is a mature and concrete technology whose benefits are easily understood (large energy and cost saving from switching to LED lights) (Gartner Report, 2017). Therefore, this case's membership of the Collaboration Intensity, Capable Municipality, and Social Legitimacy conditions is related to the theoretical expectations. However, the absence of Articulation of Public Needs condition seems somehow contradictory here. We return to this matter in more detail in Section 6, where we discuss the findings.

Row 12 comprises two cases (case 17 *Sensor City Assen* and case 12 *Copenhagen City Data Exchange*) that are the only members of the Social Legitimacy and scale-up sets (the outcome), while at the same time they are mostly out of the Articulation of Public Needs set. In the following intermediary solution, these two cases form part of a path to the outcome, which shows how being out of the Articulation of Public Needs set is part of an INUS condition. This row contains Uncertainty as a sufficient condition in this combination for the outcome to occur, which is counter to what we expected, namely, not_Uncertainty. However, this could be interpreted as follows: if a technology is perceived as highly uncertain, but holds a strong amount of Social Legitimacy and Capable Municipality, these are sufficient for scaling up.

The purpose of producing the truth table above is to obtain a solution term (Table 6), wherein the combinations of conditions and their expressions are minimized by using Boolean algebra. This potentially provides us with three solution terms: the most complex solution, the most parsimonious solution, and the intermediary solution. Through logical minimization, the software produced these three solutions, and we used the intermediary solution, which Ragin (2008: 160–175)

recommended for interpretation (Schneider et al., 2010). The intermediate solution is a compromise between the conservative and the most parsimonious solution. The conservative solution consists only of minimization of the empirically observed combinations of conditions, while the parsimonious solution incorporates the logical remainders in the minimization process (Schneider et al., 2010: 262). To derive the intermediary solution, we set directional expectations that only include logical remainders in line with our theoretical expectations (Schneider & Wagemann, 2012: 168–175).

According to our theoretical framework, we expect Collaboration Intensity, Capable Municipality, Articulation of Public Needs, and Social Legitimacy to be present when the outcome is present, while we expect Uncertainty not to be present. Hence, after stating our theoretical expectations, the software minimized the truth table into an intermediary solution (Table 6).

Table 6: Intermediary Solution Term

Solution term:	**Capable Municipality*NOT Articulation of Public Needs*Social Legitimacy + Collaboration Intensity*Social Legitimacy*NOT Uncertainty => Scale-Up**		
	Consistency	Raw Coverage	Cases
Path 1: Bureaucratic Tailoring	0.837	0.42	3; 5; 6; 8; 11; 12; 17
Path 2: Low-Uncertainty Partnering	0.927	0.6	1; 4; 5; 6; 7; 8; 10; 11; 15; 16
Total Solution Term	0.901	0.74	

First, we examined the consistency of our solution term. Both expressions have consistencies above 0.8, and the solution as a whole has consistency of 0.901, which is well over the defined cut-off point of 0.8. Thus, there is a relatively high consistency across all cases in the solution term and the combination of conditions. To assess the solution term, we examined raw coverage, which reports the overlap between the set of the combination of conditions and the outcome set (Schneider et al., 2010: 258). Coverage is a good indicator of empirical importance (Ibid.). The membership of the outcome covered by each path is 0.42 and 0.6, respectively, while the solution overall has coverage of 0.74, meaning that our intermediary solution paths cover more than half the outcome (Schneider et al. 2010: 258).

Hence, the expression in our findings reads as follows: *Capable Municipality AND (not) Articulation of Public Needs AND Social Legitimacy OR Collaboration Intensity AND Social Legitimacy AND (not) Uncertainty* lead to scale-up. We name these two paths **bureaucratic tailoring** and **low-uncertainty partnering**. We present and discuss these results in the next section.

VI. Results and Discussion: The Two Paths for Scale-Up and their Theoretical Implications

The results of our study indicate two paths for smart city pilot projects to scale up: the bureaucratic tailoring path and the low-uncertainty partnering path.

The name "bureaucratic tailoring" is inspired by our findings that Capable Municipality is part of the combination of sufficient conditions leading to scale-up. In this path, municipalities seem to be particularly important in scaling up processes. This might be related to an explicit public mandate to effectuate scaling up, or to more general governance aspects in smart city project management (Ruhlandt, 2018; Gohari, et al., 2020). Our findings concerning the centrality of capable municipalities resonate well with findings about the limits of smart

governance in data-driven projects in cities, especially those that are challenged by an ineffective administrative apparatus (Ranchod, 2020), given the complexity involved in these projects for municipal decision makers (Pierce and Andersson, 2017). “The challenges that secondary cities encounter in establishing smart governance practices have a wide remit, and include the strategic disposition of the administration, the political effects of evidence generation and utilization, and the lack of technical and analytical capacities to effect smart governance” (Ranchod, 2020: 9).

In the bureaucratic tailoring path, we also observe that the Articulation of Public Needs is a condition that responds differently to the theoretical expectations (see Section 3). What is problematic for the theory is that not having public needs articulated should be part of a combination of sufficient conditions for scaling up. Cases 12 and 17 follow this path and have scaled up while being mostly out of the set of Articulation of Public Needs. These cases demonstrate that if the Capable Municipality and Social Legitimacy conditions are adequately present, scale-up can occur independently of Articulation of Public Needs. Cases 5, 6, 8, and 11 are also attached to this path, and these projects aim to install sensors on the streets (in A Coruna, San Diego, Las Vegas, and San Leandro). In these cases, the high level of Social Legitimacy and the capable municipalities have been sufficient for the scale-up to occur. Therefore, we argue that, in the bureaucratic tailoring path, the Articulation of Public Needs is more fluid than we anticipated, and is probably developed in a fluid and gradual manner (“tailored”) during the collaboration among partners, rather than being static and pre-defined. In summary, bureaucratic tailoring is a path to scale up where the municipality is a capable public organization that has a certain degree of latitude to define and “tailor” public needs in a flexible manner. On this path, the centrality of the municipality plays an important role.

The second path to scale up combines Collaboration Intensity, Social Legitimacy, and no_Uncertainty. We name this path "Low-uncertainty partnering." This combination shows that it is sufficient for the outcome to have an intense collaboration if there is low uncertainty about the technology. Notably, cases 4 and 16 refer to waste management, generally considered a low-tech sector in municipal management, and simultaneously, these two cases score very low (0 and 0.05, respectively) in Capable Municipality, in contrast with the eight other cases of this path, all of which are more in than out of this set. Case 4 *Transforming Household Waste in Austin* is a good example: by partnering with Austin Resource Recovery, Smarter Sorting developed a solution that scanned hazardous waste for the municipality to reuse it, rather than incinerate it using a costly process. Although this solution was not very high-tech and thus did not require a Capable Municipality, the legitimate goal of reusing chemicals and the intense collaboration between partners involved made it possible to scale up the solution to the entire city.

Therefore, we argue that in the low-uncertainty partnering path of scaling up, the low level of technological uncertainty provides the basis for an intense collaboration among partners because the risk assessment and allocation/negotiation of liability is less of a problem facilitating a collaboration that is more intense.

Finally, we observe that both paths include Social Legitimacy. Initially, we expected Social Legitimacy to be a necessary condition; however, our findings reveal a level of indeterminacy for Social Legitimacy to be a necessary condition. Hence, although there is some trivialness with Social Legitimacy as a necessary condition, it is sufficient in combination with other conditions in both paths.

Discussing both paths together, we can identify three theoretical implications. First, the findings show that the process of scaling up to the entire city is not a unique possible process. City-wide scale up can take place through at least two clearly

differentiated paths, according to two specific combinations of governance conditions. Previous studies have discussed different types of scale up (van Winden and van den Buuse, 2017). All 17 of our cases fall under what they term "replication" because they are pilot projects that scale up from specific streets into the whole city. According to van Winden and van den Buuse, this is the most complex type of scale up. Our findings complement theirs by showing that there are at least two possible paths in this type of scale-up, and that these paths are highly contextual according to the combinations of governance conditions.

Second, our findings suggest that successful cases of city-wide scale-up require an active and Capable Municipality in only one of the paths. Whereas the recent literature has already established the importance of capable municipalities (Ranchod, 2020), our study reveals that this might be exercised in different ways. In the bureaucratic tailoring path, the municipality mobilizes its own capacities and takes a proactive role in processes of city-wide scale-up. The findings about this path provide robust empirical evidence for prior theoretical assumptions on municipalities' roles as "promoters" and "enablers" in smart city innovation governance (Kronsell and Mukhtar-Landgren, 2018; Borrás and Edler, 2020). By contrast, in our low-uncertainty partnering path, the municipality mobilizes less of its own technical capacities and more of its networking with other organizations. This path corresponds to the literature focusing on interactions with external stakeholders (Viale Pereira, et al., 2017). In the low-uncertainty partnering path of scaling up, municipalities are more dependent on external partners and the projects are less uncertain, technologically. Hence, the first theoretical implication is the need to differentiate the role of the municipality and its capability in relation to the other conditions.

The third theoretical implication of our study is the variation in the degree of Uncertainty with which the technology is perceived, and that this variation shapes the processes of scale-up. Previous studies have pointed at economic or policy uncertainties in smart city projects (Contreras and Platania, 2019), and at the social

perception of technological uncertainty (Nam and Pardo, 2011a; Viitanen and Kingston, 2014). Our findings show that social perceptions of uncertainty vary across these two paths of scale-up. It also shows that cases with low Uncertainty (the low-uncertainty partnering path) are probably related to the nature of the technology and/or to how the risks in the experimental nature of innovative smart city pilot projects were allocated and negotiated among the organizations involved. Hence, the second theoretical implication is that our findings open a new and more nuanced theoretical approach to social perception of technological Uncertainty in smart city projects. The findings offer an excellent link to studies on uncertainty and routines in intra- and inter-organizational processes involving complex knowledge management (Carayannis, et al., 2017), and to the critical smart city literature (see Hollands, 2008). We have found that Uncertainty is not a static quantity that is either high or low depending on technology, but rather that Uncertainty is related to other governance conditions, and is thereby influenced by them, for instance Collaboration Intensity.

VII. Conclusions, Practical Implications, and Future Research

The focus of this paper is to study the combinations of governance conditions under which smart city projects scale up to an entire city. The literature has focused on individual governance conditions separately, but lacks studies of how those governance conditions function in combination to achieve scale-up. We conducted a robust analysis to address this gap in a comparative study of 17 relevant cases of smart city projects on digital technology applications. We found two paths for scale-up to the whole city: the bureaucratic tailoring path and the low-uncertainty partnering path. As seen above, these findings make three important theoretical contributions. The first is that smart city pilot projects have differentiated possible paths for scaling up to the entire city, not just one. The second is that there is a need to differentiate the role and capability of the municipality in these different paths

and in relation to the other governance conditions. The third contribution is that the social perception of technological Uncertainty is not static, but fluid and highly related to other governance conditions, such as the intensity and nature of collaborative processes.

Our findings have at least two important implications for practitioners. First, they complement studies focusing on market and entrepreneurial conditions for scale-up. Therefore, our findings underline the importance for practitioners to look beyond market mechanisms when attempting to scale smart city projects. Second, the two paths show that practitioners might prioritize between the different paths when considering how to scale up smart city projects, depending on their particular situation. Therefore, our findings help future-oriented policy-makers anticipate which path is most suitable for scaling up, and act accordingly under these governance conditions.

Our study has two limitations that are worth considering when devising future research efforts. In our study, we operationalized Social Legitimacy in specific terms, namely, popular opinion contestation, end-users' involvement, and open ownership of data. In this respect, our findings relate well to previous assumptions on the relevance of Social Legitimacy in smart city projects (Walravens, 2012; Batty, et al., 2012). However, Social Legitimacy relates to broader issues of urban governance that we did not explore. Social Legitimacy is a relational phenomenon and, as such, has to do with the legitimacy of public organizations in changing forms of political authority in society (input legitimacy), as well as with the public organization's ability to organize solutions to pressing urban challenges (output legitimacy) (Meijer, 2018; Mena and Palazzo, 2012). Therefore, future lines of research must investigate both dimensions: one dimension is the *input* of Social Legitimacy in smart city projects by focusing on the changing relationship between the municipality and the society; and the other dimension explores the *output* of Social Legitimacy in terms of the ability of smart city projects to resolve pressing urban challenges.

This second line of research relates to the second limitation of our study. Our study focuses on scale-up per se. Scale-up moves innovative projects beyond their initial street-level pilot, putting them into city-wide contexts. However, scaling up to the whole city does not mean that the projects automatically generate public value. For that reason, further research should study when smart city projects generate public value, and if so, what public value. That would further contribute to our current efforts to bring the study of smart cities closer to the study of transformative innovation, solving the grand challenges associated with urban sustainability.

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Appendix II: Research Article 2

Creating Public Value from Public Private Innovation Partnerships: A Tale of Two Smart City Solutions

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Abstract

Public Private Innovation Partnerships (PPI) are used to create innovative solutions for the public sector, yet the literature is unclear on what public value is created due to a lack of empirical investigations into outcomes. Through comparative case studies, this paper accounts for the type of public value created in two smart city partnerships and investigates how public value emerged in the process. The findings show that PPIs predominately create deontological value and some long-term utilitarian value. Furthermore, collaboration and leadership, with the latter exercised inside the municipal partner, is an imperative driver of public value outcomes when needs are properly understood. These findings suggest that the public sector should account for a broader range of public value outcomes. These considerations help inform which PPIs to undertake according to their potential in terms of public value creation.

Keywords: partnerships, public value, smart city, innovation

I. Introduction

As global urbanization surges, cities find themselves struggling to maintain quality of life for citizens. Faced with global warming and its strain on natural resources, cities face challenges relating to the supply of energy, clean air, water and potential risks of rising sea levels. Concurrently, cities are transforming from capitals of industrial production involving heavy industries, into knowledge centers dominated by service industries (Savitch, 1988). This process requires readily adaptable organizations and growth to sustain an increasing population. The new skills and capabilities available to cities provide both challenges and opportunities. Municipalities do not have the capabilities to take on the challenges alone, but must rely on partnering with the private sector, universities, affected communities and other cities to spark the necessary solutions. Thus, cities engage in Public Private Innovation Partnerships (PPI) in order to innovate and co-create solutions to achieve sustainable economic, social and environmental societies.

Public Value Theory has advanced in the past three decades in order to assess and understand what public value is and how it is created (Moore, 1995). Public Value Theory and public management scholars focusing on cross-sector collaboration for innovation have paid considerable attention to Public Private Innovation Partnerships (Brogaard, 2017; 2019; Evald et al., 2014; Crosby et al., 2017; Hartley 2005; et al., 2013; 2017). PPIs was born out of the expectation that collaboration across the public-private divide creates a platform where ideas, knowledge and expertise can be shared in order to create new knowledge, innovation and public value (Evald et al., 2014; Torfing, 2019; Crosby et al., 2017). The literature considers public value as an inherent outcome from these processes and this assumption undermines the complexity of both public value outcomes and the uncertain nature of addressing wicked problems. This is related to an important gap within the literature: the lack of empirical enquiry from which to drive theoretical development (Hartley et al., 2017). This paper addresses this shortcoming by anchoring public value outcomes empirically through the

application of Moore's (2014) Public Value Account. Furthermore, by deducting a series of factors from the literature, and by studying them empirically in the analysis, this paper will link the study of static outcomes to the study of dynamic factors within two typical cases of PPIs. The empirical evidence from the cases serves to develop the relationship between the factors that impact PPI processes and the resultant public value outcomes as they emerge through the perspective of the Public Value Account. Hence, this paper asks the following research questions:

> *What public value is created in Public Private Innovation Partnerships and how does it emerge?*

These are two important questions that need to be jointly addressed in order to ground the understanding of how PPIs create actual public value. The research questions will be analyzed using two cases of PPIs, which involve the City of Copenhagen's attempt to leverage data-driven municipal solutions.

