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A Configurational Approach on Conditions of Collaborative Innovation in Public Service Delivery

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Abstract

Governments around the world are in need of new approaches to develop public services. Both pressures from the environment, such as the rise of complex problems which have no obvious solutions (e.g. financial crises, global warming, pandemics), the rise in demand for customized services and the general increase of citizens' expectations, and pressures from within government, such as the government's desire to deliver services of high quality, increase the need for innovative services. However, governments also realize that their own resources and capacities are limited, and that tackling complex issues requires collaborations with other stakeholders. By collaborating with private sector actors and service users, governments are able to access valuable resources and capabilities, enhance creative synergies, and create broad support to implement new services. Such a 'collaborative innovation', in which innovation is produced out of the collaboration between multiple external actors, is the main focus of this dissertation.

This dissertation studies how configurations of conditions influence innovation through collaborations. We make the argument that conditions of collaborative innovation on the level of the involved organizations, the partnership, and the users influence how innovation is achieved through collaboration. We test our assumptions in multiple organizational settings, such as public service organizations, public-private partnerships (PPPs), and public-private eHealth collaborations. We search how particular combinations of conditions from multiple levels of analysis impact collaborative innovation, and shed light on relevant questions regarding the dynamics of the collaborative innovation process. Both qualitative and quantitative data was collected and analysed to generate the conclusions of this dissertation, and multiple research methodologies were used.

The general findings of the dissertation show that a configurational approach to conditions of collaborative innovation is valuable in understanding the interconnected features of collaborative innovation. Such an approach allows to generate rich insights on the processes and dynamics of collaborative innovation. The approach shows how diversity in partnerships is a double-edged sword for innovation, how control structures reinforce partnership processes, how opposite generative processes of collaborative innovation act simultaneously on innovation, and how user involvement is contingent on the roles the users take on during the innovation process.

Preface

Almost four years have passed since I began working on the chapters for this dissertation, and I have learned a lot since then. Each step of the way was challenging but also satisfying, and this journey would not have been possible without the support of many of the people around me. I would therefore like to dedicate this preface to express my gratitude to my colleagues, friends and family, without whom this dissertation would not have been possible.

First of all, I would like to thank my supervisor Koen Verhoest and co-supervisor Jan Boon for their advice, support, and guidance. I'm very grateful for the opportunity to work on this dissertation under the supervision of Koen, who helped me to become a critical thinker, showed me the ins and outs of international project coordination, and was always prepared to help me search for solutions for problems I faced. My special gratitude also goes to my co-supervisor Jan, who was always there to listen to my problems and concerns, significantly enhanced my academic skills, and supported me throughout the whole process. Koen and Jan have had an incredibly important role in making me the researcher I am today, and for this I'm very grateful.

I would also like to thank the members of my doctoral commission. Wouter Van Dooren was, as the chair of my commission, crucial in adjusting the direction of my dissertation and in helping me to obtain new perspectives during our 'office talks'. Veiko Lember brought important new insights to the table, which were very helpful for reflecting on the implications of my research for practice, and Joris Voets always encouraged me to critically reflect on my results in order to understand the bigger picture. I would also like to thank the two external jury members, Jan Wynen and William Voorberg, for being part of my jury. Jan enhanced my methodological skills profoundly during my PhD years, and William inspired me through his work to connect collaborative innovation to processes of co-creation and coproduction with citizens and users.

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The TROPICO project and its consortium deserves a special thank you, as it gave me the opportunity to work in an international context with researchers from all over Europe. The project learned me how important international collaboration in research is, and how new ideas and insights emerge from such collaborations. TROPICO did not only make the research in this dissertation possible, but it also positively affected my development as a researcher. I'm especially grateful for the opportunity to work closely together with Erik Hans Klijn, Veiko Lember, Lena Brogaard and Vicente Pina, and for meeting all the young 'Tropicorn' researchers in the project.

The process of writing this dissertation would not have been the same without my colleagues and friends, who helped me to deal with problems and frustrations and provided me with new perspectives. I'm especially thankful for the great collaboration I had with Marlies, Vidar, Tom, Emmanuel, Dries, Jaime, and Steven. I also want to thank my 'office buddy' Frederik, who was always the first one to listen to my thoughts (and frustrations). I also consider myself lucky for having friends such as Andranik, Evelynn and Tom with who I could actually discuss the topic of my dissertation without boring them to death. And when I needed some time off, Steven, Louis, and Simon were always there to clear my head.

But at the heart of this all is of course my family. It is easy to take family for granted, but family has such a long-lasting impact on how our lives evolve. I'm very grateful for how my parents have supported me in every aspect of life, and I'm fortunate to have two incredible sisters and three wonderful nieces. I'm also very grateful for my family in-law, who has helped and supported me in many ways. And last, but definitely not least, Eva, you were the stability that I needed the last six years. You were always ready to help me whenever I needed it, and your presence and support was invaluable the last six years. In all aspects, you are the most beautiful person I know, and I'm looking forward to start my own family with you.

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Chapter 1

Collaboration as a driver for innovation

Chesney Callens

1.1. Introduction

Almost a decade ago, the federal government of Belgium decided to change the way in which citizens access their health information. As part of the eHealth policy plan, the government began to search for ways to integrate the fragmented Belgian eHealth services. In the preceding years, a trajectory of extensive technological innovation in multiple health institutions had changed the health landscape drastically. Instead of directly consulting physicians to get access to health information, the technological innovations enabled citizens to access their health information online. Health information became more and more digitalized, which increased the accessibility of this information. However, as each health care provider innovated its own services, a dispersed system of online services emerged, each oriented towards its own user group. In an attempt to integrate these services, the Belgian government created a large partnership with more than twenty actors, including government agencies, public and private health care providers, interest groups and service users. The partnership transcended the boundaries of each of the involved organizations, which stimulated the search for integrated solutions. The partnership eventually implemented a central health portal through which citizens were able to efficiently access their health information.

Although the government is not always recognized as an important innovator, the example indicates the crucial role they play in innovating services. Due to the complexity, diversity and interconnectedness of many of today's services, governments become increasingly important to enable innovations in these services. A large, overarching innovation such as the central health portal, would have been impossible to achieve without the government's intervention. Furthermore, history shows that a lot of the technological breakthroughs of the last centuries, such as biotechnology, the World Wide Web, and the internet were initiated by the public sector (Mulgan 2007; Windrum 2008). Governments and public sector organizations have also good reasons to innovate, as citizens demand better and more customized services, wicked problems require creative solutions, and resource scarcity necessitates the creation of smart solutions (Sorensen and Torfing 2011). Innovation allows organizations to transform in response to internal and external pressures, it holds back the entrenching effects of organizational inertia by disrupting obsolete organizational processes, and it is a key feature of rapid organizational growth (Damanpour, Walker and Avellaneda 2009).

A wide variety of mechanisms and conditions can lead to innovation in public sector organizations, depending on the type of organization (e.g. government agencies, partnerships,

etc.), the type of innovation that is pursued (e.g. policy innovation, technological innovation, service innovation), and the motives to innovate (e.g. enhancing organizational performance, increasing quality of services, solving complex policy issues). Most of these mechanisms and conditions consider individual, organizational, or institutional features, such as the creative capabilities of innovators, the management and leadership of organizational innovation, or the institutional pressures to innovate (Osborne and Brown 2013; Boon et al. 2021).

However, the example of the central health portal also shows the difficulty of achieving isolated innovations in today's interconnected society. The intervention of the federal government as a broker between the diverse health organizations indicates the importance of a network approach to public service innovation. While each of the health organizations in the example had already implemented innovations on their own, a collaboration between these organizations was necessary to further improve the quality of their services for the users. Such a *collaborative innovation*, i.e. *the production of innovation out of the collaboration with multiple external actors*, is a promising strategy to create innovation in complex environments, as it allows the access and connection of diverse knowledge pools and resources, facilitates synergies and mutual learning, and promotes creative ideation, risk sharing and implementation opportunities (Torfing 2019).

The rationale behind collaborative innovation is twofold. On the one hand, collaboration creates additional 'degrees of freedom', as different partners, each with distinct backgrounds, perspectives and knowledge, engage with each another, out of which new and creative ideas can emerge. On the other hand, partnerships can enable a broad development and implementation of innovative solutions, as they can draw on the resources and support from a wide variety of engaged stakeholders. In this sense, collaboration has both a *reinvigorating* and *protecting* effect on the innovation process (Callens et al. 2020), as it allows organisations to access new knowledge, resources, and experiences, which can boost the innovation process (Davis and Eisenhardt 2011), and also protects the innovating organizations as costs, risks of failure, and the complexity of problems are shared between the collaborating partners (Baldwin and von Hippel 2011; Corsaro, Cantù and Tunisini 2012; Crosby, 't Hart and Torfing 2017).

Although collaborative innovation research has increased substantially during the last decade, a lot is still unknown about the specific conditions that stimulate innovation in collaborations. This dissertation contributes to the general argument of innovation through collaboration by studying the conditions and processes that lead to collaborative innovation. A particularly interesting research gap revolves around the combined effects of various conditions of

collaborative innovation. Most conditions of collaborative innovation work in a specific context, in which other conditions are also exhibiting an effect on the collaborative innovation process. Only very recently, authors such as Torfing et al. (2020) have started to explore this important aspect of collaborative innovation. Obtaining a better understanding of the *configurations* of conditions that work on collaborative innovation, is the main theoretical contribution of this dissertation. We study the collaborative conditions and processes through this *configurational approach* both in public sector organizations and public-private collaborations. The dissertation focuses on innovation in *public service delivery*, as citizens and other stakeholders interact directly with public services and service innovation is therefore often the most visible kind of public sector innovation. The dissertation addresses these conditions and processes in *four empirical chapters,* each of which pertains to a different set of conditions. A final chapter summarizes the main insights from these empirical chapters and reflects on theoretical and practical contributions.

However, before we dive into the empirical chapters, the current chapter provides the necessary background into innovation research and the collaborative innovation rationale. The chapter first elaborates on the meaning of 'innovation'. In order to understand what it means to innovate, the concept of innovation should be thoroughly defined. Next, some conceptual background is provided. As public sector innovation and collaborative innovation are relatively new research fields, we provide a concise overview of the idea of innovation in the management literature. We start from the work of Joseph Schumpeter, who was essential for our current understanding of innovation in the public sector. Subsequently, we outline the roots of public sector innovation and collaborative innovation research, which, inevitably, have a strong private sector origin. Next, the state of the art on collaborative innovation is introduced. This section provides three levels of conditions: 1) the organizational capacity of involved organizations, 2) the partnership processes at the partnership level, and 3) the involvement of users in collaborative innovation. In the next section, we discuss the questions that are still unanswered in the current literature regarding those levels of inquiry, and propose four research questions, which are addressed in the empirical chapters of the dissertation. Last but not least, the chapter addresses the research methodologies used in the dissertation, discusses the main contributions of the dissertation, and summarizes the outline of the dissertation.

1.2. What is innovation?

Before we introduce the core of this dissertation, a detailed description of the concept of innovation is appropriate. The Oxford English Dictionary defines 'innovation' as 'the introduction of novelties; the alteration of what is established by the introduction of new elements or forms'. On the most fundamental level, two characteristics seem to define innovation. First, innovation is the introduction of something new. 'Newness' in itself is, however, not easy to delineate, since the answer to the question 'is this new?' is highly dependent on who is asked. Innovation scholars have often run into this problem, and it is now generally recognized that the newness of innovation should be evaluated in relation to its context of adoption (Rogers 2003). This means that innovations are not necessarily 'totally new' as long as they are perceived as new for the context in which they are introduced (Anderson, Potočnik and Zhou 2014).

There is some debate in the innovation literature on who is most eligible to assess whether an innovation is new or not. Should an innovation be perceived as new by those who adopt the innovation, or should it be perceived as new by anyone that is able to relate the innovation to its context of adoption? Of course, those that are part of the adoption context have more knowledge about this context and may be more accurate in evaluating the newness of the innovation. However, they might also be more prone to bias as they are indeed the ones who adopt the innovation. The opposite reasoning can be employed for those individuals that are not part of the context of adoption but are able to relate the innovation to its adoption context. These individuals might be more objective, but their knowledge of the precise adoption context might also be more restricted, which hampers the validity of their assessment. There is no right answer to this dichotomy, and most researchers will select one of these perspectives or apply a combination of both in their research design. This dissertation employs the former approach, and reduces bias in responses by selecting a wide variety of involved actors who are able to evaluate the newness of the innovation.