Conducting an empirical analysis using the Public Value Account (PVA) on a Public Private Innovation Partnership is the first novel contribution of this paper. The second novel contribution of this paper is linking the 'static' analysis of what the outcomes are with the dynamic approach. It does this by understanding *how* these outcomes emerge, specifying the relationship between the two. The analysis compares two Copenhagen-based PPIs, both in terms of *what* outcomes they established and also *how* these emerged. The analysis shows that, while *collaboration* and *leadership* are important for these outcomes to emerge, *deontological* public value outcomes are most prominent in both cases, albeit in different contexts across the two cases. The effect of barriers in the PPI process varies across the two cases, and functions differently as barriers of public value, compared to the theoretical expectation of them as barriers of the PPI process.

As a starting point, section II conducts a literature review of Public Value Theory and of Public Private Innovation Partnerships. In section III.i the Public Value Account (PVA) is described, providing an analytical framework for studying *what* outcomes of Public Value emerge from PPIs. In section III.ii, a series of factors that impact PPIs are identified in the literature, which enables the second analysis to investigate *how* these outcomes emerged. Section IV describes the comparative research design, including the two cases. The dual analysis is carried out in two steps and can be found in section V and VI. Finally, section VII consists of a discussion on the practical and theoretical implications of the analysis, after which the paper concludes on the research question and sets outlines for future research.

II. Literature Review and Theoretical Framework

II.i Public Value Theory

Public Value Theory (PVT) was first developed by Mark H. Moore (1995) as a normative framework for public managers to better understand their role in '*Creating Public Value*'. PVT has since been applied in 18 different disciplines and has seen more than 700 academic articles published (Hartley et al., 2017). The literature has developed in different directions, focusing on strategy, management, institutions, value perceptions, organizational and psychological conceptions of public value. The core concept of public value, however, the core concept still lacks a clear established definition (Hartley et al., 2017; Alford & O'Flynn, 2009). Furthermore, critics (Rhodes & Wanna, 2007; Sekera, 2016) have pointed out that PVT should be seen more as a paradigm or a model and that its vagueness risks making public value "*(…) all things to all people."* (Rhodes & Wanna, 2007 in Mazzucato & Ryan-Collins, 2019: 7). This paper aims to address this shortcoming by empirically anchoring public value outcomes through applying Moore's (2014) Public Value Account. PVT has been alleged to overstate the role of public

managers, especially with regards to how their roles differ in various political systems (see Rhodes & Wanna, 2007). Moreover, its applicability beyond the US system has been called into question. However, Moore (1995) is open about the constraints on public managers from the authorizing environment, which is also clear in his strategic triangle (Alford & O'Flynn, 2009). Conducting empirical research with Public Value Theory has been ascribed as a means to see beyond the "*public manager-centric approach"* (Hartley et al., 2017: 670). Thus, through analyzing two empirical cases of Public Private Innovation Partnerships, this article will help empirically develop this theory further.

There are roughly three distinct strands of the literature: Moore's (1995; 2013; 2014) management focused framework; Bryson, Crosby & Bloomberg (2015 and Stoker, 2006; Denhardt & Denhardt, 2011) who aim to establish a governance framework that focuses attention on, among other things, collaborative innovation processes; and Bennington's (2009; 2011) focus on the 'publics sphere,' borrowing this notion from Habermas (1989) and Bozeman & Jørgensen's (2007) research on public values. The next section dives deeper into the first two, as they form the basis of the analytical framework in this paper.

As a response to growing individualism and focus on individual needs in management literature, Moore (1995) sought to empower public managers as agents of a collective public. He did this by addressing what the public articulates its normative values to be through "*(…) imperfect democratic governance"* (Moore, 2014: 466). Moore (1995) originally created the Strategic Triangle, consisting of (1) Legitimacy and support, (2) Operational capabilities and (3) Value. The Strategic Triangle was developed as a tool for public management to focus on specific outcomes rather than input controls in order to ensure the creation of social value in the shape of a fair, democratic and sustainable public. Moores' (1995) framework enabled public managers to go beyond bureaucratic confines and actively strive for public value creation, much like private managers (at least in theory) maximize shareholder value. The public manager should leverage his ingenuity, creativity and

expertise and remain curious with regards to experimenting with solutions that could increase productivity, respond to citizens' needs, enhance justice and fairness and increase the publics' ability to respond (Pang, Lee & DeLone, 2014).

Moore has been criticized for proposing public value as analogous to shareholder value, as this presupposes that citizens are consumers and so diminishes the role of the 'empowered citizen' to that of passive recipients (Dahl & Soss, 2014; Wolin 2008; Pateman, 2012). Ultimately this risks copying the logic and form of neoliberal markets, which diminishes the variety and range of public value outcomes to that of efficiency, something Moore (2014) has passionately dismissed. It is beyond the scope of this paper to address this rhetorical discussion. However, the paper does contribute to the development of PVT by empirically applying Moore's (2015) Public Value Account to capture public value outcomes from two empirical cases. A key contribution of this paper will be to examine empirically the ability of PVT to capture outcomes beyond that of efficiency. This is generally seen as the ultimate ambition, purpose and intention of the theory (Moore, 1995; 2015; Benington, 2009; Mazzucato & Ryan-Collins, 2019; Dahl & Soss, 2014).

Building upon Stoker (2006) and Denhardt & Denhardt (2011), Crosby, Bryson & Bloomberg (2015) set out to describe public value as an emerging paradigm of governance for public administration. By combining the various strands of public value under a common paradigm, the aim was to challenge New Public Management as the dominant public management paradigm. According to Crosby (et al., 2015) the established management paradigms "*(…) are not up to the tasks of networked governance, leadership, and management when a variety of public values should be served, including, but hardly limited to efficiency, effectiveness and equity*" (Bryson et al., 2015). In spite of this ambition and multifaceted view of public value, PVT has assumed that public value is an implicit part of *innovation processes* and failed to recognize the complexity involved with securing public value from its outcomes (see Brogaard, 2019). As in PPI literature, the public value studies of cross-sector collaboration focus entirely on the processes, neglecting to develop an

understanding of outcomes from a PVT perspective. Thus, this paper seeks to complement this focus by looking deeper into *what* type of public value is created and reexamine the assumptions from the literature on what the drivers and barriers are of public value creation in PPIs (See figure 1 below). Certainly, Public Value literature's focus on the *dynamic process* is not without merit and it, thus, contributes to the second analytical framework by adding to the factors that determine how public value emerges from PPIs (see Section III.ii).

II.ii Public Private Innovation Partnerships

The purpose of this paper is to determine what public value is created in Public Private Innovation Partnerships (PPIs), and provide an understanding of how this emerges. PPIs are defined as projects involving both public and private actors that collaborate in order to develop innovative solutions for the public sector (Weihe, 2008; Evald et al., 2014; Brogaard, 2015; 2019; Evald, 2014). PPIs are a subset of Public Private Partnerships (PPPs), which have a well-documented history (Hodge & Greve, 2007; Osborne 2000; Rosenau 2000; Grimsey and Lewis 2005; Hodge et al. 2010), both among practitioners and also in academia as a tool for developing services, policies and solutions to the public sector (Dam, 2015).

The articulated goal of creating innovative solutions for the public sector, and the selection criteria used for private partners, is what distinguishes PPIs from other types of public private interaction (Brogaard, 2019; Edquist & Zabala, 2012). Apart from Brogaard's (2019) comprehensive review however, the reviews of PPIs have not gone beyond conceptualizing the phenomenon (see Evald et al., 2014). Thus, Brogaard's (2019) enquiry is the only systematic attempt to ground these conceptualizations in empirical findings. Brogaard presents 33 peer-reviewed studies on PPIs and unpicks these into explanatory variables that form an analytical framework of how PPIs create innovative solutions. Brogaard's (2019) framework is ambitious and shows the emerging importance of PPIs both as an option for policymakers, but also as a research topic. However, her approach only focuses on

the process by which drivers and barriers create innovative solutions for the public sector. It does not focus on the potential public value outcomes of such a process. There is an important distinction between the two, considering that, on the one hand, innovative solutions for the public sector might generate public value, but on the other hand they might not. For this reason, it is important to study PPIs' outcomes in terms of what public value they create and coupling the processes with these specific outcomes. This article thus aims at providing an understanding of the relationship between the factors impacting the processes of PPIs and their public value outcomes, following the public value accounting approach (see below).

In total, Brogaard (2019) identifies 9 factors (2 barriers and 7 drivers) of innovation. As her article is a comprehensive literature review, it is beyond the scope of this paper to investigate all 9 factors individually, especially since these are factors for the dependent variable, innovative solution for the public sector (not necessarily public value), as Brogaard (2019: 150) herself points out. In the search for balance, the analytical framework (see section III.ii) consists of five barriers and five drivers, thus I have limited myself to include Brogaard´s barriers in order to include factors from the literature on collaborative innovation and public value. The remaining three barriers are selected from the literature on collaborative innovation, a field in which PPIs are a subset, which underlines its relevance to this study (Brogaard, 2019) (see Hartley, Sørensen & Torfing, 2013). Table 2 and 3 in section III.ii provides an overview of the drivers and barriers used to analyze how the public value outcomes emerged.

This paper fills a gap within the PPI literature and, thus, complements Brogaard's study by linking the static analyses of public value outcomes to the dynamic process of how PPIs result in these. This is one of the two novel contributions of this paper. Consequently, by using the Public Value Account, this paper contributes to a more detailed account of empirical public value outcomes, giving way to a more nuanced debate of which factors influence the desired outcomes. Figure 1 shows the two stages of the analysis. The lower part of the figure refers to how outcomes are

usually studied in PPIs. This paper follows the upper level, linking the study of the PPI process with outcomes of *deontological* and *utilitarian* public value.

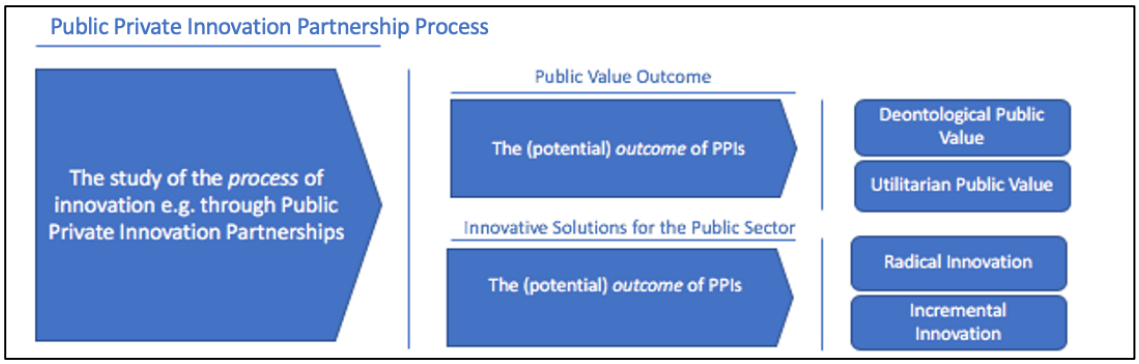

Figure 1: Authors own elaboration

The next section lays out the analytical framework, linking the two-step analysis. This is done by using Moore's Public Value Account to show *what* public value was created in these partnerships and *how* these outcomes emerged, drawing on the drivers and barriers to collaborative innovation put forth by the literature.

III. Analytical Framework: Understanding what Public Value outcomes and how they emerge

III.I Public Value Account

One of the novel contributions of this paper consist of providing an empirical analysis of public value using Moore's (2014) Public Value Account. Given the lack of empirical studies applying the theory, the extent to which Public Value as a theory is sufficiently well developed to be useful, has been subject to debate (Hartley et al., 2017). The lack of empirical studies has inhibited the empirical development of the theory. The description and operationalization of the Public Value Account that follows in this section represents a first step towards the empirical analysis in section V. Considering public *value* outcomes are the main

focus of this paper, the *cost* side of Moore's Public Value Account will only be used to contextualize the use of public funds or authority.

When evaluating public value as received by the public, Moore (2013; 2014) makes a distinction between two types of public value: utilitarian and deontological value. Utilitarianism focuses on the good rather than the just or fair. A positive utilitarian value will be a process that results in the public achieving something they desire or need as a collective or an individual, something that improves their material wellbeing. Utilitarian value is referred to as Mission Achievement because it presents itself as the most measurable contributor to public value, making efficient and effective use of government assets. Empirically this type of value will consist of cost-savings as a result of the partnership or institutionalized learnings that lay the foundation for future cost-savings. Developing deontological value diminishes the discrepancy between what governments value and what citizens value, guiding policymakers on how best to use public assets to create a more just and fair society. Empirically, this type of value is harder to observe than mission achievement given that the normative improvements can consist of creating transparency, democratizing access, co-creation, and/or improved social relationships.

Public Value Account	**Cost**	**Value**
Utilitarian	5. Financial As with any other account, it is important to recognize that different innovation faces different levels of uncertainty, thus	6. Mission Achievement The utilitarian focus on efficiency evaluated against expectations Has the municipality

	making diversification important and the financial cost relative. Unintended Neg. Consequences	changed its operations to leverage the new technology? Unintended pos. consequences
Deontological	7. Authority An assessment of the use of force or threats to personal freedom used in the project. Privacy	8. Justice and Fairness Individually affected: Citizens or organizations Collectively: Society Unintended pos. consequences

Table 1: Public Value Account (Moore, 2014)

III.ii Barriers & Drivers of Public Private Innovation Partnerships

The second step of the analysis determines *how* PPIs create public value. In order to analyze this dynamic process, this framework builds on current theoretical expectations of factors that impact PPIs. The literature has identified barriers and drivers of PPIs and these form the lens through which I compare *how* public value emerged in the two cases.

Drawing on the works of multiple authors, Crosby et al., (2016) identify four leadership roles that are required at different stages in collaborative innovation (Bason, 2010; Crosby and Bryson, 2005; 2010; Ansell and Gash, 2012; Hartley et al.,

2013). The four leadership roles are (I) *sponsor, (II) champion, (III) catalyst and (IV) implementer*. Leaders are urged to take on these roles across public and private organizations in order to harvest the ideas, potential and capacities of a network of actors and organizations to drive the innovation process (Crosby et al., 2017). Beyond leadership, the level of inter- and intraorganizational (V) *collaboration* is an important factor in how PPIs, through collaborative innovation, create solutions for the public sector (Downe, Hartley and Rashman, 2004). According to this latter factor, a driver of innovation is the successful management of disagreements between actors through constructive management of differences. This helps define common problems and the development of joint solutions based on provisional agreements that may coexist with disagreement and dissent (Hartley et al., 2013).

Drivers	
I.	**Sponsors – *use formal authority capable of harnessing support & legitimacy to authorize innovation***
II.	**Champions – *use informal authority to mobilize capacity to energize innovation***
III.	**Catalysts – *authority figures that create imbalances, provoking creative problem-solving***
IV.	**Implementer – *do'ers and leaders who execute in absence of rules & procedures***
V.	**Inter- and intraorganizational Collaboration**

Table 2: Drivers of PPIs, author's own elaboration

Brogaard (2019) identifies two barriers in PPIs; (iv) conflicting motives and (v) contract management. The former is a barrier because conflicting motives might provide wicked incentives and distort joint visions within PPIs. Likewise, contract management might impede risk taking if this is not automatically shared. Alternatively, it might establish conservative functional specifications lowering the

bar in terms of the innovative solution, creating potential lock-ins. Brogaard identified these barriers on the back of, among others, Siemiatycki (2006) who found that contractual obligations limited the scope of innovation in a Toronto-based urban transport PPI. In addition, Brogaard conceptualizes (iv) conflicting motives by pointing to Dewick & Miozzo's (2004) article, which investigates how differences in organizational structures and logics lead to barriers to innovation in PPIs.

The remaining three barriers are selected from the literature on collaborative innovation, a field in which PPIs are a subset, underlining its relevance to this study (Brogaard, 2019) (see Hartley, Sørensen & Torfing, 2013). Three of the five barriers referred to directly by Hartley et al. (2013) focus on *processes* rather than contextual barriers (geographical & political) and have therefore been included to feature in this articles' analytical framework. The first of these three is the potential for (i) power discrepancies between partners, which can lead to one partner dictating and others simply following (see Gray, 1989). The second barrier is the potential for (ii) private capture of the solution space by a private partner to further individual agendas. The third barrier enters the realm of how to manage a PPI given that (iii) changing traditional roles is highlighted as a barrier. Here, policymakers lose the privilege as political sovereigns who carry the bulk of power and responsibility. This results in private partners assuming the responsibility for public value as opposed to their market traditional role as competitors or lobbyists (Hartley et al., 2013).

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Barriers	
(i)	**Power discrepancy**
(ii)	**Private capture**
(iii)	**Changing traditional roles**

(iv)	**Conflicting motives**
(v)	**Contract Management**

Table 3: Barriers of PPIs, authors' own elaboration

IV. Case Selection, Data & Method

IV.i Method

This article uses a qualitative comparative case study design to analyze two Public Private Innovation Partnerships. Both cases are typical cases of smart city projects using different technologies (IoT sensor and data platform). This study follows a comparative case study research design, as it allows the researcher to develop better-founded knowledge through the observation and comparison of significant variations (Ackroyd, 2009). This allows me to observe the differences and similarities in the cases and find patterns of an underlying social process (Ibid.) – in this case how certain factors influence specific public value outcomes. The logic of discovery used in this study is that of abduction. Abduction is not altogether different from the hypothesis testing *deductive* approach and the *inductive* approach. Abduction recasts the understanding of a phenomenon by letting existing theory guide the empirical investigation and in turn allowing empirical findings to develop existing theories (Danermark et al., 2002). Abduction allows me to discover generative processes, i.e., *how* PPIs create certain public value outcomes.

IV.ii Case Selection and Case Comparison

The cases that are subject to comparison in this article are *Clean City* and *Copenhagen City Data Exchange,* both of which are PPIs involving the City of Copenhagen, Denmark. These cases are typical Smart City projects in both their organizational structure as Public Private Innovation Partnerships and also their focus on using digital technologies that aim to create economically, socially and environmentally sustainable cities. Thus, both the CDE and the Clean City represent

typical attempts to drive sustainable developments in cities through Smart City projects. Typical cases may be considered *representative* for a population (Seawright & Gerring, 2008); however, I do not intend to generalize the outcomes to the population of Smart City projects or PPIs. Using the logic of abduction, a comparative research design ensures that the mechanism under study, *what* type of public value is created and *how* it emerges, can be clarified further through the variation showed across the cases (Ackroyd, 2009). In other words, by comparing two cases, it will facilitate an explanation of "*the extent to which outcomes are attributable to a mechanism or to its context.*" (Ackroyd, 2009: 538). By comparing the CDE and Clean City's drivers and barriers of public value, the empirical findings will further help theoretically develop these factors and their importance for the outcome. The potential contrasts between the cases, in what drives and hinders public value creation, will show the diversity of how factors create various public value outcomes (deontological and utilitarian).

When conducting comparative case studies using abduction, it is important that the cases are selected "(…) *because they exhibit or are likely to exhibit variations in the mechanism under scrutiny (…)"* (Ackroyd, 2009: 539). These two cases were selected because they represent the variety of technologies used in Smart City projects: an IoT-based waste collection solution and a data platform solution. There is thus an expectation that these cases will show variety in the factors that influence their public value creation, if not also in the outcomes themselves. Both cases are from Copenhagen, as comparing outcomes of *Public Value* across the same *context* is appropriate due to their similar values, acceptance levels towards the use of government assets and the resulting value (Ackroyd, 2009). By keeping the context similar, this article is able to dive deeper into the variations within the factors and the outcome (Ackroyd, 2009). The research design in comparative studies is very similar to that of single case studies when using abduction. There is an acceptance that everything about the two cases can be subtly different, as indeed the cases depend on different technologies (Ackroyd, 2009). However, the *generative*

mechanism, in this case *how* PPIs create *what* public value, must in essence be the same (ibid.). That holds true for the two cases, since they were both part of a prior QCA study, wherein they were both observed to be smart city pilot projects that attempted to scale up.

The City Data Exchange was a data-platform designed to be a one-stop shop for buyers of big data in the Capital Region in Denmark. It was intended to make public data available for citizens and firms alike, while also selling the data of private firms to interested actors. Breaking down data silos between private firms and public data platforms was intended to accelerate the innovation of data-based solutions in Copenhagen. Furthermore, as part of the partnership, Hitachi would deliver two apps for citizens to use, based on data from their platform. The Clean City project is one part of an initiative focused on ensuring that 2/3 of all Copenhageners consider the city "clean" in 2025. This particular part of the project leverages the advent of sensor technology that provides waste collectors with an estimate of how full a particular bin is. Thus, creating an optimized route for the collectors with the intention of emptying bins before they overfill keeping the city cleaner. This project was initiated as a considerable workflow efficiency and cost saving from implementing the technology was projected.

IV.iii Data

The data was collected through in-depth semi-structured interviews with both public and private managers from the two partnerships. The interviews for the Clean City case were conducted in November and December 2018 and consist of eight interviews. Five interviews from the City Data Exchange were conducted between March and August 2019. All interviews were semi-structured and the respondents were selected to ensure representation from participating organizations at several levels of seniority to form a comprehensive depiction of the process. The semi-structured interview guide was based on the best practices identified by Kallio et al. (2016), ensuring that a reciprocal conversation could arise between the author and the interviewee. This method of conducting interviews was

chosen to allow for an organic conversation, which could highlight and enrich the understanding of the phenomena investigated in this paper – namely the role of leadership, collaboration and barriers to the PPI process. Semi-structured interviews require prior knowledge of the topic, which I attained through studying feasibility and evaluation reports and theoretically through a literature review (Turner, 2010; Rabionet, 2011). This includes an evaluation report on the CDE and a feasibility report carried out by an external consultancy to understand the potential benefits of Clean City. Finally, I had prior knowledge of the CDE through my temporary employment at the Lord Mayor's office at the City of Copenhagen from April-December 2016. As a newly arrived graduate, I filled a ceremonial function as a personal assistant to the head of section at the municipality who arranged the practicalities surrounding the CDE launch event in May 2016. It should be noted that I was in no way responsible for nor was I able to influence the design or execution of the CDE partnership itself.

V. Comparative Analysis of the Public Value Created

The analysis in this section will determine what public value outcomes emerged from the Copenhagen City Data Exchange and Clean City through conducting a Public Value Account. This first step lays the foundation for the second step of the analysis, understanding how this value was created. Connecting the static account of value outcomes and the dynamic process of how drivers and barriers influence public value creation is one of the novel contributions of this paper, grounding the understanding of PPI outcomes further through empirical analysis. Table 4 and 5 is the author's adaption of Moore's (2014) Public Value Account and gives the reader a quick insight into each account.

V.i City Data Exchange Value Account

Public Value Account	**City Data Exchange**	
	Cost	**Value**
Utilitarian	*Financial* 8 million DKK / *Unknown Hitachi investment* Funds and political support gained through unelected public servants	*Mission Achievement* The platform, offering both public/private data was supposed to fuel new innovation, this never happened Two apps were delivered by Hitachi as per the contract, albeit failed to make an impact Furthering the knowledge of data driven solutions and educating public sector organizations. Worldwide publicity for the City of Copenhagen
Deontological	*Authority* Lack of authority since project was operated by a private firm GDPR (implemented during	*Justice and Fairness* 400 open workshops facilitating knowledge sharing and calling a public into existence

	project) ensured that there was no cost to privacy, but also inhibited the full scale of the project (interviewee 1).	Lowered barriers of entry into the market of selling/buying data for smaller firms. Increased knowledge on data-platforms in municipality

Table 4: Public Value Account of City Data Exchange, adapted from Moore (2014)

Mission Achievement

The utilitarian value aim of the CDE was to establish a market for data-based solutions in Copenhagen. As a former project manager from the city explains: "*At the time everyone thought big data was the new oil, so this project fit perfectly into the Growth Agenda (…) I can't say that we thought this is exactly what we need, but we kind of thought it was developing in this direction and that these marketplaces trading public data would happen. (…) We expected there to be a commercial demand and Hitachi would have to make a business plan work*". The platform would revolutionize how data was sold and bought; creating a central database of both public and private data, making public services more efficient by fueling databased innovations. However, due to a lack of a sustainable business model, the platform was formally closed within two years of its launch and, thus, the outcome of a self-sustaining data platform did not materialize.

The contract between Hitachi and municipality resulted in one concrete deliverable, namely two apps for citizen use. However, this proved harder than first expected, as there was neither the availability of the data in question, nor a demand for the solution. This had a negative impact as explained by one interviewee (#1): "*We spent an unreasonable amount of resources on these apps because the City of Copenhagen and Capital Region insisted on it. (…) It was political, the city wanted to see these apps, but they (the apps) had nothing to do with what else we were building,*

and we spent way too many resources on them. (…) They were actually launched in the end. They weren't the worlds' greatest apps, but they were developed after all." A more significant value outcome, according to the final report, was the publicity the City of Copenhagen received. This can be largely attributed to Hitachi; their worldwide PR reach was mobilized and incited interest from foreign firms. This is a good example of public value enabled by private capabilities as it might result in attracting foreign businesses and investments to the city, something the post-industrial economic strategy of cities worldwide depend on (Mckendry, 2017).

As part of the contract, Hitachi was tasked with setting up match-making events where prospective data buyers could meet sellers. These events made firms aware of their own potential as data providers and in one case even led to a major acquisition (Interviewee 1). At a time when cities are attempting to create and share as much data as possible in the hopes of generating a smart and data-driven administration, it seems that the most important value from this project was the lessons learned for future projects. As one Hitachi employee said: "*This was definitely an innovation and pilot project for the City of Copenhagen, which I think one tends to forget. (…) I think in the end everyone involved learned a whole lot. If you look at other cities compared to Copenhagen then they are far behind with these learnings[on how to run a marketplace for data]".* This perspective was supported by an employee from the City of Copenhagen who noted: (Interview 4) "*It's created a bunch of experience and learning on these types of tenders and innovation and provided us with a new perspective on using data and how complex it is. (…) Now we work much more tight, follow stricter procedures (…) chasing concrete benefits (…) it's not just about (quantitative) data, it has to be the right, good and valid data we chase"*. This value was, thus created both for the municipality, but also private firms.

Justice and Fairness

This section captures how the CDE added to a more just and fair society. The approximately 400 meetings and workshops organized by the City Data Exchange

helped facilitate knowledge sharing between different organizations and created a public conversation about the use of data for firms, public organizations and universities alike. This has strengthened the capabilities for local firms and their aptitude to not only use data actively, but also profit off of their own data (interviewee 1). These workshops functioned as co-creation spaces where Hitachi received input regarding what would be valuable for businesses and public organizations to use on the platform, and, thus, added legitimacy and transparency to the project. Hitachi held lectures at the IT University Copenhagen to understand how students might interact with the platform, as such community stakeholders were consulted on how a data platform would be most practical not only for commercialization, but also researchers (CDE Report). According to Voorberg, Bekkers & Tummers (2015), unlike cross-sector collaboration as PPIs, co-creation with citizens as a process represents deontological public value in and of itself because it gives legitimacy to the project. In fact, a majority of co-creation projects aim to create no other value than the co-creation itself (ibid.).

The City Data Exchange leveled the playing field within big data by democratizing access to using and selling data. This allowed access to and capabilities of data usage regardless of the size of organizations (interviewee 1). One project manager points to the lessons learned on the usability of public data as a key public value outcome, uncovering how a steady flow of public data is necessary for private enterprise to reliably and validly base their business on. The City of Copenhagen brought together key actors from the process and commissioned a report on the learnings from the high-profile collaboration. The CDE evaluation report directly refers to '*value created from the platform'* in educating and establishing best practices for the public data-platform opendata.dk.

V.ii Clean City Value Account

Public Value Account	**Clean City**	
	Cost	**Value**
Utilitarian	*Financial* 2.5 million DKK	*Mission Achievement* Less overfilled waste bins and cleaner streets Better transparency and control with respect to time management; improving the strategic triangle's focus on legitimacy and support Intraorganizational learning on how to translate data into social workflows.
Deontological	*Authority* Increased surveillance of waste collectors.	*Justice and Fairness* No unnecessary heavy lifts performed by waste collectors Empowerment of municipal waste workers

Table 5: Public Value Account of Clean City, adapted from Moore (2014)

Mission Achievement

An initial report showed potential for resource savings by installing waste bin sensors[12]. However, this saving could not be realized by simply installing the hardware and handing over an optimized route for waste collectors. The mission was only achievable under certain conditions and primarily on roads, not in parks or recreational areas, which shows the difficulties in implementing new work procedures through innovation. By leveraging the information from the technology, the waste collectors would be able to know when to empty the bins before they overflow. However, the cost-saving, which was the municipality's reason for initiating the project, was not realized. Rather, it represented an added cost for waste collection (Interview 5).

The increased transparency and enhanced control mechanism represent a mission achievement. Mapping the work process gives an extra tool for bureaucracy to ensure effective waste collection. *"We are aiming for a hybrid between the man on the street and the knowledge worker, someone who can solve operational tasks, but do it in a smart way leveraging the technology that provides him with data. This way our operations become risk-based, so that we can perform the task (waste collection) exactly when we have to, this is the only way that it's possible since the cutbacks on operational workers*", explains one public manager (#5). Yet, this achievement can be detrimental, as the increased use of authority to control waste collectors might increase distrust of management. This line of thinking however requires further research. This opens an important discussion on the ambiguity of public value and how mission achievements can be in contrast with fairness and justice.

An important learning for the municipality was the complexity involved in changing the workflow of one group of workers using big data, and how translating data into concrete cost-savings was harder than expected. Yet, should these learnings be

[12] 40 % labor collection.

properly institutionalized, this will facilitate future utilitarian value outcomes in adjacent projects, especially if the vision of the hybrid ideal worker is realized.

Fairness & Justice

One public manager holds that a positive side effect of the solution is the ability for waste collectors to avoid emptying bins filled above 80 % capacity, at which point they become too heavy to lift according to regulations. The municipality found a way to make the most of the technology while creating value for the collectors themselves: "*People started actually using the solution, even the old ones who had been most reluctant, started using the solution all by themselves, because it makes sense and creates value for them" (#5).* This is a deontological value, as waste collectors avoid making unnecessary and harmful lifts while also integrating technology into the work process and familiarizing and adapting employees to digitization. This particular project did not involve any ambition to involve citizens or wider spillover effects into society. Yet, the involvement of low-skilled workers in the development and roll out of the technology likely increased trust between the administrative units and the operational units inside the City of Copenhagen, potentially offsetting the increased control also introduced by the technology.

V.iii Sub-Conclusion: What public value was created?

Solely based on their utilitarian value in the immediate aftermath, both cases have a negative account, seeing as their utilitarian value did not increase efficiency outright. However, the nature of the utilitarian value is such that if this value is institutionalized it could add to future projects' ability to do so. The City Data Exchange called a public into existence and started a dialogue on data use in universities, firms, civil society and public organizations while Clean City managed to integrate data into an analog process. These efforts undoubtedly had an educating effect, which might result in these organizations' ability to create

utilitarian value through data-driven solutions in the future or enable the public to make informed decisions.