Second, in order to define something as an innovation, that something should be *tested, adopted or implemented in a specific environment*. Innovations have real, practical consequences for individuals, organizations or other entities as they alter existing routines, functions or behaviours. This characteristic sets it apart from the concepts of 'invention' or 'creativity', which both adhere to the 'newness' feature, but are not adopted or implemented in a real-life environment (Amabile 1988; Anderson, De Dreu and Nijstad 2004, Walker 2007; Anderson,

Potočnik and Zhou 2014). New, creative ideas might have a real impact for those who come up with these ideas as they increase knowledge and enhance insight into a particular problem. They, however, have no practical consequences as they are not yet translated into a useable object, tool or routine. This also means that innovation is a process which combines creative idea generation with the practical adoption of the created ideas (Damanpour and Schneider 2009).

In addition to the two foundational characteristics of innovation, some related characteristics have been proposed. For instance, some authors indicate that the *'extent of change'* of innovated systems in comparison to their previous (i.e. status quo) state, is a distinguishing feature of innovation. For example, Sorensen and Torfing (2015, 147) argue that innovation requires a 'discontinuous change that breaks with the past'. Other authors have pointed to the difference between innovation and '*optimization'*, in which the latter is 'associated with enhancing efficiency and alignment of current operations to maintain or enhance short-term performance, by incremental improvement of existing designs, products and services for existing clients' (Gieske, Duijn and van Buuren 2020, 342). Innovations can be both incremental and radical, depending on whether or not they provoke a paradigm shift (Osborne and Brown 2013; Norman and Verganti 2014). However, according to Osborne and Brown (2013), they all involve a significant change in (some of) the properties of organizations, markets, or societies, which would not have been possible to achieve through incremental optimizations from an existing state. In fact, one of the first definitions of innovation describes the concept as 'new combinations' (Schumpeter 1939), referring to the distinct, combinatorial means through which innovation comes about. Innovation requires the creation of new associations between distinct ideas or objects, which distinguish it from merely optimizing existing ideas or objects.

When we connect the different aspects of innovation, the following definition of innovation can be proposed[1]:

Innovation is the introduction of new policies, practices, services, processes, structures, routines, or objects in a specific context (i.e. organization, government, market, society, etc.), through a process of creative ideation and practical adoption, which significantly alters or expands the properties, effects or functions of the innovated system.

1.3. The roots of innovation and collaborative innovation research

This section provides a conceptual overview of public sector innovation by tracing back the roots of the idea of innovation in the management literature. These roots are tightly connected to the origin of innovation research in the business management literature. In order to fully appreciate the accrued knowledge regarding public sector innovation, proper attention should be given to the foundations of this knowledge. The first section thus provides a concise overview of innovation and collaborative innovation research in the private sector. Building on this, the second section gives an overview of the public sector innovation and collaborative innovation literature. Note that the purpose of this section is to shed light on the complex and dispersed innovation literature and provide connections between relevant concepts, but not to give a comprehensive and detailed description of this literature.

1.3.1. A concise overview of innovation research in the private sector

Schumpeter's legacy

Any scholarly effort to unravel the roots of innovation should consider the seminal work of Joseph Schumpeter. Schumpeter was the first economist who openly rejected the dominant position at that time that economic theory is confined to the explanation of the equilibrium state of economic systems (Hall and Rosenberg 2010). According to traditional economic theory, economic systems have a tendency to shift back to an equilibrium state when changes to that system occur. Economic theory, therefore, should especially explain the forces through which the economy slides back to this equilibrium. However, Schumpeter observed that, contradictory to this assumption, capitalist economies have a tendency to shift away from the equilibrium and through these dynamics incite economic growth and development (Schumpeter 1942). Criticizing the notion of economies in equilibrium, Schumpeter inevitably headed towards the formulation of a theory of economic change and innovation.

In 1942, Schumpeter published his seminal work 'Capitalism, socialism and democracy', in which he introduced the mechanism of 'creative destruction', which, for him, presented the motor of economic change and innovation. Creative destruction is 'the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one' (Schumpeter 1942, 83). Instead of reacting to changes by pushing back to the equilibrium, Schumpeter argues that economies change 'from within'. Innovations are not introduced because firms want to enhance

themselves, but because of the inherent process of creative destruction (Baunsgaard and Clegg 2015). When new technologies are introduced in the economy, they displace old technologies, and destroy fields in the economy that have become obsolete. What follows is that firms start to compete with each other, not through the price mechanism as traditional economic theory suggests, but through better products and technologies. This 'quality competition' (Schumpeter 1976) replaces 'price competition' as the central driver of economic growth, and inherently implies innovation.

Schumpeter's ideas on economic change and innovation reflect the manufacturing age of the 19th century and the first half of the 20th century. As such, he introduces five types of innovations, which are all relevant in a manufacturing economy: 1) new products or 'product innovations', 2) new manufacturing processes or 'process innovations', 3) new ways to organize firms or 'organizational innovations', 4) opening new markets or 'market innovations', 5) new supply sources for raw materials or 'input innovations' (Fagerberg 2005; Windrum and Garcia-Goni 2008). Since then, Western economies have rapidly evolved towards service economies. In fact, influential theories in economics and service management have proposed that all economic exchanges are in fact service exchanges of which goods are only incidental carriers (Normann 2001). This 'service-dominant view' (Lusch and Vargo 2019) shifts the focus from product innovations to 'service innovations', which covers a wide spectrum of economic transactions. Furthermore, as innovations are produced by people and organizations, the purely economic focus on innovation has been complemented over time with insights from management theory and sociology (Hall and Rosenberg 2010).

Private sector innovation and collaborative innovation research

Because of its close relationship to market dynamics such as competition, the concept of innovation accumulated a lot of popularity in the management literature in the private sector as a means to increase firms competitive advantage (Tsou, Cheng and Hsu 2015). Strategic management theories such as the dynamic capability view considered the dynamic and renewing capacity of innovation as a cornerstone of effective resource and performance management (Teece, Pisano and Shuen 1997). Another popular theory that included innovation as a key management practice was that of the 'ambidextrous organization'. First introduced by Benner and Tushman in their seminal 2003 paper on exploration and exploitation, the concept suggests that organizations which employ both management practices directed towards 'exploring new knowledge' and 'exploiting current processes' would increase their productivity

because of the optimization of existing production processes, but also improve their competitiveness through innovation.

Although they were able to incorporate innovation in comprehensive management theories, according to these theories, organizations were always solely dependent on their own resources. Schumpeterian notions on market growth and quality competition emphasized the need to protect and shield innovations from competitors, for instance through intellectual property, patents, and appropriation, in order to maximize the own competitive advantage (von Hippel 2017). However, as the service industry began to grow larger, more complex and more diverse, the interdependency between firms started to increase. Industries and firms became increasingly specialized because of the substantial growth of knowledge and the extensive complexities of new technological developments, which made it impossible for firms to have all the in-house knowledge of particular products or services (Gnyawali and Park 2011). Firms became more and more dependent on the knowledge and resources from other firms, even competitors. For instance, Powell, Koput and Smith-Doerr (1996) observed that innovation in young, technologically complex industries such as the biotechnology sector, thrived in collaborative networks between biotechnological firms. In fact, the phenomenon of actively reaching out to other firms to innovate was already suggested in the 1960s, by scholars in the field of technological innovation (e.g. Allen and Cohen 1969). Particularly the work of Tushman (1977), Teece (1986), Cohen and Levinthal (1990) and Nonaka (1991) presented large leaps forward in understanding how inter-organizational collaboration can lead to innovation. By collaborating with other organizations, the authors argued that organizations acquire valuable (tacit) knowledge, which might incite new associations between concepts, and hence, innovation.

This ‘organizational learning’ perspective on innovation spurred research into ‘strategic alliances’ between firms, in the form of joint ventures, R&D collaborations, innovation networks and industry clusters (Trott and Hartman 2009). In parallel to this research, Eric von Hippel started in the 1980s with studying how external stakeholders, particularly ‘lead users’, influenced the product development process of firms (von Hippel 1986; Urban and von Hippel 1988; Herstatt and von Hippel 1992). This led to the notion that product and service users outside the actual product or service development process could drive innovation, which implied a direct involvement of external stakeholders in the innovation process. Instead of protecting and shielding innovations from competitors and trusting on the in-house capacity of the internal R&D department to introduce innovations and ensure competitive advantage, it

seemed that firms were actually doing the opposite. New concepts such as 'open innovation' (Chesbrough 2003), 'collaborative innovation' (Ketchen et al. 2007; Davis and Eisenhardt 2011), and 'open collaborative innovation' (Baldwin and von Hippel 2011) were introduced to explain these features of innovation. Although often interchangeably used, these concepts have slightly different meanings. Chesbrough's open innovation concept contrasts open innovation with 'closed innovation', which he perceives to be an inferior alternative (Chesbrough 2003). According to Chesbrough, firms have to be open to external influences in generating innovations, and not isolate their innovations in their own organizations. The concept of 'collaborative innovation' specifies the means through which such an open innovation can be achieved. By collaborating with other firms, firms can share their knowledge, ideas and expertise (Snow, Miles, and Miles 2005), hence enhancing their ability to innovate. Baldwin and von Hippel's concept of 'open collaborative innovation' specifies that the involved actors 'share the work of generating a design and also reveal the outputs from their individual and collective design efforts openly for anyone to use' (Baldwin and von Hippel 2011, 1403), i.e., they together develop the whole innovation.

1.3.2. A concise overview of innovation research in the public sector

Towards a theory of public service innovation

Because of the economic traditions in which the first theories of innovation emerged, innovation scholars were never particularly interested in the public sector. Public services are not driven by economic systems such as the free market; hence there is no need for innovation in the public sector. However, at least two dynamics invigorated the discussion of innovation in the public sector. First, the shift from manufacturing economies towards service economies in Western democracies and the subsequent introduction of innovation in service management theories, increased the relevance of public service innovation. As the public sector is a large contributor of the service economy (e.g. health services, education, infrastructure, etc.), it has a direct impact on that service economy as a principal stakeholder (Windrum 2008). Although Schumpter's perspective on innovation is indeed linked to economic principles, it is not exclusively connected to market competition. The public sector incites significant dynamics in the service economy, affecting the service economy drastically. For instance, some of the most substantial inventions of our time such as the World Wide Web, the internet and biotechnology have been produced by the public sector (Mulgan 2007; Windrum 2008). All of these innovations have had a lasting impact on the service economy and helped to create new markets and industries. Technologies that we now call innovative, such as social media and genetic

modifications, would probably never have emerged without the innovations introduced by the public sector. Realizing the importance of public services for the study of innovation, private sector scholars became more interested in innovation in the public sector. For instance, Windrum and Garcia-Goni (2008) introduced, based on the general principals of Schumpeterian innovation theory, a multi-agent framework which includes political actors, public and private service providers and consumers. Other business scientists have worked on the integration of the industry, universities and government into one model of innovation (i.e. triple helix models, Leydesdorff and Meyer 2003).

Second, a major paradigm shift was ushered in in the late 1970s in the public sector. After many decades of applying the principals of the Weberian bureaucracy to government institutions, the New Public Management (NPM) introduced lessons from private sector management, with a large focus on the privatization and decentralization of public organizations. 'Running government like a business' (Box 1999), with an increased emphasis on input and output efficiency, cost reduction, competitiveness and entrepreneurial leadership (Osborne 2010), the public sector began to expand its management 'toolbox' with private management practices. Citizens were perceived as 'customers' (Thomas 2013) and financial cuts made internal reorganizations necessary, which incentivized an increase in organizational efficiency and service quality (Pollitt and Bouckaert 2017). Public sector innovation was perceived as a viable strategy to achieve these challenging objectives.

Hartley, Sorensen and Torfing (2013) give two reasons for why the NPM spurred the interest in innovation in the public sector. First, the strategy of privatization and decentralization increased the competition between public, private and non-profit service providers, and the substantial budget cuts forced public service organizations to do more with less. This spurred the creation of cost-efficient alternatives, which enhanced the level of public service innovation. Second, the NPM significantly changed the management culture in the public sector, with a stronger emphasis on quality management and strategic management, and an increased focus on performance, efficiency and results. This enabled the introduction of novel management practices in the public sector, and it drove the urge to develop innovative services.

Incentivized by the NPM and the lack of available knowledge regarding innovation creation in the public sector, scholars and practitioners alike adopted private management theories (Hansen and Ferlie 2016). As such, innovation strategies derived from strategic management (e.g. innovation capability theory, Piening 2011; 2013), economic transaction theory (e.g. public procurement for innovation, Edquist, Vonortas, and Zabala-Iturriagagoitia 2015), creativity

management (e.g. innovation cultures, Kim and Yoon 2015), and network theory (e.g. collaborative innovation, Bommert 2010) were successfully applied to the public sector context.