The Public Value Account enables a categorization of value into deontological and utilitarian, but it appears conceptually unconvincing to *learn* from 'deontological' value. A more appropriate term for this type of value, including what makes society more just and fairer, would simply be *soft* value. The Public Value Account was not developed specifically for PPIs, and on the basis of these cases they tend to be more apt at creating complex soft outcomes of knowledge creation and leveling the playing field for organizations as well as end-users. Thus, future research should dive deeper into soft outcomes in order to capture these conceptual distinctions within the categorizations.

Public Private Innovation Partnerships seldom have settled business models from the outset, but rather have a potential public value purpose that should be fulfilled (Brogaard, 2019). Decisions on what project to initiate should be based on assessing not only its utilitarian value, but also its deontological value propositions. In sum, the Public Value Account reflects the reality of how the public receives value enabling an account for outcomes that are not just economic, but also social or environmental. This shows the importance of opening the black box of PPI outcomes, as these can guide policymakers and manage expectations. The second step in the analysis will look at how the drivers and barriers of the PPI process explain the emergence of these public value outcomes.

VI. Comparative Analysis of how public value was created

The first step of the analyses outlined public value outcomes from the cases. Both primarily aimed for utilitarian value, yet both ended up creating predominantly deontological value while laying foundations for future utilitarian value. This section will attempt to answer the how part of the research question: ***How*** *public value emerges in PPIs?* This analysis fulfills the ambition to contribute to the

literature by linking the public value outcomes with an analysis of the dynamic process.

While external collaboration went smoothly for the municipal developers in the Clean City case, it was far more difficult to work with the municipalities' Operations Office as summarized by an employee from PUMA[13]: "*To begin with they were pretty skeptical (operations office). They wanted a plan for when what would be done and how much it would cost (…) that's just not how we work. We know they have an economic frame we have to stay within, but we have to start with what creates value and then what creates the greatest value that faces the least uncertainty."* The first hurdle for the developers was to ascertain if the data from Nordsense would fit their software and then translate it into an optimized route for the collectors, something Nordsense' own software had not been able to. Some even claimed it was a hindrance more than an aid. "*Nobody who was telling them (the collectors) anything. So, we removed that route from them and made one they wanted to use. It is all about being out in the real world, listen listen listen, watch, observe"*. This demonstrates how key actors inside the municipal organizations applied a flexible understanding to end-users and were able to extract public value from an otherwise stalled process due to (iii) *changing traditional roles*. A type of leadership Crosby et al. (2017: 660-61) would characterize a *champion* and an *implementer* who interchangeably '*mobilize(d) the capacities of their organization'* and '*cope(d) with the dissonance that emanates from the coexistence of old and new administrative designs'.*

A key reason why the Clean City solution was implemented was the ability to mend the business model for the private partner as the project developed. "*We are a firm that's 90 % software development (…) but in this project we were reduced to hardware suppliers (…) that's new for us, but of course we'll do it however the City of Copenhagen wants it*" (#6). The project lead at Nordsense felt excluded from the dialogue about how to create more value off of the data collection, but holds that

[13] PUMA: the municipal Platform to Support Mobile Workflows

this was due to the strict structure of the partnership and the city's insistence on not commercializing the data. This shows slightly (iii) *conflicting motives,* as Nordsense were forced to change their business model to fit the City's demands. The project lead at Nordsense, however, felt the collaboration went smoothly and found the public counterparts to be very flexible. This indicates that the collaboration was constrained by the (i) *power discrepancy* influencing the *process,* yet also functioned as a driver for retaining ownership of the publics' data; something that might be considered deontological value.

Within the City Data Exchange, the public partners' insistence on realizing the contractually obligatory apps had a negative effect on overall public value creation because it inhibited an organic development of the solution (interviewee 1). According to Brogaard (2019), too rigid *contract management* in PPIs can be a considerable barrier to the creation of innovative solutions, and as this case shows that goes for public value outcomes. This could in part be explained by the lack of understanding from the authorizing environment or the lack of a *sponsor,* since the project was conceived in the Economic Department and carried out in the Technical Department. Several interviewees refer to the displacement of the project as a barrier, since the Technical Department were preoccupied with their own data platform project Open Data DK. This disinterest stems from the transfer being made *after* the tender, and thus with the window for influence/adapting to the department needs having passed (interview 4). This confirms the theoretical expectation that (iv) *Conflicting motives* intraorganizationally or the loss of privilege and control associated with (iii) *Changing traditional roles* to accommodate the new organizational setup are considerable barriers to value creation.

At Clean City, similar intraorganizational *conflicting motives* between the street level waste collectors, administrators and developers seem to have been fully mitigated by leadership and trusting collaboration. Communication took place via text, phone or video calls, since the waste collectors did not have e-mail access,

resolving issues swiftly as one manager explains: "*It (the communication) was very informal (…) surrounding some problem the solution would be to send a text with an image and ask 'how does this influence things?' and then you'd get a response within 7 minutes and that would be that so, certainly informal."* The municipalities' developers, PUMA, were able to spend time with the users. According to one manager, this was only possible as the team was considered "*a startup within the department*" and if external developers were hired, the costs of the project would make the business case unfeasible. In contrast, the developers of the City Data Exchange were Hitachi contractors based outside Denmark (Interview 1). This limited the room to collaborate on the development of the solution. Compared to the theoretical expectations, this shows that collaboration, a main driver of collaborative innovation, was structurally limited in the CDE.

The CDE presented Hitachi with an opportunity to create a model that was scalable to cities worldwide (Interview 1). To the municipality, the platform would fulfill the promise of data-driven innovation and provide local firms with a new revenue stream as well as complete a smart city ecosystem. This reflects (iv) *conflicting motives* between the public and private partner. Hitachi was searching for a business model to commercialize data on the platform as the primary objective, and the City of Copenhagen was eager to get as much data onto the platform as possible in order to make it available for free to the widest possible audience. According to the contract, Hitachi was not allowed to commercialize data from public organizations, and naturally their main interest became to accumulate as much private data as possible. This task was more fragmented and difficult because firms did not have any experience with selling data. This became a barrier to the innovation process, since deontological value in particular cannot be appreciated equally within public and private organizations.

Leadership in the CDE was undertaken by Hitachi, which did not have the assets to appeal to or even force local firms to make use of the platform. Furthermore, it lacked the ability to make a purchase from the platform giving the CDE a use-case;

something that municipal leadership would have been able to exercise. Without the formal authority of *sponsors* or the informal authority of *champions* inside the municipality, this type of leadership within the private partner is not enough to will public value into existence. This is further evidenced by one private manager (interview 1) who noted that the City identified a data need that could be supplied by the platform but decided against procuring it; something that could have otherwise given the platform a much-needed use case. This reveals a (i) *power discrepancy* in the municipalities' favor, which gave way to an unhealthy situation with clear (iv) *conflicting motives,* inhibiting the process of value creation.

The *need* for Clean City[14] gave impetus to the implementation and, compared to the City Data Exchange, made public value creation more straightforward, as the municipality in Clean City was able to use its financial and authoritative assets to push through towards the goal. The problem Clean City addressed was comparatively more clearly defined and understood by municipal employees. Initially, a barrier to operating the pilot project successfully was the users' lack of understanding regarding the need for the solution. The collectors were less convinced than policymakers that a data-driven solution would make them smarter or faster in their daily operations. It was not until PUMA developed a solution that could combine the knowledge of the collectors themselves with the data from the waste sensors that it was successfully operationalized. Even then, obstacles to achieving cost-savings persisted; however, the deontological need was sufficient for PUMA to act as a *catalyst* to generate a sense of ownership for both sides over the solution and *implementers* by finding a way to make the solution work. This is in contrast to the CDE, which had such a catalyst in the initial planning phase of the project but which seems to have escaped the project as soon as it was switched from the Economic Department to the Technical. From these cases, an important factor in how public value is created is the legitimacy in the authorizing environment that addressing a *need* enables. From these two cases *"needs"* can be

[14] The goal for two thirds of citizens to consider the City cleaner.

induced as a possible driver for public value creation from PPIs or a significant barrier when not present.

Drivers and Barriers	City Data Exchange	Clean City
Intra-interorganizational Collaboration	Little to no collaboration between Hitachi and the City, while a lack of intraorganizational collaboration was detrimental to the public value creation.	Close collaboration between the partners. Issues between these and the municipal units, in particular the waste collectors and administrators, were resolved through collaboration.
Leadership Roles	Apart from the initiation of the project, there was little to no leadership inside the public sector organization, and the private leadership was ineffective to deal with the problems that arose.	Various units and individuals inside the public sector organization took up the roles of *champion, sponsor*, *catalyst* and *implementer* at various stages of the process to overcome barriers to public value creation.

Needs	The need for a City Data Exchange was ill-defined and investigated prior to the PPI. It was largely based on the expectation of a need arising in time.	Easily understand need for the solution in order to reach the clearly defined target of a cleaner city. This eventually overcame initial contestation from waste collectors.
Barriers	*Conflicting motives* between the partners inhibited the public value creation, while the Technical Department also did not seem to adapt well to *changing traditional roles* to support the platform. Furthermore, *contract management* and *power discrepancies* also hindered actual public value creation	*Conflicting motives* intraorganizationally was encountered between administrators and waste collectors. The same barrier was observed between the partners on the question of data ownership, yet this was offset by a *power discrepancy* in the municipalities favor. The latter barrier functioning as a driver for public value creation in this case.

Table 6: Drivers & Barriers, author's own elaboration

The second step of the analysis brought the study of the dynamic process closer to the static outcomes provided by the Public Value Account. This revealed how drivers conceptualized for outcomes of public sector innovation can help explain the emergence of public value creation in PPIs – with a few important differences. Crosby et al. (2017) hold that the leadership roles can be taken on by any organization in collaborative innovation, yet City Data Exchange and Clean City indicates that *public* leadership matters more when it comes to *public* value outcomes. Important policy tools are missing when private leadership is the sole driver of the PPI process, especially the lack of formal authority and the ability to have a slower rate of return on investment, which might have carried the CDE into a future developing market. This point is compounded by Clean City's ability to use precisely public leadership to overcome barriers such as *changing traditional roles* and *conflicting motives* between partners. This can, in part, be attributed to the close intra- and interorganizational collaboration within the Clean City case. Both leadership and collaboration were key drivers of public value outcomes.

Finally, an important difference between the two cases, which was reflected in their public value outcomes, was the presence of a *need* for a specific outcome. Clean City was able to convince the affected waste collectors that a new technology would not only serve as a control mechanism but also actively assist them in their work. Meanwhile, the CDE was not embraced at the Technical Department nor was it modeled on any specific need within the city's units. The next section concludes on both drivers and barriers for public value creation.

VII. Discussion & Conclusion

This paper set out to answer the dual research question: *What public value is created in Public Private Innovation Partnerships and how does it emerge?* The comparative analysis on the *outcomes* of the two cases provided two important findings. First, outcomes of PPIs are mostly deontological, complex and 'soft'. Second, in some instances, if it is institutionalized, this value has the potential to

function as a foundation for future public value creation of the utilitarian kind. Using the Public Value Account to explain the outcomes of two empirical cases showed that the theory is able to describe two different types of public value outcomes; however, it fails to truly reflect the complexity with which this value is dependent on being institutionalized. The comparison also showed that even if both cases provided deontological value, there was great variety in the value within this category, which means the concepts developed by Moore (2014) does not necessarily reflect the empirical complexity.

The comparative analysis investigating the factors that influence the process by which public value is created in PPIs, showed how *leadership* and *collaboration* functioned as drivers for public value creation in both PPIs. While the former driver was present in both cases, it appeared to be far more decisive within the case where *leadership* was present *inside the public partner.* The barrier, *conflicting motives,* inhibited both cases, yet with the distinction that one case encountered this barrier intraorganizationally rather than between the partners. The empirical analysis further revealed how *needs* inside the public sector organization, can drive public value creation in PPIs. These findings are discussed in this section, along with their implications for theory and practice and the novel contribution of this paper; connecting the static and dynamic analysis of outcomes and processes.

By applying the Public Value Account to an empirical case, this paper deepens Public Value Theory's understanding of outcomes from PPIs. The account captures important nuances in what public value PPIs create and could be a viable framework for empirical studies concerning public value outcomes. The findings of the comparative analysis shows that little utilitarian public value was created in the cases. This might be surprising given the projects' technologically intensive nature, but this simply underlines the difficulty involved when extracting utilitarian value through novel solutions. The utilitarian outcomes in the Clean City case were

intraorganizational learning on how to translate big data into workflows and less waste in the streets. This learning has potential for other workflows and could in time create resource efficiencies. In the CDE case, the utilitarian outcomes concerned knowledge of big data and publicity for the City of Copenhagen. These utilitarian outcomes generally represent long-term value for the city rather than immediate impacts from the PPIs. This long-term utilitarian value is dependent on the knowledge being carried into future projects. In both cases more *deontological* value outcomes were observed. In the Clean City case, employees could use the solution to avoid heavy lifts, and the inclusive process of the PPI ensured empowerment and co-creation with the street level waste collectors. In the CDE, 400 workshops and open meetings provided citizens and stakeholders with an opportunity to co-create the platform, and guidance for stakeholders on how to use big data lowered the bar for local organizations to use big data. In sum, the outcomes of public value highlighted a possible conflict between public and private partners, as only the former has an incentive to maximize *public* value in the long-term and beyond the duration of the PPI.

The comparative analyses of the factors impacting the Public Private Innovation Partnerships showed that *Leadership roles* played out differently in the two cases. In the CDE, its effect as a driver of public value was limited, seemingly since the private partner was the only one exercising leadership throughout the PPI. Conversely, in the Clean City case, several types of leadership could be observed, all from *within* the public partner. This shows that leadership is important, however in PPIs *who* delivers leadership is more important than *what type* of leadership is enacted. In the Clean City case, *collaboration* too functioned as a driver for the public value created, while this driver was absent in the CDE case. The analysis showed that collaboration was not only a driver between the partners in Clean City, but also within the municipal units where issues sparked by the new technology were resolved through collaboration on a new solution with end-users. In sum, the drivers for innovative solutions for the public sector function similarly for public

value outcomes, as the lack of collaboration in the CDE case might also explain its lack of public value outcomes. The cases also showed that leadership is a stronger driver for public value, when exercised *within* the public sector. Future research should be undertaken to understand the differentiated role of leadership in- and outside the public organization involved in PPIs.

Finally, the analysis showed that importance of *needs* to achieve public value outcomes should not be ignored. Whether deontological or utilitarian, *needs* set a desired direction for PPIs that is in line with similar policies and efforts, and thus increases the chance that the public value outcomes become institutionalized.

The comparative analysis showed how *power discrepancies* between partners created tension. In both cases the power was skewed towards the public partners and in the Clean City case this seemed to provide the determination needed to push through public value outcomes. However, in the CDE case this discrepancy functioned as a barrier to public value creation, as it stood in the way of establishing a true partnership. In any case, it seems that power discrepancy can be a driver for Public Value in PPIs, as opposed to how it is seen as a barrier in the literature.

In both cases, *conflicting motives* was a barrier for public value to emerge, however where the CDE found this barrier to occur between the municipality and Hitachi, the Clean City case experienced this barrier within the municipality involving the municipal waste collectors – the end-users. While the end-users did not perceive the new solution as an improvement, their skepticism was overcome by including them in the co-creation of an updated solution with, tailoring it to their needs. This underlines that there might be multiple perceptions of a new solution within a public sector organization and public value creation is dependent on the ability of PPIs to align those motives.

A novel contribution of this paper was linking the analysis of the static outcomes, with an analysis of the dynamic processes of a PPI. There are empirical as well as theoretical implications from this research: the barrier *power discrepancy* and the driver *leadership* show that the rationale for PPIs should be to embrace the potentials from sharing and mobilizing capabilities and knowledge of the private sector to advance public value. Policymakers should design the elements of a PPI to maximize the creation of public value outcomes, however it must manage expectations vis-à-vis its private partner as to what type of public value is aimed for. The selection of PPI projects should not exclusively be based on short-term cost-benefit analyses, since this excludes the nature of the deontological and *long-term* utilitarian public value that was created in these two PPIs. The Public Value Account provides an understanding of what public value is created in PPIs, and is an appropriate framework to guide policymakers' decisions. However, it should be developed further using empirical inquiries as its current and very philosophical form makes it difficult to apply and categorize outcomes. This article has shown that the function of drivers and barriers in Public Private Innovation Partnerships are modified when the dependent variable is public value outcomes rather than public sector innovation outcomes. The literature would benefit from clearer frameworks that can adequately capture broader public value outcomes and link these to specific processes in PPIs.

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Appendix III: Research Article 3

Soft Public Value in Public Private Innovation Partnerships

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Abstract

Public Value Theory has failed to appreciate and conceptually develop Public Value outcomes beyond the logic of efficiency. Using an explorative case-study, this paper seeks to deepen the literatures' understanding of these outcomes as they emerge in Public Private Innovation Partnerships. It does this from three theoretical attributes: *(I) Learning; (II) Transparency; (III) Public Sphere.* The analysis shows that these three processes can lead to diverse Soft Public Value outcomes, which consist of technical and organizational knowledge, trust between partners, desired narratives and equal access to experimentation. Finally, through the Public Sphere, PPI's can enable co-creation and the development of citizen's collective values to help direction-setting. The implications of this research highlight the juxtaposition of competing interests in PPIs and suggests practitioners should be aware of - and direct processes towards - a wider set of public value outcomes.

Keywords: public value, innovation, partnerships, collaboration, smart city

I. Introduction

Growing urbanization and the increasing strain on resources has led cities to search for innovation that can transition cities into a sustainable future. This has sparked interest, both from practitioners and scholars, into the tools by which innovation and public value is created through collaboration. Public Private Innovation Partnerships (PPIs) is one tool with which to pool capabilities, resources and engagement in order to shape solutions that can address wicked problems. Public Value Theory has attempted to understand how these cross-sector collaborations create innovation (Hartley, 2005; et al., 2013; 2017; Crosby et al., 2017), yet little is understood about the public value that is developed in these partnerships. This paper develops the concept of *soft public value*, arguing that it consists of key and often overlooked outcomes from PPIs. More concretely, this paper suggests three process-focused attributes that operationalize Public Value Theory and enable an analysis of public value outcomes from PPIs.

According to Public Value Theory (PVT), cross-sector collaborations ensure that the competencies and capabilities necessary for overcoming wicked problems (Bryson, Benington & Sancino, 2016; Hartley, Sørensen & Torfing, 2013; Moore, 2005). Through a narrow focus on the **processes**, and by lack of empirical development of the theory, the outcomes from cross-sector collaborations and PPIs specifically, have not been *empirically* captured beyond the logic of efficiency. Processes that aim to tackle wicked problems face uncertainty, which means these processes cannot always deliver ready-made solutions according to the logic of efficiency (Kattel et al., 2018). Therefore, this gap needs to be addressed to understand what public value **outcomes** derive from PPIs beyond what is captured by cost-benefit analyses.

Public Value Theory has attempted to establish a public management paradigm through *public value governance*. Focusing on collective rather than individual value creation and on the creation of outputs and outcomes instead of the dominant New Public Management paradigm's emphasis on input control (Moore, 2014; Stoker,

2006; Denhardt & Denhardt, 2011; Bryson et al., 2015). There is widespread appreciation in the literature of cross-sector collaborations as an important ingredient in creating public sector innovation (Hartley et al., 2013; Crosby et al., 2017). PVT offers a wealth of analyses about processes creating public value, but by ignoring the multifaceted nature of public value, it has often narrowly defined the outcomes that these processes lead to, which is contradictory to the ambitions of the paradigm. The strand of the literature focusing on cross-sector collaboration has limited the understanding of outcomes to those that can be captured by the logic of efficiency (see Crosby et al., 2017). PVT has, thus, not yet provided a coherent conceptual framework to study public value **outcomes** beyond the logic of efficiency. Building from the theory's own definitions of public value processes, this paper aims at addressing this gap by operationalizing three attributes that conceptually encompass processes of public value creation, leading to public value outcomes. This effort will not only provide a warranted conceptual development, it will also support efforts to conduct empirical analysis going forward. Hence, this paper aims to make two contributions: First, it seeks to theoretically and conceptually develop these specific processes and relate them to outcomes as key constitutive elements of public value creation. A second contribution is the application of these constitutive elements in an empirical case study of a Public Private Innovation Partnership. This will test the analytical frameworks' assessment of possible outcomes of public value. The research question of this paper reads:

How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?

This paper uses an explorative case study involving a typical PPI, which did not result in efficiency outcomes, but nonetheless provided important outcomes. The case will be used to corroborate the theoretical expectations of the three process-attributes and to link the processes to empirical outcomes. In so doing, this case will establish an operational framework that goes beyond measuring the logic of

efficiency. The case in question is the Copenhagen Street Lab project, which was an Urban Living Lab (ULL) launched in June 2016 between the City of Copenhagen, Cisco Systems, Citelum and TDC. Using in-depth interviews with actors from both within the partnership and also within key stakeholder organizations, the case shows how the processes (I) Learning, (II) Transparency and (III) Public Sphere create public value outcomes in PPIs.

The analysis shows that it is possible to account for public value outcomes beyond the logic of efficiency. Some outcomes form incremental steps that lay the groundwork for future projects aimed at public sector efficiency. These steps include: (I) Learning, which also accounts for most of the public value picked up by the public sector organization itself; the process of (II) Transparency, which ensures that a partnership is built on trust, creating a coherent narrative that is desired by the public and allows for potential experimentation; and finally, PPI's must be purposefully designed to go through the process of (III) Public Sphere in order to fuel the discovery of what the public *values*. This third process was not observable in the case, as other processes were prioritized. The value created by those processes transcend and expand previous definitions of Public Value outcomes, such as deontological and utilitarian, but share the property that it is difficult to measure, intangible and inherently *soft public value.*

Soft Public Value is complex, and the structure of Public Private Innovation Partnerships can cause tension between the different processes. This is especially so given that emerging outcomes are potentially valued differently between the private partner, the public sector and citizens; however, more research needs to be dedicated to further establish this relationship. Public Value outcomes can be analyzed by observing the three processes, and the resulting emergence (or not) of Soft Public Value, which further highlights both challenges and opportunities in PPIs. This provides a platform for understanding and recognizing a broader palette of Public Value outcomes and a means with which to analyze these.

II. Theoretical Framework

II.i Smart City

The literature on smart cities is gradually developing beyond plain normative inquiries but continues to be somewhat split between two grounds (Meijer, 2018; Drapalova et al., 2020). One strand of the literature considers the increased use of technology to be uniformly empowering, democratizing and necessary for becoming a smart city (Caragliu, Del Bo & Nijkamp, 2011, Giffinger et al., 2007, Shapiro, 2006; Gil-Garcia et al., 2015). Whereas a different strand of the literature (Hollands, 2008; Datta, 2015; Greenfield, 2013; Green, 2019) tends to see smart city developments as elements of neoliberal power in the urban space. These two different strands have gradually given way to a more nuanced approach, one driven by empirical analysis of the political, societal and organizational implications of smart city developments (Meijer, 2018; Drapalova et al., 2020; Lombardi and Vanolo, 2015). This is befitting of the nature of smart city projects, as a policy or administrative reform process, which highlights the importance of studying their outcomes empirically.

II.ii Public Value Theory

Public Value Theory has grown out of Mark Moore's (1995) *Creating Public Value*, a book targeting public administration and how to manage so as to maximize public value. Moore's work was designed as a public sector equivalent of the literature dedicated to maximizing shareholder value in the private sector. The theory that has grown out of Moore's call to action has resulted in various approaches building on Moore's initial idea of creating awareness around the opportunity of public managers to create public value. The various approaches have focused on the *public sphere* (see Benington, 2009; 2011) and *policy* (see Bozeman & Jørgensen, 2007) and Public value as a governance tool (see Bryson et al., 2014; 2015; 2017; Hartley et al., 2005, Stoker, 2006; Denhardt & Denhardt, 2011). It is this latter framework, which is most apt to investigate the organization of Public Private Innovation Partnerships and their networked governance structure (Hartley et al., 2013). The

analytical framework of this paper draws on all parts of Public Value Theory to develop a framework that captures public value outcomes beyond the logic of efficiency.

One of the continuous tasks facing Public Value Theory is how to define (changing) public values (Hartley et al., 2017). This section outlines the existing definitions and conceptualizations of public value in order to identify the relevant starting points in the literature for identifying outcomes. According to Bryson et al. (2015), the various strands of PVT distinguish between three different conceptualizations relating to public value: *public values, creating public value* and *public sphere*. To Meynhardt (2009), *public values* are simply whatever has an impact on values about the public. Bozeman & Jørgensen (2007) list eight nodal public values, including human dignity, integrity, sustainability and citizen involvement, which operationalize the quest for public values. This definition has been the basis of a discussion on hierarchies of values, how to map them and whether they are relational, subjective, who forms them, how they are measured, and whether they exist in and off themselves or as a means to something that is valuable (Bryson et al., 2015). In Moore's (1995; 2013; 2014) *creating public value,* the appropriate arbiter of value is a public defined through democratic processes. Value is then achieved through the deployment of assets in the shape of finance or authority and is assessed by aggregating costs and benefits, the latter amassing from efficiency, effectiveness and conceptions of what makes a good and just society. Finally, the *public sphere,* according to Benington (2009; 2011), is a democratic space where value is *"(…) what provides a society with some sense of belonging, meaning, purpose and continuity, and which enables people to thrive and strive amid uncertainty"*. The public sphere is a social, political, institutional or physical space where value is created, held and destroyed (Bryson et al., 2015). Bryson et al. (2014) lend from these different works to define public value as "(…) *that which is valued by the public or is good for the public (including the publics sphere) 'as assessed against various public value criteria'"* (Crosby et al., 2017).

These definitions and concepts are rather broad and not concrete, hinting at the variety and complexity of the concept itself. Yet, when public value scholars undertake the precarious task of assessing public value from innovation processes, such as PPIs, they tend to reduce outcomes to terms of efficiency (see, Brogaard, 2019; Crosby et al., 2017; Hartley et al, 2013) (Kattel et al., 2018). In other words, there is a gap because the literature has not provided a coherent conceptualization about the 'other' aspects of public value outcomes that go beyond efficiency. Thus, it is a key contribution of this paper to further develop these missing aspects into a coherent concept that allows for a theoretical and empirical understanding of public value outcomes. In order to do so, this paper takes its starting point from the literature. At its core, however, it uses an empirical case to examine how these other aspects of public value manifest. As such, this paper works abductively in order to use an empirical analysis to advance and further develop the conceptual understanding and theoretical framework of public value. As such, I am "(..) *taking advantage not only of the systematic character of the empirical world, but also of the systemic character of theoretical models."* (Dubois & Gade, 2002: 556) (see more on the abductive approach in section IV.i). As Hartley (et al., 2017) point out: "*The further development of both public value theory and its critique will suffer if it continues to lack grounding in empirical research because theory and empirical research can challenge, test and influence each other."* This underlines the suitability of using an abductive logic to conduct the empirical analysis.

The literature's lack of conceptual clarity is additionally problematic considering that the stated intention – to create a management paradigm for practitioners (*Public Value Governance)* – allows for more inclusive value creation, which does not privilege markets and diminish democracy at the expense of collective value creation (Dahl & Soss, 2014). A first step towards addressing this paradigm must be to operationalize an empirical analysis of public value that is not captured by the logic of efficiency. The findings represent a reiterative conversation between theory and the empirical case, and thereby discover new relationships within PVT, which

support the analysis of a variety of public value outcomes from Public Private Innovation Partnerships. The next section turns to the literature on PPIs as understood through Public Value Theory.

II.iii Public Private Innovation Partnerships: A Public Value Perspective

The governance strand of Public Value Theory has called for increased cross-sector innovation efforts as a response to the growing challenges facing the public (Crosby et al. 2017; Hartley et al, 2017). Crosby et al., (2017) hold that by pooling capabilities and capacities, external actors can assist public managers in creating innovative solutions for the public sector, assuming that by itself, the public is risk adverse, lacks the competitive edge to create innovative solutions and is held back by bureaucracy and democratic governance. Through networked governance, and by institutionalizing the competitiveness of the private sector, innovative solutions for the public sector supposedly generate public value (ibid. 2017). This reasoning illustrates how a lack of a focus on conceptually defining public value outcomes, has led Public Value scholars to position the public sector as a passive partner addressing market failures and facilitating private value creation (Dahl & Soss, 2014).

However, it is exactly when facing collective challenges that the public sector is best positioned to coordinate and actively shape markets and create public value (Dahl & Soss, 2014; Mazzucato & Ryan-Collins, 2019). In order to return to the original ambition of PVT - to bring forward how public managers are uniquely placed to address collective challenges and translate these into democratically founded services and policy - a broader and deeper understanding of public value outcomes is necessary (Kattel et al., 2018).

Public Private Innovation Partnerships enables cross-sector collaboration, and Brogaard (2019) has recently built an analytical framework to analyze what factors affect those processes. By synthesizing 33 peer-reviewed articles, the author develops an analytical framework in the search for explanatory variables for

innovation outcomes. Brogaard (2019) hypothesizes that (i) structural environments; (ii) the nature of the collaboration in the PPI; and (iii) the participants of the PPI form three umbrella variables of barriers and drivers of innovative solutions for the public sector. Brogaard recognizes that the drivers and barriers of innovative solutions for the public sector are more complex than merely emulating the private sector. By appreciating the complexity, unpredictability and the often-experienced discrepancy between intentions and execution in these (Hartley et al., 2013), Brogaard shows how PPIs do not always result in innovative solutions for the public sector. Brogaard (2019) acknowledges that outcomes of innovative solutions for the public sector might create public value, private value, both or none of the above. This is an empirical question.

This paper does not seek to investigate the relationship between *public sector innovation* and *public value,* instead it aims to identify and categorize the processes that define **public value outcomes** beyond the logic of efficiency. In doing so, this article complements Brogaard's (2019) enquiry by deepening the knowledge on the dependent variable (public value outcomes). The next section describes and operationalizes the analytical framework.

III. Analytical Framework

The previous section showed how the literature has not addressed public value outcomes beyond those that account for efficiency. Drawing on the concepts from Public Value Theory, this section will develop a framework that can capture empirical public value outcomes from Public Private Innovation Partnerships.

A central contribution from this paper is to create an analytical framework, further developing specific attributes theoretically derived from Public Value Theory, in order to provide an empirically founded understanding of public value outcomes. To systematically investigate such outcomes, I propose that parts of public value not captured through the logic of efficiency, comprise of three attributes. Each attribute defines a process that leads to public value outcomes in PPIs. This section

lays out this analytical framework, which will subsequently be used in an exploratory case study. As such, this section will provide the literature with a much-needed understanding of how to analyze and understand public value outcomes beyond the logic of efficiency. This paper brings together elements that have previously been scattered across the Public Value literature to provide a combined framework to study public value outcomes. Previously, these concepts have lacked consistency and explicit formulation, in spite of being located within the core of Public Value Theory.