Public sector collaborative innovation research

Although the introduction of the service economy and the NPM were crucial for the increase in interest in public sector innovation, these dynamics cannot solely explain the evolution towards *collaborative* innovation. At least two additional evolutions increased the interest in public service innovation through collaboration: the inclusion of the public sector in economic models of innovation and the rise of the New Public Governance.

The first real introduction of government and other public sector actors into the classic, economic innovation research was through the notion of 'systems of innovation'. At the end of the 20th century, researchers increasingly recognized the complex drivers through which most major innovations were introduced. Research conducted by Freeman (1987), Lundvall (1992), and Nelson (1993) indicated the existence of 'National Systems for Innovation', which were regarded as the combination of institutions that drove technological innovation in developed and developing countries. Innovation policy of the national government was regarded as one of the main reasons for why developing countries such as Japan were able to rapidly innovate. Hence, innovation was not only driven by market mechanisms, but also by government resources. In their work, the authors recognize that, although the firm still has a leading role in the development of innovation, governments are crucial in coordinating the larger 'system of innovation' (Soete et al. 2010). Through reform, public spending and regulation, governments are able to steer the market enough to enhance technological innovation. Charles Edquist (1997, 14) broadened this conception by including 'all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion, and use of innovations'. The author later shaped the research field of 'public procurement for innovation', which is a practical application of the idea that public actors coordinate innovation systems (e.g. Edquist et al. 2015, see also Chapter 3).

However, throughout this research, the private sector still remained the leading actor in developing innovations. This idea was challenged by Etzkowitz and Leydesdorff in their 2000 paper on 'Triple Helix' partnerships of university-industry-government. The authors argued that the network of universities, industries and governments, the interactions between these institutions and the changes in their configurations were essential drivers of innovation. This argument was strengthened by the increasing dependence of the industry on fragmented

knowledge and resources in service-dominant economies and knowledge-based societies. Because of the significant investments that were needed in accessing knowledge for the development of new products or services, a network approach in which knowledge between industry, university and government was shared, was a logical path to take. Although the government still had an important coordinating role, the approach of Etzkowitz and Leydesdorff allowed a more systematic and practical involvement of governments in the innovation process. In fact, one of the configurations of the Triple Helix the authors proposed, suggested an institutional overlap between the three entities, meaning that each of the institutions could take part in the innovation processes of the others, with 'hybrid organizations' as a direct result. Other authors later introduced additional societal fields to the model. One of the most widely used is the 'Quadruple Helix' framework from Carayannis and Campbell (2009), which recognizes that the civil society (which includes citizens and customers/users) is a crucial stakeholder in the knowledge economy and one of the driving forces of innovation.

In parallel to these evolutions in the fields of economics and business administration, a new paradigm was rising in the public sector. It has been argued that the 'paradigm shift' of the NPM was only a transitory phase in the development from the traditional Public Administration (PA) towards the New Public Governance (NPG) (Osborne 2006). Osborne (2006, 2010) distinguishes two key characteristics of the NPG. On the one hand, it proposes a plural state in which multiple spheres of society (industry, government, civil society) together contribute to the delivery of public services. On the other hand, it posits a pluralist state in which multiple processes inform the policy-making system (Osborne 2010, 9). Rather than emphasizing the political perspective as PA did, or focussing predominantly on intra-organizational management conditions as NPM did, NPG applies an inter-organizational network approach to the organization of government and society (Osborne 2006). Government is both coordinator and actor within a large network of public service organizations, non-profit organizations, firms, and civil society.

Due to its emphasis on the interconnected nature of the state and society, the NPG presented an excellent breeding ground for theories of network management (Klijn et al. 2010), collaborative governance (Ansell and Gash 2007) and coproduction (Alford 2014). All of these theories suggest that, by influencing the interactions between stakeholders, government is able to increase the quality of service delivery. First, the network management theory of Klijn et al. (2010) proposes different strategies to manage processes during network interactions between stakeholders. The authors define network management as 'the deliberate attempt to govern

processes in networks' (Klijn et al. 2010, 1065). Four strategies are proposed: 'exploring content' (e.g. searching for variation, goal congruency, etc.), 'connecting' (e.g. activation of actors, resource mobilization, etc.), 'arranging' (e.g. creating ad hoc organizational arrangements), and 'process agreements' (e.g. rules for interactions, decision making rules, etc.). Second, the collaborative governance theory of Ansell and Gash (2007, 544) considers the deliberative and consensus oriented nature of collaborative arrangements between public agencies and non-state actors, which aim to create and implement public policy. The authors present a 'model of collaborative governance' in which they suggest the crucial importance of face-to-face dialogue, trust building, commitment to the process, shared understanding, and intermediate outcomes. Third, although the introduction of coproduction in the public sector can be contributed to the seminal work of Elinor Ostrom in the 1970s, theories on the coproduction of public services were reinvigorated due to the more open and interconnected view on service delivery processes, in which private actors and citizens play important roles (Alford 2014). This trend, for instance, resulted in the introduction of 'service-dominant' logics into coproduction processes, which entails an integration of service users into public service delivery processes (Osborne and Strokosch 2013).

The breeding ground that theories of public governance created, stimulated the transition of NPM notions on innovation, towards collaborative innovation (Hartley, Sorensen and Torfing 2013). Scholars began to use theories of network management, collaborative governance and coproduction in conjunction with inter-organizational collaboration theories on innovation from the private sector, such as alliance theories, open innovation and user-driven innovation, to explain the presence of public service innovation. While a lot of these research trajectories overlap and it is therefore difficult to exactly pinpoint the rise of interest of PA scholars in collaborative innovation, some of the early work on collaborative innovation by Bommert (2010) and Sorensen and Torfing (2011) has certainly propelled the research field. Two key insights regarding collaborative innovation in the public sector are provided by these authors. First, the relevance of collaborative innovation is found in the inability of previous theories of public sector innovation to provide answers to important problems related to how innovation arises in the public sector (Bommert 2010). For instance, innovation theories within the NPM paradigm assert that innovation comes to fruition when the competition dynamics from the private sector are imitated, and that driving the innovation process is only in the hands of public managers (Sorensen and Torfing 2011). Building a 'theory of public service innovation' on these fundaments contradicts the public governance logic that emphasizes the intertwined

nature of government with the other spheres of society, and does not explain how new public services are created and provided through networks of public and private actors.

Second, Bommert (2010) and Sorensen and Torfing (2011) provide insights on the possible mechanism of collaborative innovation. Bommert (2010) asserts that the processes of idea generation and idea implementation/diffusion, which make up the innovation process (Walker 2007), are stimulated by collaboration as a wide range of knowledge and resources are accessed and the implementation and diffusion of the newly created ideas is better supported by the position and capabilities of the involved actors. Sorensen and Torfing (2011) propose that idea generation is spurred by the diversity in experiences and ideas of the involved actors, the selection of ideas is improved because the collaboration provides a platform for joint assessment of the ideas, the implementation resistance is reduced because of the shared ownership of the innovation, and the social and professional networks that are created during collaborative innovation supports the dissemination of the innovation. All these aspects increase the likelihood that innovation is created in collaborative arrangements, even if this is not the main focus of the arrangement.

1.3.3. Relevance of collaborative innovation for public service delivery

Relevance of public service innovation

The overview of collaborative innovation in the public and private sector certainly indicates the evolution of collaborative innovation as a prominent research field, but it does not justify why public service organizations should invest time and energy in collaborations aimed at the creation of service innovations. When advocating the relevance of collaborative innovation for public service delivery, we need to argue why public service organizations should invest in service innovations in the first place. Two arguments can be extracted from the provided literature overviews. The first argument uses the traditional Schumpeterian notion of innovation. Schumpeter's vision that innovation is the main driver of economic growth and development is key in understanding private sector innovation, but is also valid in explaining why the public sector should innovate. Governments and other public sector organizations are important economic actors and account for a large percentage of countries GDP. However, from an economic perspective, competition is essential to accumulate economic rents and stimulate economic growth. As public services are often provided by monopolistic governments, this competition is absent in the public sector. This depiction, however, ignores the interconnected nature of different spheres of the economy (Gault 2018). Indeed, customers in the market are also citizens in a state, and consume both public and private services. Also, market actors such

as firms consume public services and governments consume private services. Therefore, competition dynamics due to innovation in the market might eventually transpose to the public sector as citizens begin to expect and demand more from the public services they use. If governments deliver services that are deemed outdated, of inferior quality, or not aligned to citizen's expectations because the citizens are used to the highly sophisticated services they use from private companies, political leaders may favour investments in better services, which stimulates innovation. Governments that invest a lot in innovating services and technologies might also incite direct competition with market actors, which culminates into an urge to innovate in the market. Either way, economic growth through innovation is stimulated by innovation efforts in the public sector.

The second argument departs from the Schumpeterian notion of innovation, and suggests an approach to innovation that is tailored to the needs of the public sector. Indeed, Schumpeter's notion of economic development through innovation should not be the only perspective on innovation. Societies are faced with health challenges such as pandemics, economic challenges such as financial crises, and ecological challenges such as global warming, which have no obvious and easy solutions. Innovation is a way to find – as a society – solutions for these challenges, as it drives the change and growth of societies. The public sector has a central role in society, as it tackles societal problems through public policy and service delivery. For instance, Sorensen and Torfing (2011) provide three reasons for why innovation is relevant for the public sector. First, citizens and firms have rising demands from the public sector and government, which cannot be satisfied with limited alternations to existing services. The emerging heterogeneity of user needs causes a rise in the demand in customized services (von Hippel 2005; Greer and Lei 2012). At the same time, the government is confronted with decreasing resources, which increases the need for new and smarter services. Second, due to the increasing complexity of society and government, in combination with the growing aspirations of politicians and public managers to enhance the quality of public services, new ways to provide these services are pursued. Third, wicked problems related to health services (e.g. COVID-19 pandemic), public safety, sustainability, etc. are not solved by investing more money or resources in them, or by using existing solutions, but require novel and innovative services.

General types of innovation strategies

As innovation is an important driver of economic and societal growth, the next question is why *collaborative* innovation is a relevant innovation strategy. To answer this question, we need to distinguish three general types of innovation strategies. First, organizations can achieve innovation through in-house endeavours. Creating innovation in house implies that the organizations acquire all the needed capabilities and resources to generate innovation. This innovation strategy resembles what Chesbrough (2003) calls 'closed innovation', in which an in-house R&D department is responsible for creating novel solutions. The knowledge necessary to achieve innovations is present within the organization, and if this is not the case, the organization obtains this knowledge by hiring new staff or investing in new capabilities (Hartley, Sorensen and Torfing 2013). This strategy enables the organization to be independent from external actors in achieving innovation, and achieve a strategic advantage towards competitors. It, however, also implies a large investment in innovation related activities and capabilities, which may have no direct or immediate turnover for the operational activities of the organization.

Second, organizations can also outsource innovation activities to experts, such as business consultants, IT-companies, service organizations, research institutions, or other providers. Instead of developing the innovations in house, contracting-out innovations means that the organization accesses the knowledge needed to innovate ad hoc (Mata and Woerter 2012), without the need to structurally invest in the long-term perseverance of this knowledge, which lowers transaction costs and risks (Stanko and Calantone 2011). As most governments and public sector organizations possess a complex spectrum of different services, establishing a R&D team that encompasses the innovations for all these services seems redundant. Also, the direct competitive advantage achieved by generating in-house innovations and protecting this innovation from competitors is less of a driver for governments and public sector organizations, which means that the threshold of contracting-out innovation is lower than for firms in highly competitive markets. The combination of increasing the efficiency, effectiveness and economy of government, and stimulating privatization and decentralization during the NPM era have made innovation through contracting-out one of the primary innovation strategies in government (Hartley, Sorensen and Torfing 2013).

Third, organizations can also work together to innovate their services, utilizing the synergistic dynamics of collaboration to improve and innovate existing services. The collaborative interactions between the involved actors are crucial in this collaboration strategy of service

innovation. Although contracting-out innovation implies a certain interaction between actors, these interactions are not collaborative in nature. The innovation efforts can be traced back to the contractor in outsourced innovation, while it are the combined efforts of the collaborating actors that are responsible for the creation of innovation in the collaboration strategy. Also, while the in-house innovation strategy implies substantial input investments (i.e. in personnel, capabilities, resources), the collaboration strategy implies significant process investments in order to achieve synergies between the different actors (Klijn and Koppenjan 2015). Because of the close collaborative interactions, the involved actors will be interdependent in achieving the innovation. The collaboration might be used to create innovative ideas that are eventually implemented in the own organization, but the collaboration might also entail the joint ownership of the innovation (cf. Sorensen and Torfing 2011), which implies that the collaboration can also be the main vehicle for the implementation, diffusion and use of the innovation. Furthermore, a wide variety of 'collaboration types' might be used to apply the collaboration strategy, including, but not limited to Triple-Helix collaborations, Public-Private Partnerships (PPPs), coproduction arrangements, experimental partnerships such as living labs, joint ventures, and industry or sector clusters.