I. Learning

Public managers create public value through PPIs by stimulating interaction and mutual learning between public and private actors in order to *"(…) harvest the experiences, ideas and competencies of multiple stakeholders*" (Crosby et al., 2017: 656). Collaborating through PPIs with private and nonprofit actors strengthens the capacity of organizations to address societies' wicked problems (ibid.). Hartley et al. (2013) hold that understanding wicked problems and their solutions is easier when a plethora of different actors with their experiences and capabilities are brought together. The selection, prototyping and testing are multiplied and enhanced by collaboration when resources are mobilized, exchanged and ownership is shared through dialogue. Not only, is this pertinent during the problem formulation and development phase, but also for implementation and diffusion, which are facilitated, as '*external actors become ambassadors for these new ideas and practice*' (Hartley et al., 2013). If learnings are institutionalized they might become stepping stones towards public value creation and future direction-setting (Head & Alford, 2015). This follows Moore's (2014) assertation that defining public value lies within the public, meaning that the outcomes and the meanings attached to these are just as important, if not more so, than the inputs. This attribute captures the public value accumulated through Learning inside the public sector organization.

II. **Transparency**

Within Public Value Theory, transparency is not only a tool that secures external oversight, but also an approach for actively collaborating with stakeholders (Sørensen & Torfing, 2012; Talbot, 2010; Douglas & Meijer, 2016). Transparency is a process that levels the playing field for stakeholder organizations' involvement, creates awareness that disciplines the focus on public value and comes from publicizing and communicating results. As such, part of Moore's (2014: 471) "deontological value" created by the public, is the maintenance and establishment of the "*(…) right (or tolerable, if imperfect) social relationships"*. Inspired by Dewey (1954), legitimacy can be derived through *"(…) a continuous process of social problem-solving using government as a convener and agent*" (Moore, 2014: 474). The public value goal is then naturally a part of the public that is called into existence. Transparency enables procedural value creation as it animates public and private actors to perform on behalf of a collective rather than as individuals with particular interests (Sørensen & Torfing, 2005; Moore, 2014). Generally, this type of value outcome increases the more inclusive, deliberative and imaginative the policy-making process is, and it is accurate insofar as realizing the intended consequences of action. Thus, this process creates public value outcome through equaling access to participate in the innovation process and its experimentation by facilitating public dialogue and public responsiveness (Sørensen & Torfing, 2005). Conversely, the extent to which a partnership has achieved the opposite, and excluded certain partners or allowed others to seize the agenda away from public value, devalues it.

III. **Public Sphere**

John Benington (2009; & Moore, 2011) first introduced the notion of the *public sphere* when he attempted to shift the focus of practitioners and academics investigating public value to the collective rather than the individual level. Public value, according to Benington, is *what the public values and what adds to the public sphere*. The former focuses on individual interests of users, citizens and

communities, while the latter views public interest beyond the needs of current (individual) users to encompass long-term public value, future generations, similar to Dewey's notion of 'pragmatic idealism' (Benington, 2009; Dewey, 1954). It is this concept that is captured by the third attribute: the public sphere is a place where public values are contested and established through continued dialogue, as inspired by Habermas (1989). Ecological, political, economic and social outcomes are inherently questioned, complex and subjective. Yet, if these can create a dialogue that adds to the public sphere and brings forward important perspectives from the bottom-up this will help set the direction for public value creation. Attribute (III) captures the extent to which outcomes in PPIs add to the public sphere by engaging the public and discovering values. This attribute is a process out of which outcomes emerge, which strengthen social relationships in society, networking from the bottom up and makes citizen engagement a public value outcome.

Table 1: Analytical Framework, author's own elaboration

	Description of Processes	***Core references in the literature***
Learning	Learning is a process by which mutual exchange takes place in the search for solutions. By discovering and utilizing competencies from other actors, learning supplies key insights into technical, organizational and challenges.	Hartley et al., 2013 Crosby et al., 2017 Brogaard, 2019 Stoker, 2006 Moore, 1995
Transparency	Transparency is a process that levels the playing field for stakeholder organizations'	Douglas &

	involvement, creates awareness that disciplines the focus on public value and comes from publicizing and communicating results.	Meijer, 2016 Moore, 1995 Sørensen & Torfing 2005; 2012
Public Sphere	Public Sphere is a process that creates a context where public values can be debated and contested by an informed public.	Habermas, 1989 Benington, 2009, Dewey, 1954 Moore, 2014

The analysis in Section V studies the presence of these three processes of public value in order to understand the specific public value outcomes that were created from the case study: Copenhagen Street Lab, an Urban Living Lab in Copenhagen. This analysis provides a platform for the discussion (in section VI) of the relationship between these three processes and how public value scholars can identify them in future empirical enquiries. The next section will explain the use of the case, data and the method applied in this article.

IV. Case, Method & Data

IV.i Method

This paper will use an explorative case study to understand the public value outcomes beyond the logic of efficiency. This article relies on a explorative single

case study, as these can reveal the underlying mechanisms covered by certain processes by using abduction (Miles & Huberman, 1994). Explorative case studies are used when attempting to *"(...) understand complex social phenomena"* and the relationship between phenomena and context, especially in situations where the complexity of set phenomena means both constructs and relationships cannot be fully defined (Yin, 2009: 4; Graaf and Huberts, 2008). Case studies are ideal for building theory through the application of empirical evidence and established theories. This is due to the fact that these provide meaningful characteristics, which can assist in generalizing social processes (Yin, 2009: 4; Eisenhardt and Graebner, 2007). This reflects the case studies' applicability to the goal of this paper: to develop an operational framework for studying empirically how three process-oriented attributes result in public value outcomes on the basis of a review of Public Value Theory. Thus, the interview guide used to collect data on the case has been based on semi-open-ended questions related to the three items identified above. The empirical data obtained from the interviews will serve to identify the concrete outcomes, and to develop further these attributes into a coherent framework. The core concept of public value outcomes stemming from Public Private Innovation Partnerships is still conceptually blurry, and, thus, well suited for an explorative approach where empirical findings will illuminate and guide further theoretical and conceptual development (Dam, 2015).

This article relies on an abductive logic of discovery (Ackroyd, 2009; Sayer, 1992). In the abductive approach, researchers rely on empirical evidence that reveals the mechanisms "*(...) that are the real or underlying causes of social processes.*" (Ackroyd, 2009: 533). This fits well with the intention of this study to identify and analyze the processes in PPIs that lead to public value outcomes. Abduction facilitates the identification of generative social mechanisms guided by theory, while the precise operation is subject to empirical corroboration through the Copenhagen Street Lab (Ackroyd, 2009: 537). This results in an account whereby mutual reinforcement from theory and the empirical data form a causal sequence

within the studied context (ibid., 2009). Thus, to the extent that this study provides a reconceptualization of the outcomes in Public Private Innovation Partnerships, it has successfully applied this method (see Danermark et al., 2002).

IV.ii Case Selection

The Copenhagen Street Lab resembles a typical case of a Public Private Innovation Partnership. It "*(…) exemplifies a stable, cross-case relationship"* (Seawright & Gerring, 2008: 299), and as such suits the purpose of illustrating the explanatory power of the three attributes (Creswell et al., 2007). The selection of a *typical* or *representative* case study allows the researcher to look in-depth *within* a case in order to explore specific phenomena. From there it can further develop more fine-grained conceptual attributes through the logic of abduction (Sayer, 1992; Seawright & Gerring, 2008; Creswell, 2007). Yin (2009) holds that case studies are '*generalizable to theoretical propositions and not to populations or universes*' (Dam, 2015: p. 127). This fits well with the purpose of this inquiry: to examine three conceptually founded process-oriented attributes that are key mechanisms for public value outcomes. The case was selected for its analytical purposes, since explorative case studies are well suited to use empirical evidence to attempt to build theory (Eisenhardt, 1989).

The case study is the Copenhagen Street Lab, developed in a Public Private Innovation Partnership between the City of Copenhagen, Cisco, Citelum and TDC. It is an example of an Urban Living Lab (ULL), a space designed to "*explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts"* (Bulkeley et al., 2016: 13). According to the European Network on Living Labs, these labs are present in almost all EU27 countries and the network itself has 450+ members. Although, ULL's are a rapidly emerging empirical phenomenon, they have yet to be critically examined to understand whether the outcomes of such a lab match the intentions (Bulkeley et al., 2016). Thus, this paper aims to provide an understanding of the public value outcomes from ULL's. The case is typical owing to the involvement of technology –

product innovation amounts to 42 % of the PPI cases accounted for by Brogaard (2019) in her review of peer reviewed empirical inquiries into PPIs. Furthermore, the case's focus on infrastructure is the second most typical topic for PPIs (Brogaard, 2019). Here, the Street Lab is representative, as Brogaard (2019) shows that most PPIs face a high level of complexity, uncertainty, multiple stakeholders and attempt to overcome these barriers by acting as development partners, continually transferring ideas and knowledge (Evald et al., 2014). In her review of PPI studies, Brogaard (2019) finds that 55 % of these led to an innovation outcome, despite some of the studies having a positive sampling bias. Furthermore, 90 % of the PPI's found in the literature were not included in this ratio because Brogaard was unable to find a clear binary response to her dependent variable (innovation). This underlines the importance of studying a variety of outcomes from PPIs (not only innovation, or cost-benefit). It also places the Copenhagen Street Lab as a typical PPI case in that regard, since it did not lead to any innovation nor to outright cost-benefit efficiency.

The PPI was born from an MoU[15] between the City of Copenhagen and Cisco Systems, which endeavored to accelerate the smart city development in the city. As a material output of the MoU, it was decided that a ULL in the area surrounding City Hall would become a test lab for new solutions. This was decided at a time when the promise of data-fueled innovations loomed large and establishing living labs, which would provide connectivity to Internet-of-Things sensors, was a practical first step. Three private companies were key: Cisco would provide the routers necessary to test new sensor solutions; Citelum was brought in owing to their expertise in electronic installations in urban spaces; and TDC provided connectivity. The latter two firms traditionally come from the street lighting and telecommunications industry respectively; however, it has long been a trait of the smart city industry that firms outside of the traditional technology provider sector are keen to establish

[15] Memorandum of Understanding

new revenue streams from a compelling high growth market. The four partners (Copenhagen municipality and the three private firms) proceeded to build the lab on the two roads surrounding City Hall, which opened in connection with a Smart City conference in Copenhagen in June 2016. The initial partnership was scheduled to last until 2019, where after it was concluded, and the living lab dismantled.

IV.iii Data

The data consists of two different sources, namely nine semi-structured interviews gathered in February and March 2020 and a series of key documents and archival data, including the partnership contract and internal municipal documents. Using the case study method, it is important to secure data from multiple sources (Creswell et al., 2007) if the case is to be illuminated from several perspectives "*to cover the contextual conditions*" (Yin, 2003: 13).

A comprehensive review of best practice conducted by Kallio et al. in 2016 was used in the design of the interview-guide (see appendix). Thus, a five-step process was used to develop the questions[16]. Semi-structured interviews are the most common data collection method for qualitative researchers (Kallio, Pietila, Johnson & Kangasniemi, 2016; DiCicco-Bloom & Crabtree, 2006). This is due to the methods' versatile and flexible nature, and its ability to allow the researcher and interviewee to establish reciprocal conversation, which in turn allows the researcher to ask follow-up questions based on the interviewees' response (Kallio et al., 2016). While, an interview guide is employed to structure the dialogue, the interviewer and interviewee are still able to digress into related questions that might arise during the session (Holloway & Wheeler, 2010). In this fashion, the research area is covered slightly differently by each interviewee, which better reflects their unique experiences (Kallio et al., 2016). Kallio et al. (2016) hold that this is a particularly suitable method when studying complex processes, and, thus, suitable to the nature

[16] The five steps: "*1) identifying the prerequisites for using semi-structured interviews; 2) retrieving and using previous knowledge; 3) formulating the preliminary semi-structured interview guide; 4) pilot testing the interview guide; and 5) presenting the complete semi-structured interview guide*" (Kallie et al., 2016: 10).

of interorganizational collaborations on innovation and the inherent complexity working across the public private divide (Hartley et al., 2013). Interviewees were selected from different organizations and different levels in order to use the method optimally and to allow for the diverse perceptions to be reflected in both a hierarchical and interorganizational understanding (Cridland et al., 2015).

Kallio et al.'s (2016) first step is to identify the prerequisites for using semi-structured interviews, which means to determine the areas of interest based on existing knowledge and determine if those areas could be enlightened by using several interviewees perceptions and opinions (Barriball & While, 1994). The complex nature of a PPI represented by multiple organizations, and as such a diverse range of interviewees, will shed light on key aspects of the partnership. The second step is to ensure that the researcher has prior knowledge of the topic before the interview (Turner, 2010; Rabionet, 2011). Prior knowledge creates a conceptual basis for the interviews and in the instances used in this paper a literature review has been undertaken. In this case, the researcher's empirical knowledge and understanding of the project is unique, owing to the researchers' embeddedness in one of the participating organizations. This aspect complements the theoretical background, which embodies the third step of the interview guide. The fourth step concerns the testing of the guide, which was done with a municipal employee working on a similar but unrelated project (Maxwell, 2013). The fifth and final step is to present the interview guide, which can be found in the appendix.

V. Analysis

Part of the novel contribution to Public Value Theory of this paper is testing the operationalized attributes. This was done by conducting an empirical analysis of a Public Private Innovation Partnerships, so as to understand how to conceptualize public value outcomes beyond the logic of efficiency. The application of this framework is a key contribution as it develops the literatures' understanding of

public value outcomes through the application of three attributes (Learning, Transparency and the Public Sphere). Following the analysis, a discussion focuses on the application of the three attributes and what they entail for the understanding of outcomes associated with PPIs.

I. Learning

The process of creating innovative solutions for the public sector is iterative, taking participants through technological dead-ends and learning loops in order to discover how to innovate existing processes. The Street Lab was a pilot project for the future of digital infrastructure: a place where technological experimentation could provide knowledge of *possible* applications. According to one public manager, the results of Learnings from the Street Lab have led to fewer large investments into technology that has yet to prove its ability to create public value: "*(Street Lab) generated a general capacity for handling this technological paradigm at municipal level (…) I think there are some stupid and bad investments that we're not pursuing (as a municipality), because of this project and the learnings we have generated*" (Interview 3). This statement is backed by a private sector partner describing their main task in cities around the world: "(…) *these days (our job) is increasingly about integrating all these random systems that people (municipalities) have bought, without knowing why*". This shows the value that the partnership potentially provided in feeding into the capabilities of the municipality itself while avoiding large investments into immature technology. One public manager (#3) reasons that the PPI was used explicitly to advance knowledge: "*You don't always learn so much from just buying sensors. But entering a developmental project with them (industry), that's where you really learn a lot about what the technology can and cannot do. I think that learning, that innovation, that capability development in the digital area has been of as much value (as anything else from the project)"*. These experiences are not unique, and, as Bulkeley (et al., 2016: 13) describes, ULL's main feature is their focus on providing "*knowledge and learning"* for urban sustainability transitions.

The Street Lab was funded equally by Cisco, the City of Copenhagen, TDC, and Citelum. The latter two were on-boarded after an MoU was signed between Cisco and the Lord Mayor[17]. One public manager describes the ambition as "*(…) data fueled innovation was to be a new wave of Copenhagen specific value propositions within urban development",* and the Street Lab played a major part in this plan (Interviewee 9). Another important learning concerned the organizational set up of innovation processes. The PPI itself informed this process, as it was new to the departments and employees involved. Copenhagen Solutions Lab (CSL), funded by the Economic Department and officially part of the Technical Department, found itself in the unique position of managing the partnership because no other units work across departments within the municipality. The project lead at CSL quickly became aware that it was necessary to map and use the city's problems and challenges in order to steer the development and direction of the lab. The project lead found that the vision for the Street Lab was heavily influenced by one of the private partners, and accordingly decided to arrange workshops within the Technical Department to counter the outside-in influence dominating the project design (Interviewee 6). These workshops, and later a complete mapping of all potential challenges for the Street Lab to address, helped the project team understand that this input was necessary to provide directionality to the solutions experimented within the lab. The process of focusing on public problems and challenges and engaging with the technical department helped maximize the knowledge and learning as a public value outcome.