Relevance of collaborative innovation

Having described three general strategies of service innovation, why would the collaboration strategy be increasingly more relevant in comparison to the in-house and contracting-out strategies to achieve public service innovation? As we have mentioned, societies and economies have become increasingly more complex over the last decades. Socio-economic and technological advancements such as globalization and digitalization have increased the interconnectivity of societies across the world, which facilitated considerable steps forward in what societies are capable of doing. This interconnectivity is not only visible on a global scale, but also within societies, as previously distinct spheres of societies become tightly coupled with each other. However, societal complexity induces problem complexity, as multiple fields or spheres of societies become interconnected, and problems which were previously isolated to one sphere are now connected to problems in other spheres. 'Wicked problems' such as global warming, poverty, inaccessible or inferior health care and education, systemic discrimination of population groups, etc. can be regarded are symptoms of this societal complexity. Even technological advances, which are often aimed at addressing large societal issues, further increase this societal complexity, as the solutions themselves become more complex. Each technological advancement in digitalization, biotechnology, medicine, engineering, etc. makes

previous technologies more sophisticated. Comprehending specific aspects or components of these technologies requires substantial know-how, which triggers specialization and knowledge concentration. Specialization and know-how regarding solutions and services is, therefore, fragmented, as no one possesses all the necessary knowledge to substantially change these services.

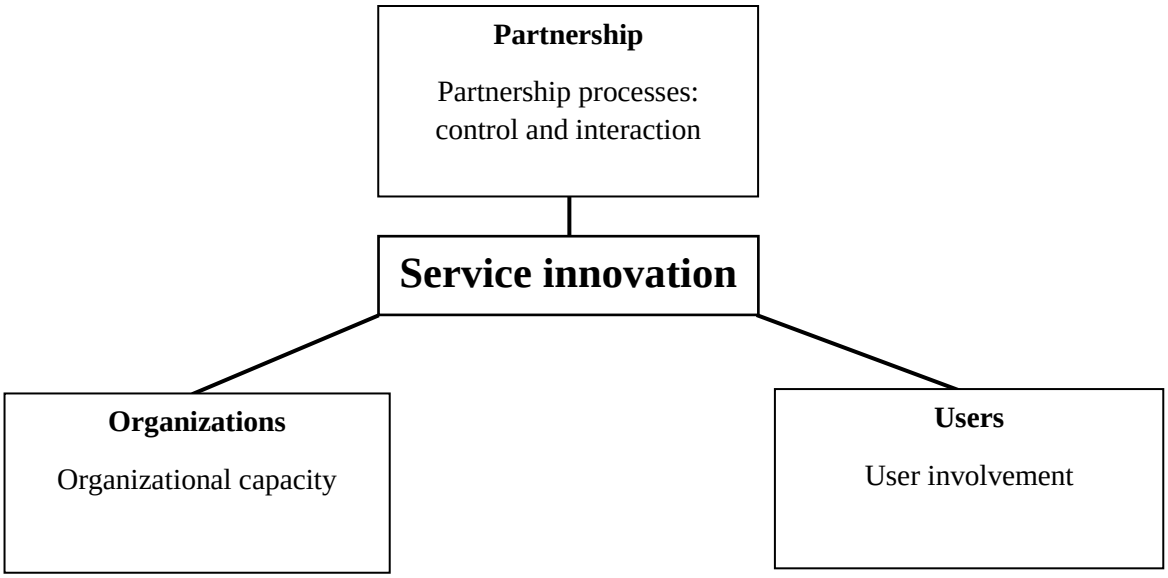
The combination of cross-cutting societal problems and technological advancements in services triggers the need for collaboration strategies to innovate. Three arguments relate to this. First, individual actors such as governments, firms or third sector organizations often do not possess the proper knowledge and capabilities to innovate complex services, and are thus dependent on other actors to innovate. In-house and outsourced innovation are insufficient strategies to innovate these complex services, as the fragmentation of know-how in such services is often too substantial to incorporate it in the own organization (in-house) or find a contractor that possesses all of the required knowledge (outsourcing). Collaborative partnerships with the relevant actors allow the innovator to access and connect the proper knowledge and resources, an thus, overcome capability barriers. Second, complex societal problems concern multiple stakeholders. Even when the innovator manages to accrue all of the necessary capabilities in-house or through outsourcing, addressing societal problems has direct repercussions for a wide variety of stakeholders, such as citizens, user groups, industries, civil society, government agencies, political leaders, etc. Collaboration efforts with these stakeholders increases the legitimacy of the innovation. Third, innovation through collaboration benefits from additional collaborative advantages, such as learning opportunities, joint efforts to implement services, enhanced usability assessment of the innovation, and creative ideation by combining diverse perspectives and ideas. Collaborative advantages entail a win-win situation for those involved in the collaboration, which is more beneficial to solve complex and interrelated problems, as multiple stakeholders are affected by these problems. In-house or outsourced innovation present zero-sum benefits, which benefits individual actors, but leaves the network of actors that should be capable of solving the problem unaffected.

1.4. State of the art on collaborative innovation

In the last decades, the literature on collaborative innovation has contributed extensively to our understanding of which factors explain the emergence of public service innovation. In this section, we introduce the state of the art on conditions of collaborative innovation. In this literature, three large groups of studies can be identified, which are illustrated in figure 1. A

first group of studies focuses on the *organizational level*. Climate for creativity, innovation leadership, knowledge and skills, and collaboration cultures are examples of conditions at this level of inquiry. A second level is oriented towards the *partnership level*, with a specific focus on how the partnership processes unfold in the partnership. Two aspects of these partnership processes are considered: 1) the conditions that allow actors to exercise control over the process, such as contracts and procedures, and 2) the conditions that stimulate constructive interactions between the partners, such as network management, trust, information sharing, and consensus building. A third level of analysis focuses on the role of *service users* in processes of collaborative innovation. Service users are valuable stakeholders in innovation processes because they possess knowledge and experiences that can propel the innovation process. We consider the relevance of user involvement and the conditions that can lead to proper user involvement.

Figure 1: Conditions of collaborative innovation



1.4.1. Organizational capacity

A first group of studies considers conditions on the level of the organizations in the partnership, with special attention for the organizational capacities of the involved partners. For instance, Sorensen and Torfing (2017) point out that the diversification of the partners within the collaboration is of crucial importance to allow creative ideation. Also, diversification of the partners makes a broader range of resources and capabilities accessible, which facilitates the

creation and implementation of novel solutions (Ansell and Torfing 2014). The resources and capabilities of the involved partners are, therefore, of crucial importance. This includes organizational traits, such as the amount of innovation training in organizations (Brogaard 2017), the technical know-how of partners (Munksgaard et al. 2017), the presence of transformational leadership (Hartley, Sorensen and Torfing 2013; Lindsay et al. 2017; van der Voet and Steijn 2020) and an innovation and collaboration culture in the organizations (Kim and Yoon 2015; Lopes and Farias 2020), and the absence of risk-aversion (Bommert 2010) and red tape (Sorensen and Torfing 2018). However, it also relates to the experience of the partners with earlier collaborative arrangements, as partners with a lot of experience in collaborative innovation are better in responding to and managing the complex interactions in the collaboration (Van Meerkerk and Edelenbos 2014; Munksgaard et al. 2017; Brogaard 2021). The appropriate connection between these organizational capacities is important to produce the required synergies on the partnership level. Lasker et al. (2001) suggest that such partnership synergies are one of the most important collaborative advantages. The innovation process is however also shaped by the support of stakeholders that are present in or exert influence on the involved organizations (Brogaard 2021). For instance, the managers of the partner organizations and the political leaders possess substantial influence regarding the employment of resources, staff and time, and are crucial stakeholders to provide legitimacy to the created innovations (Grotenbreg and Van Buuren 2018). Without the support of the managers and political leaders, it is unlikely that innovative ideas will be implemented in the involved organizations.

1.4.2. Partnership processes: control and interaction

A second group of studies focuses on the partnership-level conditions of collaborative innovation. On the one hand, partnership processes include the attempts to control the uncertainty in innovation processes by using contracts and procedures (Brogaard 2021). Although innovations require substantial investments, they do not always work properly in a real-life setting, are not always sufficiently adopted by the public, or are not sustainable in the long term (Brown and Osborne 2013, 187). The inherently risky nature of innovation is further increased by the unpredictability of collaborations with diverse partners. To ensure that the objectives and actions of the collaborating partners are aligned, and innovative results are achieved, collaborating innovators often formulate conditions in contracts which legally protect them in case one of the partners should deviate from what was agreed. This is often part of broader procurement procedures which, for instance, impose the realization of innovative

results through tender award criteria (Georghiou et al. 2014). Furthermore, in order to coordinate the collaborative efforts and structure the behaviour of the partners, collaborations apply 'process agreements', which entail 'rules for entrance into or exit from the process, conflict regulating rules, rules that specify the interests of actors or veto possibilities, rules that inform actors about the availability of information about decision-making moments' (Klijn et al. 2010, 1069). While the contract conditions structure the input and output of the collaborative innovation process, the process agreements help to structure the collaborative innovation process itself.

On the other hand, a large portion of the literature considers conditions related to the quality of interaction between the collaborating partners, as essential for innovation. A systematic literature review conducted by Cinar et al. (2019) points to a lot of interaction barriers between collaborating partners, which inhibit the innovation process. For instance, a lack of shared understanding (e.g. Cramer, Dewulf, and Voordijk 2014), effective network governance (e.g. Aagaard 2012), adequate communication and knowledge sharing (e.g. Levine and Wilson 2013), proper involvement by crucial stakeholders (e.g. Martin, Currie and Finn 2009), and appropriate accountability (Maluka et al. 2011) are shown to be critical interaction barriers between innovating public sector organizations. In addition to these barriers, public-private collaborations also experience a lot of interaction barriers in relation to failures to fulfil the contract conditions (Cinar et al. 2019). Other authors have suggested and studied additional collaboration-related conditions such as the level of autonomy (McNamara 2012) and engagement of partners (Birkinshaw et al. 2007), the presence of conflict management (Meijer and De Jong 2020), meta-governance strategies (Sorensen and Torfing 2017), visionary leadership (van der Voet and Steijn 2020), and an appropriate team climate (Anderson et al. 2014), and the pursuit of a joint ownership over new ideas (Sorensen and Torfing 2011).

This literature also pays special attention to the level of trust between collaborating partners. Recent systematic literature reviews on public service collaboration and innovation of de Vries et al. (2015), Voorberg et al. (2014), Cinar et al. (2019), Lopes and Farias (2020), and Brogaard (2021), all highlight the crucial importance of trust between the partners. Trust mitigates difficult negotiations and reduces conflict (Entwistle and Martin 2005), increases shared understanding and confidence in the actions of others (McNamara 2012), and eases the coordination of actions and the acceptance of positions and roles in a collaboration (Poocharoen and Ting 2015). Trust might be low in collaborative innovation processes as cultural diversity between the involved stakeholders may cause tensions (Diamond and Vangen 2017). However,

creativity and innovation requires psychological safety, which allows individuals to think and act openly and without any hesitation, and which is easier to achieve when individuals trust each other (Edmondson 2003; Paulus and Dzindolet 2008; Anderson et al. 2014; Paulus et al. 2018). Moreover, collaborative innovation requires intensive engagement, dialogue and commitment from the partners in order to realize, adopt and diffuse the innovation properly, which is also easier when the partners trust each other (Sorensen and Torfing 2011; Torfing 2019). Additionally, as innovation and collaboration are inherently risky and uncertain, boosting trust will be of particular importance in collaborative innovation processes (Brogaard 2017). Trust is a crucial ingredient for any collaborative endeavour, but is even more essential in processes where the end result (i.e. the innovation) is unclear and unpredictable.

Special attention should however be directed towards the innovation generating processes inherent to collaborative endeavours. Ansell and Torfing (2014) (see also Stevens and Verhoest 2016) describe these processes as 'generative mechanisms', and they include processes of diversity and synergy, mutual and transformative learning, consensus building, and commitment to achieve the end result (see also Sorensen and Torfing 2011). First, by collaborating with different stakeholders, the diversity of knowledge and perspectives increases, which subsequently increases the likelihood of achieving synergies between ideas of stakeholders. The literature considers this dynamic as a crucial aspect of achieving collaborative advantage, observed in both the public and private sector (Lasker et al. 2001; Huxham and Vangen 2005). It has also been linked to creative ideation in groups (Baruah and Paulus 2009) and knowledge creation (Page 2017), as diversity and synergy increase the likelihood that new and original associations between ideas and concepts are created (Korde and Paulus 2017). Second, learning is critical when pursuing collaborative innovation, as it is the primary process through which new perspectives and ideas arise in collaborative teams. Knowledge and believes are transformed by the perspectives and ideas of others, which allows for constructive interference between perspectives, and the creation of novel ideas (Sorensen and Torfing 2011; Crosby, 't Hart and Torfing 2017; Trivellato, Martini, and Cavenago 2020). Third, consensus building allows individuals to converge towards a commonly shared idea. Through constructive discussion, dialogue and goal alignment, individuals identify similarities between different perspectives and create shared understanding (Innes and Booher 1999; Sorensen and Torfing 2011; Klijn and Koppenjan 2015; Giekse, van Buuren and Bekkers 2016). Fourth, due to the interdependent nature of collaboration and the required implementation of innovative services, the willingness of the partners to invest time, resources and energy into the adoption and

implementation of the innovation is of crucial importance for the success of collaborative innovation (Sorensen and Torfing 2011; Ansell and Torfing 2014; Stevens and Verhoest 2016; Torfing 2019). Joint commitment to realize the solution prevents endless episodes of deliberation and discussion which fail to ever achieve an implementable solution.

1.4.3. User involvement

A third group of research focusses on how external stakeholders, and more specifically 'service users' are involved in the collaborative innovation process. For obvious reasons, service users (e.g. customers, citizens, professionals, firms, etc.) are regarded as one of the primary stakeholders of service innovation, and inadequate support and engagement of users has been observed as a major barrier for public service innovation (Cinar et al. 2019). The interests and expectations of the users and citizens are leading in designing a user-oriented solution, and will therefore significantly shape the innovation process (Sørensen and Torfing 2017). Users provide legitimacy to the created innovations and their expectations and demands should therefore be included in the innovation process. One way to do this is by involving the users in the innovation process. Actively seeking support from users by involving them into the innovation process allows the collaboration to access valuable information regarding service experiences, expectations and the local implementation context (von Hippel 1994; Bogers 2010; Simmons and Brennan 2017). Hence, user involvement does not only increase the legitimacy of services; it also increases the likelihood of achieving innovative services.

A recent literature review of Roszkowska-Menkes (2017) gives several reasons for why users are involved in innovation processes. First, users' needs are heterogeneous, which means that customization to these specific needs is often required. Without user involvement, this customization is difficult to achieve. Second, as we already alluded to, users possess 'sticky information', which is information of users that is both costly to obtain and crucial to innovate (von Hippel 1994). Involving users makes this sticky information accessible. Third, users have usually no interest in 'protecting' their innovations, which means that their innovations are more easily adopted and diffused by service providers. This subsequently increases both the rate with which innovations are implemented and the potential impact of the innovation on the user community.

The literature on user innovation benefits substantially from coproduction research, which has a long tradition in the public sector. Since its conception as a research field in the 1970s with the work of Elinor Ostrom, coproduction has become an integral part of the service literature,

both in the public and private sector. Applied to collaborative innovation, coproduction can be considered as a way through which users can be actively involved in the innovation process (Prahalad and Ramaswamy 2004; Vargo and Lusch 2004; Etgar 2008; Bogers et al; 2010; Greer and Lei 2011). Scholars have proposed different typologies to distinguish the various ways in which users can be involved. For instance, Alam (2002) proposes a framework that describes different types of user involvement using four criteria: 1) the purpose of the involvement, 2) the stages in which users are involved, 3) the intensity of involvement, and 4) the way in which the involvement is conducted, e.g. through deliberation, consultation, participation in testing, etc. Another typology is that of Bonvaird (2007), who makes a distinction between seven types of service coproduction, which are conditioned on the role of the service professional as service deliverer or service planner, the role of the service user as co-planners or co-deliverers, and the role of service user as sole planner or deliverer. Osborne and Strokosch (2013) provide us with an additional typology which is specifically applied to service innovation. The authors suggest three types of user coproduction: 1) consumer coproduction, in which users are empowered at the operational level, 2) participative coproduction, which aims at user participation at the strategic level, and 3) enhanced coproduction, which is aimed at user-led innovation of public services, and which is a combination of the previous two types. Lastly, Arnkil et al. (2010) distinguish between 1) design for users, which implies a dominant role for the service providers during service creation, 2) design with users, which means that users work on equal footing with the service providers, and 3) design by users, which implies a dominant role of the users in the creation of their services.

In addition to these descriptive features of types of user involvement and coproduction, some studies have looked at the conditions that influence user involvement. For instance, scholars have found a positive effect of various capabilities of users, including psychological skills (Etgar 2008), dialogue skills (Pralahad and Ramaswamy 2004), and the commitment to invest time in the involvement (Simmons and Birchall 2005). Other authors have pointed at barriers of successful user involvement, including the cognitive limitations of the involved users and the lack of motivation to radically innovate services (Lettl 2007). Other barriers relate to the service providers that involve users in the innovation process, including the lack of time to properly involve users and the failure to involve ‘unseen’ users (Gulliksen and Eriksson 2006). Applied to e-services, research from Karlsson (2013) adds several other barriers to those mentioned, including the lack of clear user target groups, the tension between highly specialized target groups and the democratization of the innovation process, and the lack of adequate skills

and knowledge of the users in knowledge intensive service processes. More recent studies on user involvement also indicate the importance of appropriate management of user involvement. For instance, Jæger (2013) shows the managerial tension between achieving desirable results in the innovation process (which are sometimes predetermined through funding or tender conditions), and simultaneously being sufficiently sensitive to user demands and ideas. Similarly, Torvinen and Ulkuniemi (2016) indicate the importance of managing the tasks of the involved users. They argue that 'the more specialized, insulated, and stable the individuals' task in the process is, the less likely they will recognize the need for change and the space for innovation' (p. 66). The authors also show the importance of collaboration-related conditions in user involvement, such as dialogue, access to relevant information, trust, and openness.

1.5. Remaining questions

Although the research in public service innovation and collaborative innovation has expanded greatly in recent years, there still remain large gaps in our knowledge on how public service innovation comes about and how collaboration stimulates this innovation. Throughout the description of the state of the art on collaborative innovation, it became clear that the research field has explored a wide variety of conditions that seem to be important in processes of collaborative innovation. These conditions go from organizational capabilities of the involved actors, partnership-related conditions such as contracts, process rules, shared understanding, trust, learning and consensus building, to the way in which users are involved in such processes.

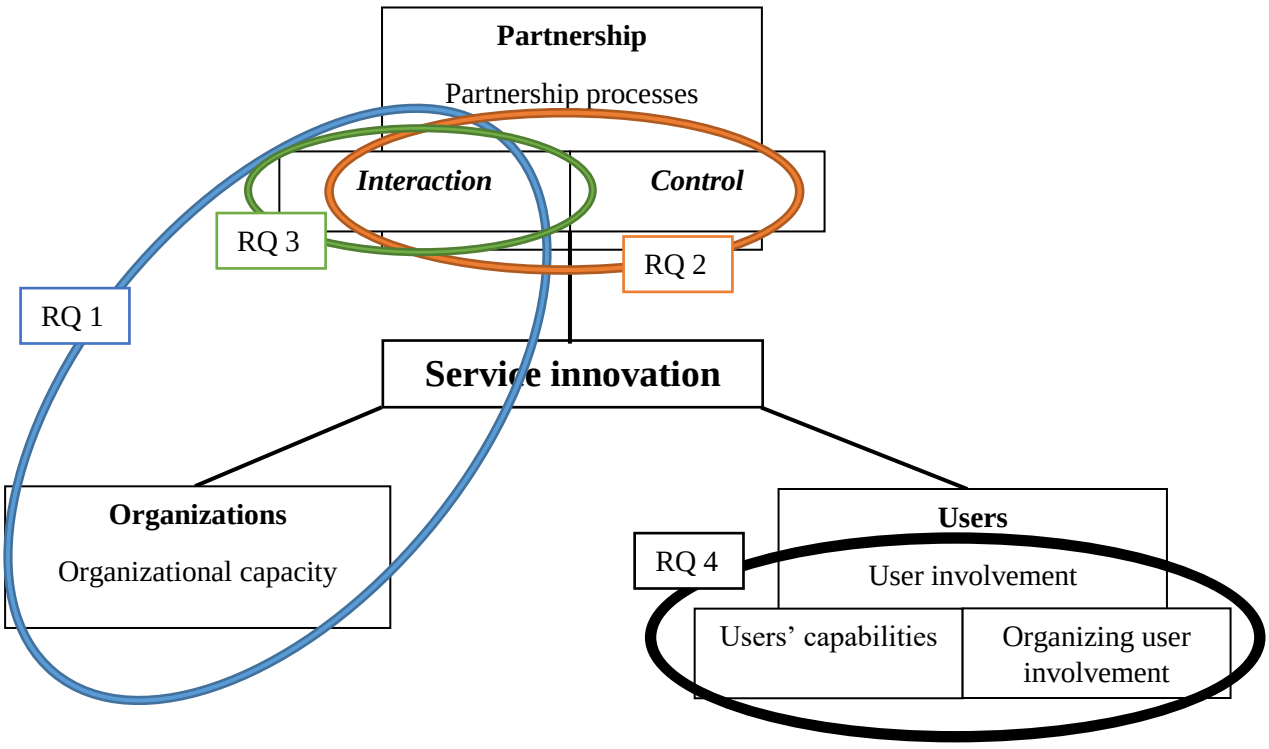
However, the current approach to explaining collaborative innovation particularly considers isolated conditions, without recognizing the interdependent nature of these conditions. In reality, conditions exhibit an effect on innovation in a particular setting, in which other conditions also affect the innovation. This *configurational approach* to collaborative innovation has very recently gained traction in the literature, with contributions of for instance Torfing et al. (2020). This dissertation emphasizes the importance of configurations of conditions to explain their effect on innovation and hence aims at integrating aspects of different streams of literature. Two levels of integration and configuration are pursued. On the one hand, conditions in the same conceptual clusters (i.e. organizational capacity, control structures in partnerships, collaborative interactions in partnerships, and the involvement of users) are combined in order to provide deeper insights into the dynamics of their combined presence in innovation processes. On the other hand, conditions from different conceptual clusters are combined to

provide overarching insights into how public service innovation is achieved. The following, general research question is proposed:

How do configurations of conditions related to the involved organizations, the partnership, and the involved users generate public service innovation through collaboration?

The configurational approach to collaborative innovation allows us to address important questions that are not sufficiently answered in the current literature. Figure 2 illustrates the different clusters of conditions and summarizes the conditions that will be considered in the next sections. We start from the perspective of innovation in single public service organizations, after which we look more closely at partnerships between multiple (public and private) stakeholders.

Figure 2: Configurations of conditions



A first question pertains to the connection between internal capabilities and external conditions of innovation. The exploration of new ideas, knowledge and perspectives is a critical aspect of the ideation phases of the innovation process (Walker 2007; Sorensen and Torfing 2011). These new ideas, knowledge pools, and perspectives can originate from both internal and external sources. For instance, an organization can create an internal setting, climate or culture, which encourages the creation and exploration of new ideas. However, the same organization might

also encourage the exploration of external ideas and perspectives by collaborating with external actors. Studies most often consider internally oriented conditions, such as leadership, management, creative abilities of employees, in isolation from externally oriented conditions such as collaboration, co-creation, and user-involvement, while they each stimulate ideation processes. How these internal and external conditions interact with each other is very interesting as it goes beyond the internal/external dichotomy that is often used in innovation research. We propose the following research questions:

RQ 1: How do conditions related to the internal and external exploration of new ideas, knowledge and perspectives influence public service innovation?

A second question, now from the perspective of public-private partnerships, relates to the connection between conditions that are aimed at controlling the innovation process, for instance through procurement procedures and contracts, and conditions that facilitate intensive interaction and collaboration, for instance network management and information sharing. Both types of these conditions are recognized as important in the literature, but their connection has not been properly addressed. However, these conditions relate rather naturally to each other, as the former introduce stability and predictability, especially in the input and output phases of the innovation process, while the latter harness the dynamic processes associated with innovative ideation and implementation, particularly in the throughput phase of the innovation process. The dynamic and turbulent core of the collaborative innovation process is therefore 'protected' by the stable and structured outer layer of the process. This influences the way in which collaborative partnerships are managed, and recent literature of Warsen et al. (2019) shows that the combination of contract management and network management stimulates the performance of public-private partnerships. Because of the mentioned relationship between the two types of conditions, a similar combined effect is to be expected on innovation in partnerships. Discovering such an effect would broaden our knowledge regarding the management instruments that are required to stimulate collaborative innovation. We therefore propose the following research question:

RQ 2: How does the combined presence of control structures such as procurement practices, and collaborative interactions such as network management and information sharing, stimulates innovation in collaborative partnerships?