Coordinating the Street Lab development across the City's two biggest departments revealed internal divisions. According to several interviewees (1, 3, 4, 5, 6, 9), the intraorganizational division materialized as conflicts of interest. For instance, the coordinating agency CSL had a lack of legitimacy within the municipality; perhaps

[17] Highest ranking mayor within the City of Copenhagen, where each Department has his own mayor reflecting how the electorate is shared.

because some pilots in the Street Lab were already being tested in different formats elsewhere. One public manager described the situation thus: "*How do we make sure there's an 'uptake' of the technology (…) we're working with a double bottom line, where one department says 'industry partnership, great!' and the operational department says 'what's that all about? How can this alleviate our administrative commitments*? *We found that we had to be able to play to both those tunes*". Conversely, a project lead described the learning outcome: "*We created a 'beta-version' (of the street lab) where so much value could be created now (in an alpha version) with the learnings involving political attention, finance, (the importance of) cultural changes and new ways of organizing"* (interview 5). This shows that some of the knowledge and learning was informing how to optimize organizational structures in order to have a possible impact with new solutions.

Experimenting with new sensor-based technologies that support operational activities of the municipality, such as air quality, waste, parking and plant health sensors, was part of the *raison d'etre* for the Street Lab. According to the private partners, the city announced procurement tenders for air quality sensor and waste sensor *without* using the knowledge and drawing on the technical specifications created by piloting *their* technologies (Interviewee 8 and 9). Although several explanations may well exist, it highlights the problem of departmental silos across the municipality or at least a communicative issue. This might lead to a fragmentation of initiatives and measures (Bulkeley & Kern, 2006). If Copenhagen Solutions Lab is not able to institutionalize knowledge and learning across the different departments, it runs the risk of becoming obsolete. One project lead describes the tension: "*I think there are conflicting interests inside the municipality, where you build strong silos of specialists who deliver services (…) there is so much innovation happening decentrally in these units (…) it can be a barrier if (Street Lab) adds new knowledge (…). You are potentially facing the greatest loss of knowledge if they (the learnings from Street Lab) aren't institutionalized properly."* This raises the question of whether PPIs should be anchored within exploratory units such as CSL

or more decentralized units where the push for some innovation is a near constant (interview 5). This problem might result in distrust among on-going collaborations, and, according to interviewee 9, it is partly why private partners might hesitate when entering into future PPIs. The technical and organizational outcomes developed by (I) Learning processes, as far as it is institutionalized, represents vertical learning inside the public organization.

II. **Transparency**

This process' ability to create public value relies on the PPI calling a public into existence and ensuring an inclusive, deliberative and imaginative policy-making process (Moore, 2014). After the Street Lab was established, a new stage of the PPI began, as one public manager explains: "*We went from focusing on establishing the lab to actually conducting cases with SME's. (…) They were thrilled to be able to install equipment and demonstrate the business cases.*" Allowing the lab to become a focal point for experimentation creates public value in terms of equaling access for actors inside and outside the partnership. By some accounts, the Street Lab was a lab for experimentation, lowering the bar for potential collaborations. A startup manager who tested their sensor in the street lab describes the experience: "*Everyone was keen to understand how air quality at a micro level or a hyper local level would actually and translate into value for society (…) From a technical perspective we learned a lot (from piloting in the Street Lab). It was like going through an accelerated product validation exercise*" (interviewee 8). In setting up an arena for experimentation, one tied to the municipality's sustainability transition, the potential value created by PPIs becomes clear. However, it remains contested whether this opportunity was fully exploited as one private partner explains: "*My impression was that it's really really hard for smaller firms, when they participate in PPIs like this one, it's just expected that they come and show it (their technology) off and there's no budget for it, and they end up spending way too much time on all the bureaucracy. It should have been a test space for smaller firms. I don't think that ever really happened"* (Interviewee #9).

These opposing views reflect how the second part of the project, once the lab was built, suffered from a general lack of direction and funds to test and experiment. "*I don't think we were conscious of the need to focus on efficiencies to get funds (from the city)"* describes one public project lead of the second phase of the project. This shows the paradox of the Street Lab, which was intended to be a place for experimentation; however, the public sector's focus on business cases, which were necessary in order to receive funds to experiment in the lab, ended up limiting experimentation. It is pertinent to question whether the municipality simply lacked ways of accounting for the public value provided by experiments. Closing down a lab intended for experimentation, because of a lack of a viable 'business cases', shows that the City failed to appreciate and create potential public value through (II) Transparency. It also underlines how the process of (II) Transparency needs to be prioritized throughout the project lifetime to ensure the delivery of Public Value from open experimentation.

The corporate partners also failed to use the Street Lab for experimentation in the second stage of the project. The lab was left to serve as a Public Relations showroom for both private and public partners. Both Citelum and Cisco used the lab as a testament to the partnership with City of Copenhagen, and also to show off their technological capabilities to interested third parties. Notably, PR is not an insignificant public value outcome as cities are increasingly competing to be the most attractive for a global pool of talent and investments. As one private partner puts it (Interview 4): "*I can't tell you how many delegations of French mayors I've entertained outside Tivoli (in the Street Lab), it's ridiculous. There is a clear benefit in being able to show that you are involved in something that is testing innovative new smart city solutions.*" One public manager describes the lab as a PR asset, which has not only led to press inquiries home and abroad, but also put the city on the map as a smart city leader. This is corroborated by a private manager who describes how it changed the perception of the City and led to better Smart City rankings: "*Copenhagen was nowhere to be seen (in the ranking prior to the Street Lab).*

Copenhagen at the time got its fair share of positive appraisal from across the world for its green policies, but not for it being a Smart City. But by 2016 you could really see the score, you know, the Copenhagen scoring, much, much, much higher in that space" (interview 1). This interpretation suggests that promotions of the lab have led to the City of Copenhagen widening their network and reinforcing a desired narrative, despite not being used for real experimentation.

Transparency, as an attribute, captures the value emanating from a process of open and trusting collaboration between the partners. This is fundamental for a continuous positive relationship between the actors involved during the project or PPI, even in cases where the laboratory experimentation did not lead to a concrete result (Head & Alford, 2015). The case shows that there is public value in collaborating with private partners and drawing on their resources and capabilities. This was enabled by the contact between the actors who experimented in the lab. As noted by one public manager (interview 3): "*The fact that the public and private sector systematically share information and talk so much gives a better understanding (between them) and possibilities for future collaborations. This is what PPIs get you, new types of interaction and collaboration, which you don't get in a principal-agent type relationship bound by a contract."* A private partner expresses a similar private value from networking (Interview #4): *"We did meet some interesting people, so we came into other Smart City firms and especially meeting X, I mean that relationship's been very interesting and the access to partners was valuable."*

Transparency is a structural part of the PPI setup, as findings must be made publicly available. This was the case in the Street Lab where the results from the experiments were disseminated to the general public and stakeholders (Interviewee 3). This shows the public value from transparency that is a structural part of PPIs. Making findings available to stakeholders of all sizes diminishes the risk of collusion from working too closely together. "*We should probably have done more of this. One thing is to do summaries and reports, but institutionalizing these*

learnings, creating the right mechanisms and incentives to get the word out wider." (#3) Transparency leads to a horizontal sharing of experience and results. According to one public manager "*Democratizing this knowledge means the level of innovation is heightened, giving us a bigger variation, both in terms of networks and potential solutions –we could do a lot more of this*." (#3).

III. Public Sphere

This attribute captures a process that opens up how Public Private Innovation Partnerships contribute to developing public values. It is possible to question the legitimacy of cross-sector partnerships adding to the public sphere. Dahl & Soss (2014) have pointed to the problems associated with private interest and value appropriating through the public sector catering to private needs. In the case, this problem is confirmed by one of the public managers (#6): "*(Private partner X) drove so so so so so much of the Street Lab process, actually X drove so so so so so much of the Smart City thought-process in the entire Capital Region the first couple of years (of the smart city development). (…) It was hard to balance their corporate interests with a municipal reality, and it was so important to us that we kept things neutral and open.*" It is clear that when working with large international corporations in partnerships, an important task for the public sector organization is to ensure that value is still added to the public sphere, value that enables a place for citizen interest and ownership in the resulting solution. It remains uncertain as to what degree private partners were allowed to appropriate value through during this project, but it does point to a structural challenge for PPIs when ensuring Public Value is created through the (III) Public Sphere.

Citizen engagement was not part of the prioritization of the Street Lab and neither was community building or empowering democratic dialogue. This is not unique to the Street Lab as an Urban Living Lab; as Kanstrup (2017) found, these rarely engage and learn from people's actual behavior, rather, they are reduced to nodes in the network. On a centrally located square, an electronic board was set up to display the data being picked up by sensors in the Street Lab for citizens. Yet,

without accompanying the raw data with communication and interpretation this did not allow citizens to play an active role as co-creator. One attempt to reach out to a Civil Society Organization was made and a tour of the lab was presented to a local citizen association; however, this was not accompanied by any real ambition to engage them. One private manager describes the situation thus: "*The City of Copenhagen are really good at working with private firms. I mean they are definitely not afraid to reach out to firms. But if you look at the citizenry, then it's my impression that they haven't been involved at all"*. This was entirely intentional as explained by one project lead (#5): "*The citizen angle was considered multiple times, but when you're looking at what we've tested, then it's been directed towards operational issues, and I mean that's not super interesting for citizens, you know, that there's some sensor inside a garbage bin*". This quote shows the focus of this PPI and how the lab chose to focus on solutions that did not warrant including stakeholders. Citizens were passive rather than active collaborators, which limits the value added by the public sphere. Benington (2009: 16) holds that, "*Public value outcomes are therefore complex and contested, and frequently involve trade-offs not only between 'goods' and 'bads', but also between competing priorities.'* In this case, the priority was validating business cases, not adding to the public sphere.

In a recent review of *social innovation,* Voorberg et al. (2015) found that more than 50 % of studies of co-creation in public sector innovation processes view citizen engagement as the *primary* outcome of the project. This suggests that to create public value through the (III) Public Sphere requires special attention and priority. This further stresses the need for recognizing this type of public value and finding ways of measuring it.

Under Broen[18], an amateur maker-space, which was set up in parallel with the Street Lab, contains machinery to create prototypes of IoT devices as a means to engage citizens in the development of new solutions. This cooperative was

[18] Under the Bridge

purposely placed in between the two streets that form the Street Lab, however, no prototype from Under Broen was ever tested in the Street Lab. As one representative from Under Broen put it: *"We haven't really (been able to use Street Lab). It's been our understanding that Street Lab was for the bigger commercial partners".* Under Broen is a cooperative with networks to citizens, which focuses on testing and experimenting with their (largely noncommercial) solutions. Leveraging the cooperative and opening the Street Lab could have potentially bridged citizen interest in the development and direction of development in the urban environment. This represents a missed opportunity to create Public Value in the shape of involving citizens so as to ensure that their values are developed on an informed basis. In addition, this can help form part of future direction-setting.

VI. Discussion & Conclusion

This article set out to answer the research question: *How can Public Value outcomes in PPIs, beyond the logic of efficiency, be analyzed/conceptualized coherently?* The purpose of this enquiry was to establish a framework that identifies Public Value outcomes beyond those associated with the 'logic efficiency'. Using the logic of abduction, corroborating conceptual processes with an explorative case study, the framework has allowed me to describe the relationship between the process-focused attributes and public value outcomes. In sum, the analysis showed that the Copenhagen Street Lab delivered Public Value outcomes beyond the logic of efficiency; however, it was clear that the PPI could not prioritize all three attributes, which limited the resulting outcomes. First, this section sums up the findings from the empirical case, demonstrating what public value each attribute did and did not create. Second, this lays the foundation for a more fundamental discussion and characterization of how to conceptualize these outcomes. Finally, I will conclude on the research question and highlight implications for the literature and practitioners.

Table 2 summarizes the findings. Following the process of the attribute (I) Learning, public value outcomes were created in the Street Lab; however, investigating this process also showed that some *potential* outcomes did not emerge from the case. First, the case exemplifies how (I) Learning was only able to provide public value *after*, and as a direct consequence of, a thorough investigation of needs and challenges within the city had been carried out during the PPI. Based on this *new technical knowledge* decisions not to procure unsuitable solutions on a large scale were made on an informed basis. (I) Learning highlighted intraorganizational challenges within the municipality and thus provided an outcome of *new organizational knowledge*. This asks questions as to whether this outcome is best served in a decentralized unit, or whether the PPI must be strongly anchored centrally in the public organization. As highlighted by one interviewee, competing intraorganizational interests, together with the sectoral division, between day-to-day operations units and experimental municipal units was the greatest barrier to public value creation in the case. Public value outcomes through attribute (I) are related to the absorptive ability of *intra-organizational capacity building*. According to the interviews, the Street Lab showed that organizational learning seems the most important outcome for the public sector organization. The Public Value outcomes from attribute (I) have immediate impact when they inform decision-making as well as impact in the long-run insofar as organizational and technical knowledge is institutionalized. This provides a platform for future innovation processes. Importantly, the extent to which (I) Learning heightened the public value outcomes was only evident *after* the municipality was able to provide directionality and actively shape the partnership.

Attribute (II) Transparency illuminated how Public Private Innovation Partnerships have a structural advantage for creating value through this attribute. This is due to the fact that PPIs embrace transparency as a condition for collaboration through *open dialogue, creating trust between the partners*. The Street Lab showed that transparency is capable of mobilizing private organizations in the pursuit for public

value creation, but only insofar as there is a private value potential. One public manager mentioned that sharing experiences beyond the partnership holds potential public value for future projects if it encourages others to share too. This is in line with what some authors have suggested is the ultimate aim of local experimentation and a step towards "translocal diffusion" for urban sustainability (Bulkeley et al., 2016; Loorbach et al., 2019). (II) Transparency led to positive PR through its development partners, creating a *clear and desired narrative* about Copenhagen as a pioneer, which was reflected in the improved Smart City ranking that might attract organizations and professionals to the city. Transparency, therefore, has an important part to play in creating narratives that can support development in a desired direction. Finally, the case's lack of (II) Transparency was exposed when it came to opening the collaboration to firms and solutions without a viable business case. This shows the limits of creating public value through (II) Transparency, as the PPI was not able to establish a truly *experimental space for future innovation in the city*.

The third attribute (III) Public Sphere is different in nature to the two aforementioned. As shown in the table below, the outcomes created through attributes I and II were mainly created by and for the partnership organizations. Attribute (III) however, is premised on partners compromising control of the PPI and acting as conveners to stimulate citizens and be inspired by their public values. Attribute (III)'s main outcomes are found when explicitly formulating and uncovering public values and directing the efforts of the public through *explicit incorporation of values to ensure direction-setting*. In this particular case, there were established avenues to achieve value through this attribute, but they were not prioritized. The interviewees on both the public and private side clearly indicate the Street Lab was aimed at solutions that did not warrant co-creation and citizen engagement, and that there were no funds for an engaging process to facilitate *co-creation and co-ownership of the PPI through citizen engagement*. The disregard for this type of value shows that the Street Lab's uniform search for value, according to

the logic of efficiency, had a negative impact on other types of value. Further research must examine whether there is room in Public Private Innovation Partnerships to manage processes towards both outcomes within *and* beyond the logic of efficiency. The Street Lab makes it evident - within its unique context - that having a normative focus on efficiency, naturally leads to an exclusion of value in other (normative) directions.