A third question relates to the generative processes of collaborative innovation. Scholars such as Sorensen and Torfing (2011) and Ansell and Torfing (2014) (see also Stevens and Verhoest

2016) have proposed various ‘mechanisms’ of collaborative innovation, including synergy, learning and commitment. These conditions are at the core of explaining why collaboration results in innovation. However, the mechanism of collaborative innovation and its components are not well understood. The conceptual work of for instance Ansell and Torfing (2014) helps in delineating different components of the mechanism, but empirical research into the combination of these components is also necessary. Processes of diversification, learning, consensus building and achieving commitment are entangled with each other when they work on the innovation process (Ansell and Torfing 2014). They each might indeed affect particular phases or aspects of the process, but their effect on innovation should be analyzed in conjunction. Identifying the combined effect of these generative processes allows us to begin to unpack the mechanism responsible for collaborative innovation. We propose the following research question:

RQ 3: What is the combined effect of generative processes of collaborative innovation on innovation in collaborative partnerships?

A fourth question concerns the specific conditions under which external stakeholders, more specifically, services users, are involved in processes of collaborative innovation and how this involvement affects the innovation process. Conditions such as the availability of adequate know-how and skills of the involved users, and the way in which users are involved by the other partners have been suggested to impact the innovation process. However, successfully involving users is not a straightforward task, as the service provider needs to be confident that involving the users will enhance the innovation, and the involved users need to be certain that their input will be used and their efforts are not in vein. Both conditions related to the know-how and skills of users, and conditions related to how empowered and free users are to engage in the innovation process, need to be balanced to ensure the emergence of synergies between the users and the service providers. Without such synergies, the likelihood increases that one of the actors invests a lot in the collaboration without obtaining the benefits of the collaboration. We therefore propose the following research question:

RQ 4: How do conditions related to the knowledge and skills of users and conditions related to the empowerment and freedom of users together affect innovation in collaborative partnerships?

1.6. Research design and methodologies

The dissertation uses a mixed-method approach by relying on both qualitative and quantitative data. The empirical data used in the dissertation originated from three different sources, which each consider different types of empirical environments, and are ideally suited to study specific configurations of conditions. First, to answer RQ1, we analyzed data from the Australian Public Service (APS). As RQ1 considered the internal, organizational conditions and external, collaborative conditions of exploration in single public service organizations (i.e. no partnerships), the large dataset of more than 30 000 observations from 102 APS agencies provided an ideal empirical environment to test our hypotheses. The quantitative survey data also allowed a generalization of the results.

Second, in order to provide insights on the combined effect of conditions related to the control structures and collaborative interactions in innovation processes on innovation in partnerships (RQ2), we studied 24 public-private partnerships (PPPs) in Belgium and the Netherlands. Both transport infrastructure PPPs (railways, roads, and sluices) and social infrastructure PPPs (swimming pools, prisons, and government buildings) were studied. 71 semi-structured interviews were conducted with 74 public and private professionals in the partnerships. Each of these respondents was asked to fill in a survey prior to the interviews.

Third, data that was collected as part of the European Horizon 2020 framework programme 'TROPICO' provided the empirical data to address RQ3 and RQ4. Data from a total of 19 partnerships was collected in five European countries (Belgium, Denmark, Estonia, the Netherlands and Spain). This data was ideally suited to take a closer look at various collaboration processes and the effect of user involvement on collaborative innovation processes, as each of the partnerships introduced technological health care innovations and also involved users during the innovation process. The cases were selected to represent the most common types of eHealth technologies, and the selected countries represented different administrative traditions in (continental) Europe. Moreover, both partnerships that were coordinated by the public actors and private actors were selected. Interview and survey data from more than 130 project coordinators, public actors, private actors and service users was collected by an international team consisting of members from the participating countries, led by the Belgian research team.

The dissertation also relies on a mixed-method analytical approach, using both qualitative and quantitative research methodologies. Due to our interest in the combined effects of multiple

conditions, we heavily rely on qualitative comparative analysis (QCA). QCA is a set-theoretic methodology that is highly suited to analyze the effects of combinations of conditions on a certain 'outcome'. The methodology has three characteristics (see Ragin 2008). First, QCA allows 'configurational causation', which means that the method searches for combinations of conditions that lead to a certain outcome, and thus considers the effect of a combination of conditions on the outcome. Second, QCA follows the principle of 'equifinality', which means that multiple distinct combinations of conditions can result in the same outcome. This means that the resulting configurations (i.e. the 'solution paths') can be quite complex, and a careful interpretation of the results (e.g. by using qualitative case information) is often necessary. Third, QCA results are asymmetric, which means that a specific combination of the presence or absence of certain conditions can produce the same outcome. This implies that 'the explanation for the non-occurrence of the outcome cannot automatically be derived from the explanation for the occurrence of the outcome' (Schneider and Wagemann 2012, 6). Although QCA allows to study a larger number of cases than is convenient with qualitative case study research, only limited generalizations can be made with the method because of its inherently qualitative characteristics. To provide generalizable results, this dissertation approaches RQ1 through quantitative methodologies (i.e. regression analysis).

1.7. Contributions of the dissertation

The contributions of the dissertation are situated on the theoretical, empirical, methodological, and practical level. On the theoretical level, the dissertation provides new theoretical insights by employing theories from outside public administration, and by integrating theories using a *configurational approach*. Such a configurational approach has been recommended in network literature (e.g. Klijn and Koppenjan 2015), in organizational capability research (e.g. Andrews et al. 2016), in user-oriented innovation models (e.g. Arnkil et al. 2010), and in recent collaborative innovation research (Torfing et al. 2020), which are all relevant research fields for this dissertation. The configurational approach allows a more holistic approach to collaborative innovation and public service innovation research, as it fills the gaps specific research (e.g. procurement literature, network management literature, etc.) leaves behind. This approach is very valuable in current public sector innovation literature, as existing research lacks overarching theories that are applicable to a public service context (de Vries et al. 2015; Cinar et al. 2019). As innovation has its roots in economic theory and private sector management literature, exploring these fields of inquiry is valuable to better understand the intricate dynamics of the public service innovation process. However, even innovation literature

from the private sector is incomplete (particularly when it comes to collaborative innovation), and is sometimes difficult to apply in a public sector context. The configurational approach helps in integrating disparate theories and in unpacking the great complexity of processes and conditions of collaborative innovation. This approach also introduces more nuance into public service innovation literature, as it shows that the effect of one set of conditions should be assessed in conjunction with the effect of other conditions. In other words, the dissertation provides evidence that public service innovation is not caused by isolated conditions, but that multiple related conditions should be considered when trying to explain innovation.

On the empirical level, the dissertation contributes to the empirical evidence of the effect of conditions and processes of collaborative innovation on public service innovation. The dissertation addresses the lack of knowledge on the processes of collaborative innovation, and investigates how different types of conditions have a combined effect on public service innovation. For this, the dissertation uses a large set of rich empirical data. Both quantitative and qualitative data from multiple countries (i.e. Australia, Belgium, the Netherlands, Denmark, Estonia, Spain) was used, which broadens insights on collaborative innovation. Furthermore, the data was collected in several policy fields, such as infrastructure and health care services, and multiple types of cases were involved in the study (i.e. public service organizations, public-private partnerships, public-private eHealth collaborations).

Methodologically, the dissertation contributes to the call for a broader exploration and use of research methods in public service innovation literature (de Vries et al. 2015). The multi-method approach combines qualitative data collection and analysis methods with quantitative methods, which broadens insights from the research results, but also retains in-depth knowledge about the dynamics, mechanisms, and causal relationships of collaborative innovation processes. The combination of semi-structured interviews and surveys allowed the collection of multiple types of data, which enhances the validity and reliability of data. The qualitative comparative analysis (QCA) methodology, which is used in three of the four papers, allows a more systematic approach to comparative case studies. Broader, although still cautious, generalizations to similar cases therefore become possible with QCA, without losing all of the deep, qualitative insights (which is a characteristic of case study research). Furthermore, one of the key properties of QCA is its configurational causation, which means that a combination of conditions can explain the presence of an outcome. This supports the theoretical and empirical contributions mentioned above, by enabling a detailed analysis of combined effects of the conditions on innovation.

The dissertation also provides several practical policy recommendations. These practical insights concern three general observations. First, the *configurations* of conditions show how different conditions are combined to generate innovation. Hence, a balancing act between stimulating these different conditions is crucial to exploit the combined effect of the conditions. For instance, employing control structures such as contracts has to be balanced with collaborative interaction such as information sharing and network management. Second, some conditions show *non-linear relationships*, which means that positive effects of certain conditions can turn negative if they are not well-balanced. For instance, diversity of knowledge and perspectives is great to enhance creativity and innovation, but can also inhibit collaboration, which negatively affects the collaborative innovation process. Third, some configuration of conditions are *contingent* on the partnerships in which they operate. Configurations of conditions of user involvement that stimulate innovation in partnerships are different in partnerships that are coordinated by public actors than in partnerships that are coordinated by private partners. Proper attention is dedicated to these practical insights in the empirical chapters and in Chapter 6.

1.8. Outline of the dissertation

The dissertation is structured as follows. Chapter 2 addresses RQ1, and studies the effect of an organization's climate for creativity and its collaborative diversity (i.e. diversity of collaborations with external stakeholders). The chapter studies internal capacities of public service organizations in combination with external, collaborative processes, by using creativity research and collaborative governance/innovation literature. The chapter employs a regression analysis to uncover significant effects of the conditions on innovation in a large dataset of public sector organizations. Chapter 3 addresses RQ2 by considering the combined effect of procurement logics and collaborative logics on innovation in public-private partnerships (PPPs). The chapter relies on theories of 'public procurement for innovation' and 'collaborative innovation', and uses QCA to uncover the combined effects of these two types of conditions on 24 PPPs. Chapter 4 is directed towards the theoretical deepening and empirical assessment of the generative processes of collaborative innovation. The chapter introduces a theoretical framework with which it studies the relationship between the four generative processes by testing the combined effect of these four processes on the innovativeness of generated public services in 19 public-private health care collaborations using QCA. Chapter 5 addresses which conditions of user involvement and coproduction lead to highly innovative public services. The chapter presents an original theoretical framework, which connects valuable capabilities of

users with the way in which partnerships involve these users. The chapter tests this framework through QCA by studying the combined effect of these conditions on the innovativeness of the created services of 19 public-private collaborations. Last but not least, Chapter 6 concludes the dissertation by answering the research questions, and by providing an extensive theoretical reflection. The chapter ends by providing the theoretical and practical contributions of the dissertation, and discussing the limitations and opportunities for future research. The chapters of the dissertation are illustrated in table 1.

Table 1: Chapters of the dissertation

Chapter	Title	Authors	Research question	Conditions/variables	Data and methods	Status
Chapter 1	Collaboration as a driver for innovation	Chesney Callens	/	/	/	/
Chapter 2	Internal and external exploration for public service innovation – Measuring the impact of a climate for creativity and collaborative diversity on	Chesney Callens, Jan Wynen, Jan Boon and Koen Verhoest	How do conditions related to the internal and external exploration of new ideas, knowledge and perspectives influence public service innovation?	IVs: • Climate for creativity • Collaborative diversity DV: • Innovation	APS data analyzed through LPM	Submitted to PMR
Chapter 3	Combined effects of procurement and collaboration on innovation in public-private-partnerships: a Qualitative Comparative Analysis of 24 infrastructure projects	Chesney Callens, Koen Verhoest and Jan Boon	How do conditions related to 'procurement for innovation' logics and conditions related to 'collaborative innovation' logics stimulate the creation of innovation in PPPs and what is their combined effect on this innovation?	Conditions • Design freedom • Stimulating tender award criteria • Network management • Information sharing Outcome: • Innovation	Data from 24 PPPs, analyzed through QCA	Published in PMR
Chapter 4	Unpacking generative processes of collaborative innovation in public-private collaborations	Chesney Callens and Koen Verhoest	What is the combined effect of diversity, learning, consensus building and implementation commitment on innovation in partnerships?	Conditions: • Diversity of ideas and perspectives • Learning through interaction • Consensus building • Implementation commitment Outcome: • Innovation	TROPICO data of 19 eHealth partnerships, analyzed through QCA	Submitted to PMR
Chapter 5	User involvement as a catalyst for collaborative public service innovation	Chesney Callens	What is the combined effect of the empowerment of users, the presence of users with specialized knowledge, and the absence of restricting rules and procedures on innovation in partnerships?	Conditions: • Empowerment of users • Specialized knowledge of users • Restricting rules and procedures Outcome: • Innovation	TROPICO data of 19 eHealth partnerships, analyzed through QCA	R&R in JPART
Chapter 6	A configurational approach to collaborative innovation	Chesney Callens	/	/	/	/

Notes

[1] Note that this definition integrates all the mentioned aspects of innovation, but that the definitions later on in the dissertation will sometimes be limited to the two foundational characteristics of innovation (i.e. its 'newness' and combination of idea generation and idea adoption).

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Chapter 2

Internal and external exploration for public service innovation – Measuring the impact of a climate for creativity and collaborative diversity on innovation

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Abstract

Public service innovation involves a process of creative exploration of new ideas, knowledge and perspectives. The article poses that creative exploration emerges from the combination of a climate for creativity that is active *inside* the organization, and collaborations with diverse actors that are present *outside* the organization. We test the effect of these conditions on innovation using data from the Australian Public Service. Our findings demonstrate that both a climate for creativity and collaborative diversity are positively related to innovation, yet a tipping point exists at which the positive effects of collaborative diversity on innovation turn negative.

Key words: public sector innovation; exploration; climate for creativity; collaborative diversity; Australian Public Service

2.1. Introduction

Across the globe, public sector organizations are faced with increased demands to execute their tasks more qualitatively, effectively and cost-efficiently (Windrum and Koch 2008). These demands are not easy to meet, since they are voiced in a context of significant economic and social-demographic challenges, such as ageing populations, strong declines in government legitimacy and trust, and budget scarcity (de Vries et al. 2018). In order to turn things around, practitioners and scholars agree that public sector organizations need to reinvent themselves to increase their problem-solving capacities and, ultimately, their performance (Osborne and Brown 2013). Innovation, in the form of new or improved products, services, processes, or policies that break with the past, is of critical importance; both as a practice and as a topic of scholarly endeavour. Innovation drives transformative change in organizations, as it introduces novelty and directs the organization away from entrenched trajectories. Innovation is of critical importance for public sector organizations to solve wicked problems, to respond to the increasing demands for customized services of citizens, to strive for better service quality, and to confront the scarcity of resources through smart solutions (Sorensen and Torfing 2011).

However, achieving innovation is far from obvious for public sector organizations. A couple of reasons can be given. First, governments and public sector organizations can be challenging breeding grounds for innovation because of their hierarchical, command-and-control, and bureaucratic structures, which limit open exploratory processes, and the presence of institutional artefacts, which contribute to the stability of the organization, but also to its inertia (Hartley, Sorensen and Torfing 2013). Second, competitive pressures to 'innovate or die', which are a central motor of innovation in the private sector (cf. 'creative destruction', Schumpeter 1942), are mostly absent in the public sector (de Vries et al. 2015). Third, public sector organizations tend to be more risk aversive than private sector organizations, because of their use of public resources, the strong external control on how these resources are spent by external stakeholders such as politicians, the media, and the general public, and the absence of (punishing effects of) decreased revenues when performance degrades (Gullmark 2021).

The challenging setting in which public sector innovation occurs, has spurred research into the stimulating conditions of innovation in the public sector. Multiple conditions have been considered, such as innovation leadership (van der Voet and Steijn 2020), innovation capabilities (Piening 2011, 2013; Gieske, Duijn and van Buuren 2020; Clausen et al. 2020), innovation training (Brogaard 2017), innovation pressures from the institutional field (Osborne

1998; Verhoest et al. 2007; Hinings et al. 2018), and collaborating or co-creating with external stakeholders such as users (Hartley, Sorensen and Torfing 2013; Nesti 2018). Remarkability, most of these conditions are either focused on the internal attributes of the organization (e.g. capabilities, leadership, training), or correspond to external antecedents of innovation (e.g. institutional pressures, external collaborations, co-creation). This approach is beneficial to uncover key aspects of innovation, but it also blurs the relative importance of internal and external conditions. In other words, questions regarding the type of conditions (internal or external) in which an organization should primarily invest, and what the relationship between these conditions is, remain unanswered due to this approach.

Such an approach is particularly tricky when the same underlying mechanism is responsible for the creation of innovation, but the conditions are separated from each other. For instance, one of the most successful mechanisms to explain how innovation emerges is that of the innovation process, in which sequential phases of idea generation and idea implementation allow the translation of creative ideas into innovative solutions (Damanpour and Schneider 2008; Sorensen and Torfing 2011; Meijer 2014). A crucial aspect of the initial ideation stages of the innovation process is the ability to generate creative ideas by exploring new ideas, knowledge and perspectives (Katila and Ahuja 2002). This creative exploration can originate from both inside and outside the organization, as both employees and external stakeholders can be the source of new ideas. However, largely separated literature streams have looked at internal and external exploration, with organizational creativity research considering the former and collaborative innovation literature studying the latter. This article develops a theoretical model of exploration that combines internal and external exploration for innovation. The framework allows to empirically test whether the source of innovation is found in agencies' internal climate for creativity, their external collaborations, or a combination of both. We propose the following research question:

How do conditions related to the internal and external exploration of new ideas, knowledge and perspectives influence public service innovation?

The article contributes on two aspects to the current literature. Theoretically, the framework brings together earlier insights that suggest that exploration processes can manifest themselves in two ways. On the one hand, literature on organizational creativity suggests that organizations which possess an internal climate for creativity are better able to stimulate creative ideation processes, because divergent thinking in employees is encouraged, which allows the employees to explore new ways of doing things (Anderson, Potočnik and Zhou 2014). Although a critical

condition for understanding internal exploration processes, few research has considered its effect on service innovation in the public sector. On the other hand, collaborative innovation literature suggests that collaboration with a variety of external actors, whether intentionally directed towards the production of innovation or not, enables the exploration of a diverse set of knowledge pools, experiences and perspectives, and stimulates synergies between the involved actors (Torfing 2019). Although the diversity of actors with which the organization collaborates (i.e. collaborative diversity) is perceived as a foundational aspect of collaborative innovation, the direct effect of collaborative diversity on service innovation in the public sector remains largely unknown (Torfing et al. 2020). Furthermore, as both conditions are related to the same exploration mechanism that is inherent to the innovation process, we consider how the interaction between a climate for creativity and collaborative diversity generates even larger effects for public service innovation.

Empirically, the article contributes by providing empirical evidence for the effect of an internal climate for creativity and external collaborative diversity, and their interaction effect, on innovation in public service organizations. We rely on data from the 2019 wave of the Australian Public Service (APS) employee census, which resulted in a large dataset of 31,501 observations from respondents at the executive level of the APS. Demircioglu (2019) discusses several characteristics in the APS that make it significant for the study of innovation, given that its structures (e.g. Office of Innovation and Science), long term objectives concerning innovation (Australian Government DIIS, 2015), and history (of radical and comprehensive public management innovations) are all conducive to innovation. By exploiting large N quantitative empirical data from the APS, we contribute to a research field that is dominated by low N case study research (De Vries et al. 2015; Arundel, Bloch, and Ferguson 2019; Demircioglu and Audretsch 2020; Demircioglu and Van der Wal 2021). The theoretical and empirical contributions of the article enrich our knowledge about the enabling conditions of public service innovation, and help practitioners in making informed choices about the practices that enhance innovation in their organizations.

In the remainder of this article, we develop our theoretical model of innovation, by introducing the process of generating public service innovation, and discussing how a climate for creativity and collaborative diversity increases the likelihood of attaining innovation in public sector organizations. Next, we present the data and methods used, followed by the results and a discussion and conclusion section.

2.2. Theory

2.2.1. The process of generating public service innovation

Generating innovative public services is a process that entails multiple phases. For instance, Sorensen and Torfing (2011) argue that the innovation process is composed out of four distinctive stages: 1) generating ideas, 2) selecting ideas, 3) implementing ideas, and 4) disseminating new practices. Other authors propose a two-stage process, with the first stage entailing idea generation and the second stage including idea adoption (Damanpour and Schneider 2008). A critical aspect of the first stages of the innovation process in these models is the effectiveness of the innovator(s) in achieving *novel ideas*. The degree to which new, creative ideas are generated, depends to a large extend on the level of 'divergent thinking' that is achieved (Acar and Runco 2012). Divergent thinking means that individuals consider less obvious or conventional concepts, and are able to create original and novel ideas. In the first stages of the innovation process, individuals explore a variety of distinct concepts and ideas, which stimulates their divergent thought. For instance, ideas from other individuals may influence and inspire the ideas of the innovator, which stimulates divergent thinking (Harvey 2014). The better the innovators are able to explore a broad range of possible ideas, the more they are enabled to 'think outside the box', and the higher the likelihood that some of the ideas that are retained in the subsequent stages of the process, will turn out to be innovative. As such, facilitating the opportunity to explore new ideas, perspectives and knowledge enables public service innovation.

These ideas, perspectives, and knowledge pools can originate from both inside and outside the organization. On the one hand, facilitating exploration opportunities inside the organization enables bottom-up creative ideation amongst the employees (Anderson, Potočnik and Zhou 2014). Employees are a group of individuals that possess great affinity with the existing services of the organization, which means that they should have a realistic judgement of which ideas are feasible. This capacity to anticipate the effects of ideas on the service delivery increases the likelihood that the new ideas are eventually implemented in an innovative solution (Rietzschel et al. 2010). On the other hand, facilitating exploration opportunities outside the organization, by collaborating with a wide variety of external stakeholders, introduces excessive variance into the organization, as the organization has now access to a broad set of ideas, perspectives and knowledge (Hartley, Sorensen and Torfing 2013; Torfing 2019). This excess of variance

stimulates divergent thinking amongst the collaboration partners, which can lead to the implementation of novel ideas into an innovative solution.

In the following sections, we discuss two conditions related to the exploration of new ideas, knowledge and perspectives. The first condition, 'climate for creativity', enables the exploration of the ideas, knowledge and perspectives of *internal* actors, such as employees and managers. The second condition, 'collaborative diversity', enables the exploration of the ideas, knowledge and perspectives of *external* actors, such as other workgroups, agencies, governments, and stakeholders. The two sets of conditions are each developed in their own research fields, with the former being part of creativity research, and the latter being included in collaborative innovation research. As both of these conditions are based on the same mechanism of exploration, we also consider the effect the interaction between the two conditions has on innovation in public service organizations.

2.2.2. Climate for creativity

A substantial literature focuses on the attributes of employee creativity, and how it affects organizational innovation (Shalley, Zhou, and Oldham, 2004; Zhang and Bartol 2010; Mumford 2012). Creativity scholars argue that creativity is an antecedent of innovation in that it deals with the creation of novel ideas without the requirement that these ideas are adopted or implemented in an organization, which is, however, a crucial aspect of organizational innovation (Amabile 1988; Anderson, Potočnik and Zhou 2014). Creativity research is primarily concerned with processes of creative idea generation, in which divergent thinking is prominent (Basadur and Finkbeiner 1985; Runco and Basadur 1993). Through divergent thinking, individuals refrain from premature convergence, as they are less restricted in their thinking and consider more inventive and original ideas. Brainstorming activities are examples of how divergent thinking can be stimulated in groups of employees (Nijstad and Stroebe 2006; Kohn and Smith 2011; Paulus, Baruah and Kenworthy 2018), but a significant portion of the literature on creativity also focusses on contextual factors that contribute to this divergent thinking. One of the most important contextual features is that of the *climate for creativity*.

An organizational climate can be defined as the cognitive representations or perceptions and believes individuals in an organization have about their proximal work environment (Anderson and West 1998; Hunter, Bedell and Mumford 2007). Climates that support creative behaviour of employees stimulate divergent ideation as employees are encouraged to explore new things without being at risk of sanctions if things should fail (West 1990; Anderson and West 1994;

Anderson and West 1998; Anderson, Potočnik and Zhou 2014). Different taxonomies have been used to describe the features of climates for creativity, but most of them relate to features such as the freedom of individuals to express ideas, the support and encouragement of the organization or team to come up with new things, and the acceptance that risk-taking and failure is part of innovation (Hunter, Bedell and Mumford 2007). Research reveals a strong relationship between the presence of a climate for creativity and the creative performance of organizations (Tesluk, Farr and Klein 1997; Bain et al. 2001; Mathisen and Einarsen 2004). Because of the importance of generating creative ideas for the innovation process, we propose the following hypothesis:

Hypothesis 1: A climate for creativity has a positive effect on innovation in public sector organizations.