In sum, the three attributes (I) Learning, (II) Transparency and (III) Public sphere define certain public value creation processes, which lead to public value outcomes beyond the logic of efficiency. When PPIs create contexts that allow for these three processes, specific public value outcomes can be created. Conversely, if the attributes are under-developed, or infra-utilized, then it follows that PPIs will create only partial or limited outcomes, which is one of the main findings of the analyses. The top half of the table below explains the outcomes that are made possible by the three attributes. The outcomes marked "(X)" identify which of these outcomes were present in the Copenhagen Street Lab.

The case provides three insights into the inter-attribute relationship. As touched upon above, PPIs focusing on efficiency might lead to an exclusion of (III) Public Sphere processes. However, focusing too much on (I) and (II), might have the same effect. There is a potential barrier in the juxtaposition between the outcomes (II) *open dialogue and trust between partners* and (III) *Co-creation and co-ownership of the PPI through citizen engagement*. Further research should be dedicated to investigating the balance between these two outcomes. The case showed that the outcome led to by attribute (III) helped ensure that the outcomes from attribute (I) and (II) are what the public values. In situations where direction-setting and the discovery of public values are essential outcomes in the guiding of public policymakers towards environmentally sustainable solutions, awareness of the implications of the processes that lead to this type of outcome is paramount.

Table 2: Soft Public Value Outcomes, authors own elaboration

Attributes of Soft Public Value Creation	**(I)** ***Learning process***	**(II)** ***Transparency process***	**(III)** ***Public Sphere process***
What are the specific <u>outcomes</u> of public value creation?	New technical Knowledge (X)	Open dialogue and trust between partners (X)	Co-creation and co-ownership of the PPI through citizen engagement ()
	New organizational knowledge (X)	Clear and desired narrative (X)	Explicit incorporation of values to ensure direction-setting ()
	Intra-organizational capacity-building ()	Experimental spaces for future innovation in the city ()	
When is it created?	Short & Long-term	Short & Long-term	Long-term
Who creates it?	Participating partners in PPI	Participating partners in PPI, Stakeholder organizations & Translocal replication	Citizens & Stakeholders
Who benefits?	Public sector organization	Non-active stakeholders, Public sector organization	Citizens & Future citizens
How is it	Through interaction &	Through dissemination &	Through establishing

created?	collaboration	network creation	directionality
What is the nature of this value?	Micro, Organizational	Micro/Meso, Organizational/Interorga-nizational,	Macro, Citizenry

One of the key issues this paper has addressed is the absence of a coherent framework for studying public value outcomes from PPI processes. Through the application of the three attributes, a framework consisting of the processes that lead to Public Value outcomes beyond the logic of efficiency has been identified. Each of the three attributes creates outcomes not captured by the logic of efficiency. The analytical framework showed that by embracing these outcomes, it is possible to highlight what drives the process of public value creation and what potential barriers exist. Considering the *softness* of the outcomes, they capture a common type of value, which can be termed *Soft Public Value* (SPV). This concept enables an analysis that moves beyond binary dependent variables, such as innovative solution for the public sector (present/not present or incremental/radical), to more fully reflect the multiple dimensions of public value outcomes.

The concept of Soft Public Value emphasizes the importance of the understudied outcomes of public value creation. The empirical findings indicate the central role this plays for the public sector in providing public value outcomes, especially at the local level. The analysis showed how municipalities can create public value by providing a protected space for new solutions. This is in line with previous research on ULL, where Bulkeley et al. (2016) showed that focusing on experimentation – as an open-ended and collective exercise in reflexivity – can be critical for realizing a city's sustainability objectives. Using the logic of abduction, the analysis established a causal explanation, limited to the context where the research takes place (Easton, 2010). While similar findings on the potential of ULL's already exist (see, Bulkeley et al., 2013; Bulkeley et al., 2016; Voytenko et al., 2016; Karvonen et al., 2014; Evans

et al., 2015; Frantzeskaki et al., 2016), I encourage future research to draw on the Soft Public Value framework to conduct comparative studies of ULL's.

In sum, this paper has developed a framework establishing a relationship between the process-attributes and specific Soft Public Value outcomes. Studying these specific processes is a means to coherently identify public value outcomes beyond the logic of efficiency from Public Private Innovation Partnerships. SPV can, therefore, be used to recognize and appreciate the public value created in Public Private Innovation Partnerships. New dynamics are observable when the range of public value outcomes is widened, which raises further questions for the decision-making of policymakers and public managers involved in PPI. It is important for both public value scholars and practitioners to recognize that there is a trade-off between creating value for the logic of efficiency or creating Soft Public Value. This article has shown empirically what Public Value scholars have established theoretically: that there are public value potentials beyond the logic of efficiency and that these can be analyzed through investigating the processes that lead to Soft Public Value.

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Appendix IV: Introduction & Survey Questionnaire Research Article 1

Letter to respondents

Thank you for taking your time to participate in this questionnaire concerning the Digital City Solution you have been part of developing. The questionnaire will form the basis of a larger research project looking into how innovation is scaled and commercialized through collaboration between public and private organizations and occasionally research institutions. The data from this questionnaire will inform our attempt to conceptualize digital city developments, and investigate which factors present opportunities or constraints for various solutions developed in this space.

This research project is a collaboration between the City of Copenhagen and Copenhagen Business School and it is made possible through funding from Innovation Fund Denmark and Denmarks' largest foundation Realdania.

Thank you for your time!

Questionnaire

Q1. Please provide the name and/or website link of your project and the name of the municipality in which it takes place.

_____

_____

_____

_____

_____

_____

Q2. What is the expected start and end date to the project?

_____

_____

_____

_____

_____

_____

Q3. What is your role in relation to the project?

(1) ❑ A. Employed at the municipality in charge of designing and implementing the solution.

(2) ❑ B. External consultant advising the municipality about the design and implementation of the solution

(3) ❑ C. Employed at firm that supplies the technological solution

(4) ❑ D. Other _____

Q4. At what level of scale-up is the project today? (Please flag the statements prior to the current level as well, if they accurately describe the previous levels of the project.)

(1) ❑ 1. Idea Complete: Problem or technology has been identified, but how value is created and which partners are necessary is unclear.

(2) ❑ 2. Prototype Complete: A problem and its solution has been identified, however there are still partners missing and the solution has not been fully tested in a pilot project.

(3) ❑ 3. In Development: An Alplha or/and Beta version is being tested in a pilot project with all the necessary partners. However it has not yet proven that it works.

(4) ❑ 4. Deployed: The solution has achieved Proof-of-Concept (The solution is working) and has been deployed outside the original pilot project.

(5) ❑ 5. Commercialized: The solution has shown that it creates value outside of pilot projects and yield a financial and/or social return and runs self-sustained.

Q5. Has the solution been deployed in the whole city?

(1) ❑ A. Has not been deployed

(5) ❑ B. Has been deployed in a few streets

(3) ❑ C. Has been deployed in an entire neighborhood

(4) ❑ D. Has been deployed city-wide

(6) ❑ E. Has been deployed as in A, B and C, but in more than one city

Q6. Please indicate the level of uncertainty faced by the project in the beginning?

(1) ❑ A. Low: both the technical and functional specifications were known from the start.

(2) ❑ B. Medium: technical specifications were well known, but the functional specifications were unknown.

(3) ❑ C. High: technical and functional specifications were unknown, but the problem was well defined and delimited.

(4) ❑ D. Very high: the technical and functional specifications were unknown, and the problem to be solved needed to be clearly defined and delimited.

Q7. What types of partners are involved in the project? You can tick more than one box.

(1) ❑ A. Private firms supplying technical solution

(2) ❑ B. Private firms advising on technical solution

(3) ❑ C. Private firms managing the project

(4) ❑ D. Public organizations

(5) ❑ E. Universities or research institutions

(7) ❑ F. Community members (Individuals or organizations)

(6) ❑ G. Other (please specify below) _____

Q8. How many partners have been involved in the whole life of project?

_____

_____

_____

_____

_____

_____

Q9. Is the project the result of a collaborative partnership between equal partners?

(-1) ❑ 1. No, there was a clear distinction between the principal (project owner) and agent (provider of solution) of the project

(1) ❑ 2. Yes, there was little to no hierarchy between the project partners

(0) ❑ 3. I do not know

Q10. How would you describe the intensity of the collaboration among partners in the project?

(1) ❑ A. The collaboration was very irregular and with low engagement

(2) ❑ B. The collaboration was irregular but with some engagement

(3) ❑ C. The collaboration was regular and with some engagement

(4) ❑ D. The collaboration was very regular and high level of engagement

(0) ❑ E. I do not know

Q11. Did the municipality require technical amendments to the solution?

(1) ❑ A. None or very minor technical amendments were required

(2) ❑ B. Some technical amendments were required

(3) ❑ C. Many technical amendments were required

(4) ❑ D. Major technical amendments were required

(5) ❑ E. I do not know

Q12. To what extent has the municipality adapted its operations in order to fully capitalise on the benefits from the solution?

(1) ❑ A. Very little

(2) ❑ B. Some evidence of adaptation

(3) ❑ C. Significant level of adaptation

(4) ❑ D. Very high level of adaptation

(5) ❑ E. I do not know

Q13. Three organisational problems have been associated with the level of difficulty of projects:

1. Problems in the practical management of the project due to lack of organizational man-power and competences

2. Coordination problems across various municipal departments involved in the implementation

3. Lack of clear leadership in the implementation phase. Please rate the level of difficulty associated with the project in question:

(1) ❑ A. High: All 3 problems

(2) ❑ B. Significant: 2 out of 3 problems

(3) ❑ C. Moderate: 1 out of 3 problems

(4) ❑ D. Low: none of the 3 problems were observed

(5) ❑ E. I do not know

Q14. Did the municipality conduct a needs assesment and feasibility study of the project regarding the technical, organizational or social requirements of the solution?

(1) ❑ A. The municipality did not conduct (or commission) any study or report about the solutions' feasibility/need in the city.

(2) ❑ B. The municipality conducted one single analysis/study during the life-span of the project

(3) ❑ C. The municipality conducted several analysis/studies during the life-span of the project

(4) ❑ D. The municipality conducted regular analysis/studies during the life-span of the project.

(5) ❑ E. I do not know.

Q15. What are the technical capacities available to the municipality in terms of the project? (Technical capacity: Engineers, ICT expert employed and/or external consultants advising).

(1) ❑ 1. The municipality has very limited technical capacities

(2) ❑ 2. The municipality has some technical capacities, mostly through external consultants

(3) ❑ 3. The municipality has good technical capacities, mostly through employed engineers

(4) ❑ 4. The municipality has very good technical capacities, mostly through employed engineers and external consultants

(5) ❑ 5. I do not know

Q16. To what extent do the citizens or end-users understand the need for the solution provided by the project?

(1) ❑ 1. Very low level of social perception about the need

(2) ❑ 2. Moderate social perception about the need

(3) ❑ 3. Significant social perception about the need

(4) ❑ 4. Widespread social perception about the need

(5) ❑ 5. I do not know

Q17. Does popular opinion contest the solution introduced by the project?

(1) ❑ A. The solution is not contested by citizens or end-user

(2) ❑ B. The solution is moderately contested by specific groups of citizens or end-users

(3) ❑ C. The solution is contested by the majority of citizens or end-users

(4) ❑ D. The solution is extremely contested by citizens, end-users and civil society organisations.

(5) ❑ E. I do not know

Q18. To what extent is the private firms' business model based on ownership of data created through the solution?

(1) ❑ 1. Not at all, the data will be owned by the municipality.

(2) ❑ 2. To some extent as the private firm has priority of the data.

(3) ❑ 3. The firms business model is fully based on the ownership of the data created.

(4) ❑ 4. I do not know.

Q19. To what extent were end-users of the solution involved in the project?

(1) ❑ 1. End-users were not consulted

(2) ❑ 2. End-users were consulted irregularly

(3) ❑ 3. End-users were consulted regularly

(4) ❑ 4. End-users were consulted regularly and shaped the solution significantly

(5) ❑ 5. I do not know

Q20. What part of the municipality was the main point of contact in the partnership?

(1) ❑ 1. An autonomous innovation unit not daily involved in city operations/administration

(2) ❑ 2. A central administrative/operations unit

(3) ❑ 3. Both of the above.

(5) ❑ 4. A foundation without the legal responsibilities of a public organization

(4) ❑ 5. I do not know.

Q21. Did the partnership require the private firm to collaborate with other firms?

(1) ❑ 1. Yes

(2) ❑ 2. No

(3) ❑ 3. I do not know

Q22. What is the level of complexity of collaboration?

(1) ❑ A. One public entity, one private entity.

(2) ❑ B. One public entity, more than one private entity.

(3) ❑ C. More than one public entity, more than one private entity.

(4) ❑ D. I Do not know.

Q23. What type of organizations collaborated through the partnership?

(1) ❑ A. SMEs

(2) ❑ B. International corporations and SME(s)

(3) ❑ C. International corporation(s), SMEs and research institutions/universities

(4) ❑ D. International Corporation(s)

(7) ❑ E. Startups

(5) ❑ F. I do not know.

(6) ❑ None of the above _____

Q24. How did you perceive the similarity of the incentives towards scaling up across public and private partners?

(1) ❑ A. The partners had very similar incentives to scaling up.

(2) ❑ B. The partners had similar incentives to scaling up.

(3) ❑ C. The partners some dissimilar incentives to scaling up.

(4) ❑ D. The partners had completely dissimilar incentives to scaling up.

(5) ❑ E. I do not know.

Appendix V: Interview-guide Research Article 2

1) What was your role and the role of your organization/unit in this PPI?

2) How would you describe or characterize the collaboration in the partnership?

3) Under what conditions and what type of communication was used within the partnership?

4) Was the process steered by mainly one person or organization? How would you describe the type of leadership?

5) What was your perception of the other actors' level of flexibility? Was there a willingness to have an open-ended process, in which the final solution could be influenced along the way or were the partners stubborn and unwilling to share resources and change specifications?

6) Which items were particularly important to the partners' involved?

7) How do you see that this project has create value for the public?

8) Which role did an eventual pilot project play for the ensuing project and how was the project intended to create value for the city?

9) How did the product/process change to adapt to the municipal organizations' needs?

10) Where did your inspiration for the project come from? Where you looking at similar pilot projects?

11) Can you describe what elements were subject to uncertainty?

12) Can you describe the decision-making process in the partnership?

13) What did you and your organization do to ensure that Public Value was created through the project?

Appendix VI: Interview-guide Research Article 3

Background

1) What was your role in the partnership and what was the role of the organization you represent?

2) How did this partnership become a relevant endeavor for your organization?

3) Did you perceive this project to be the result of a specific need in the City of Copenhagen?

Collaboration

4) How was your experience of the collaborative elements of the partnership?

5) Were there any problems with levels of trust or opportunistic behavior?

6) Who steered the process?
    i. Individuals?

7) How did you experience the other partners flexibility towards the outcome of the partnership?

8) What goals were particularly important for the participants?

9) Were there any downright conflicting incentives for the project partners?

10) Was it apparent to you how participating organizations complemented each other?

11) Did the city manage to reap the benefits of your expertise?

12) Were there any issues collaborating intraorganizationally? How was knowledge and learnings used?

Value

13) What value was created for the participating organizations?

14) Would you characterize this as hard or soft value?

15) If we consider public value as something that creates value for public organizations, as well as something that adds to the public's sphere and creates a more fair and just society, what public value was created here, as you see it?

16) What other soft public value was created?

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