2.2.3. Collaborative diversity

An influential stream of innovation literature has emerged over the last decades that focuses on 'opening-up' the innovation process by involving external actors in the development of innovation (Chesbrough 2003). Rather than relying on the creative potential of the own employees, this literature explains innovation by the degree to which individuals in the organization collaborate with external actors (e.g. Cohen and Levinthal, 1990; Lane et al., 2006; Roberts et al., 2012; Ritala and Hurmelinna-Laukkanen 2013). Collaboration increases a public service organization's ability to innovate as disparate actors engage in joined problem-solving activities, which spur processes of mutual learning and knowledge creation (Sorensen and Torfing 2013; Torfing 2019). Whether the collaboration is intentionally designed to produce innovations or not, divergent thinking is stimulated in collaborations as individuals are influenced and inspired by the knowledge and ideas of the partners in the collaboration, and are incentivized to consider other perspectives and believes (Harvey 2014; Coursey et al. 2018). The orientation of collaborative innovation research is, therefore, outward: directed towards the exploration of external ideas, perspectives and knowledge (Torfing 2019).

One of the key attributes of collaborative innovation is the involvement of a diverse set of actors in the innovation process. The differences between the actors stimulate idea generation as new perspectives and ideas are accessed and new ideas are generated through processes of mutual learning and knowledge exchange. The inclusion of a wide variety of actors in the innovation process increases the breadth of knowledge that is accessed and facilitates creative ideation and innovation (Dell'Era and Verganti 2010; Davis and Eisenhardt 2011; Hartley, Sorensen and

Torfing 2013; Sorensen and Torfing 2017; Touati et al. 2019; Torfing 2019). The logic of including diverse actors to enhance the innovation process implies that having multiple collaborations with different target groups of involved actors is beneficial for innovation, as more opportunities to explore new ideas, knowledge, and perspectives are created. Examples of such different collaborations are collaborations with other workgroups within the same organization, collaborations with other agencies, and collaborations with other government levels and external stakeholders (e.g. citizens, users, firms, etc.). The diversity of these collaborations, or '*collaborative diversity*', might, therefore, positively affect innovation. We propose the following hypothesis:

Hypothesis 2: Collaborative diversity has a positive effect on innovation in public sector organizations.

2.2.4. Climate for creativity and collaborative diversity

Both climate for creativity and collaborative diversity are derived from the mechanism of exploring new knowledge, ideas and perspectives. The conditions only differ in their orientation towards resp. internal and external actors. Hence, a combined pursuit of both conditions might have an even greater effect on innovation. Indeed, stimulating exploration opportunities inside the organization by establishing a climate for creativity might also influence exploration opportunities outside the organization. Possessing a climate for creativity can have a stimulating effect on the relationship between collaborative diversity and innovation for two reasons. First, organizations that have a climate for creativity stimulate divergent thinking in their employees (Anderson, Potočnik and Zhou 2014), which, in turn, might stimulate the divergent thinking already present in the collaborations, even further. Individuals that are exposed to a climate for creativity in their own organizations are used to exploring alternative ideas and solutions, which is a useful skill during potential ideation processes in collaborations. Second, as organizations with a climate for creativity stimulate divergent thinking in their employees, it is likely that these organizations will be more susceptible to new ideas created by these collaborations. For instance, Gong, Zhou and Chang (2013) show a positive relationship between the absorptive capacity of organizations and the creativity of employees. We propose the following hypothesis:

Hypothesis 3: The interaction between a climate for creativity and collaborative diversity has a positive effect on innovation in public sector organizations.

2.3. Data and Variables

2.3.1. Data sample

The data used in this paper stem from the 2019 wave of the Australian Public Service (APS) employee census. The survey captures attitude and opinion data on important issues such as wellbeing, innovation, leadership, learning and development, and engagement of the APS workforce[1]. The APS employee census is primarily an online survey that invites civil servants to participate by email and provides them with a unique link to access the survey. The 2019 APS employee census was administered to all available Australian Public Service (APS) employees. This census approach provides a comprehensive view of the APS and ensures no eligible respondents are omitted from the survey sample, removing sampling bias and reducing sample error (see https://apsc.govcms.gov.au/appendix-1-aps-workforce-data for a detailed description of the dataset, and specifically the sampling and coverage issues). Although participation is encouraged, the APS employee census is a voluntary activity. Nonetheless, in 2019, 77% of all APS employees (or 104,472 out of 136,527 employees) decided to participate. Questions regarding innovation were only asked if response to the actual classification level is; executive level 1, executive level 2, senior executive service band 1, 2, or 3. This reduced our sample to 31,501 observations.

The APS offers an interesting case to explore the role of a climate for creativity and collaborative diversity to attain innovation. Pursuing government innovations has been a matter of strategic importance in the APS since the mid-2000s (Australian Government DIIS, 2015). Research of Demircioglu (2019) indicates the necessity and importance of pursuing innovation for the Australian government. The author argues that the geographic isolation of Australia and its economic dependence on other countries have made the pursuit of innovation a major priority for the country, which is reflected by the fact that the Australian government is one of the principal drivers of innovation and economic growth in the country (Demircioglu 2019). Challenges such as the rapidly evolving operating environment for public services, changes in public demands and expectations of government, advances in technology with a trend towards digital service delivery, financial pressures, and the rising performance expectations of public service delivery, further highlight the need for extensive service innovations. This context makes the APS an interesting case to examine the role of internal and external conditions of innovation.

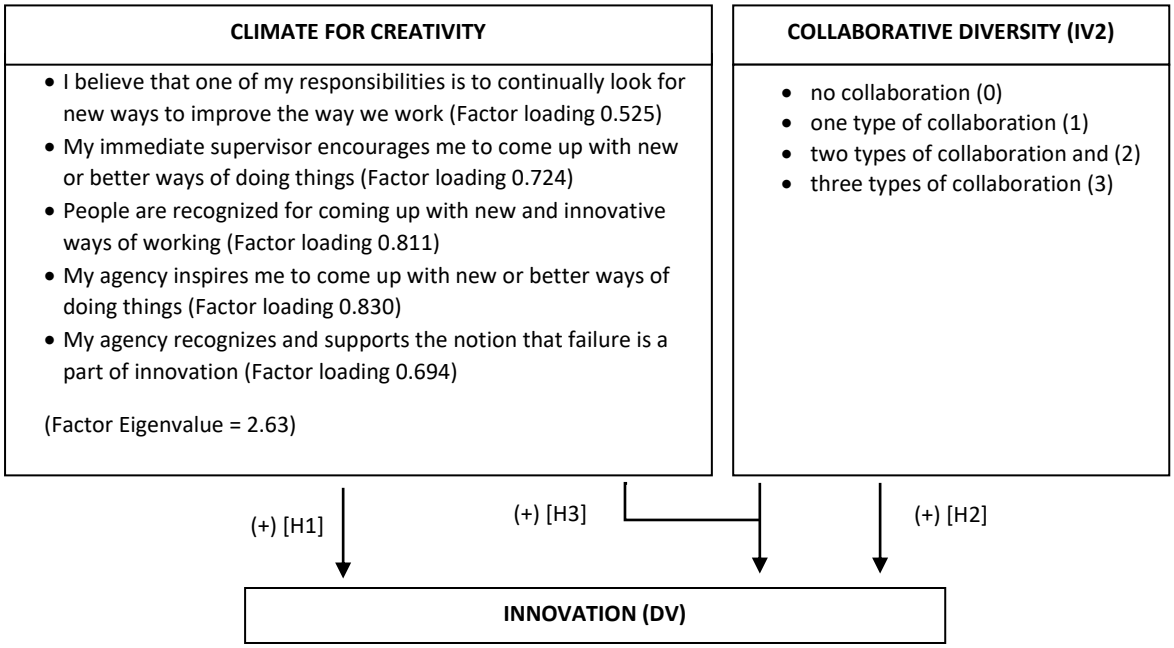
2.3.2. Measuring Innovation

Innovation is in this article perceived as a specific *outcome*, in the form of a new or improved product, service, process, or policy that is significantly different from previous products, services, processes or policies (Damanpour, Walker, and Avellaneda 2009; de Vries, Tummers and Bekkers 2015; Demircioglu and Van der Wal 2021). To distinguish innovation from concepts such as 'creativity', we follow the dominant perspective in the literature that innovation is something that needs to be adopted (Amabile 1988; Rogers 2003; Anderson, Potočnik and Zhou 2014). Hence, innovations studied in this article are solutions that are made available to particular users (e.g. citizens, the own organization). This study only considers relatively recent implementations of innovation (i.e. implemented within the last year). By using a definition of innovation that included all of the criteria above, the respondents were asked if their workgroup implemented any innovations in the last 12 months (No/Yes)[2].

2.3.3. Measuring a climate for creativity

We define a climate as the cognitive representations or perceptions and believes individuals in an organization have about their proximal work environment (Anderson and West 1998), which reflect experiences at the individual or group level (Hunter, Bedell and Mumford 2007, 70). Five items from the APS survey, related to a climate for creativity, were factorized and are presented in Figure 1. Examples are: 'I believe that one of my responsibilities is to continually look for new ways to improve the way we work' and 'People are recognized for coming up with new and innovative ways of working'. These items are in line with existing literature and measurements of a climate for creativity (e.g. West 1990; Anderson and West 1998; Mathisen and Einarsen 2004; Anderson, Potočnik and Zhou 2014; Isaksen and Ekvall 2010; Oke, Prajogo, and Jayaram 2013; Popa et al. 2017; Demircioglu and Berman 2018). The factor score (Eigenvalue = 2.63) is used in the subsequent analyses.

Figure 1: Relationship between IVs and DV



2.3.4. Measuring collaborative diversity

We defined collaborative diversity as the presence of multiple collaborations with different target groups of involved actors. We consider three general types of collaborations with target groups (that is: outside the workgroup): collaboration with individuals from […] (1) other workgroups within the same agency; 2) other APS or Commonwealth government agencies; and 3) other levels of government or other external stakeholders. The higher the diversity in these types of collaborations (e.g. one type of collaboration vs. three types of collaboration), the higher the diversity of knowledge, ideas and perspectives, as each type of collaboration is directed towards a different type of target group. To measure the collaborative diversity, respondents were asked whether they worked together with other workgroups, other agencies or other levels of government/external stakeholders during the last 12 months. The responses were grouped in one variable, which indicated if they engaged in no collaboration, one type of collaboration, two types of collaboration, or all three types of collaboration (see Figure 1).

2.3.5. Control variables and descriptive statistics

We control for gender, age and classification level of the respondent as well as for organizational size. By controlling for these factors, we want to reduce the possibility that the found influences of our independent variables on innovation are in fact due to the influence of other variables which are not in the model. In Table 1, descriptive statistics, as well as a correlation matrix are presented.

Table 1: Descriptive statistics

Variable	Survey question(s)*	Mean	SD.		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Innovation	q78	0.702	0.458	(1)	1.000						
Gender	q1	1.525	0.569	(2)	-0.004	1.000					
Age	q2	1.772	0.889	(3)	-0.032	-0.016	1.000				
Classification	q7	1.080	0.272	(4)	0.113	0.014	-0.116	1.000			
Organizational Size	Size	1.245	0.554	(5)	0.037	0.002	0.034	0.029	1.000		
Climate for creativity	q77a, q77b, q77c, q77d, q77e	0.124	0.874	(6)	0.309	-0.105	-0.005	0.172	0.015	1.000	
Collaboration diversity	q88, q90, q92	2.219	0.905	(7)	0.118	-0.020	0.002	0.173	0.067	0.104	1.000

*The survey and accompanying dataset is publicly available at: https://www.apsc.gov.au/aps-employee-census-2019

To check for multicollinearity, we also calculate the variance inflation factor (VIF). The mean VIF equals 1.06 whereby the highest VIF is 1.15. These values indicate that multicollinearity is not an issue. Note that the questions regarding innovation, climate for creativity and collaborative diversity were only asked to respondents with a classification level of 'Executive Level 1 (or equivalent)', 'Executive Level 2 (or equivalent)', 'Senior Executive Service Band 1 (or equivalent)' or 'Senior Executive Service Band 2 or 3 (or equivalent)'. This greatly reduced the sample size from 104,472 observations to 31,501.

2.4. Methods and Results

In order to estimate our outcome variable, innovation, we make use of a linear probability model (LPM). As Beck (2011) indicates, using linear regression to estimate binary dependent variables is becoming standard practice. This model implies:

$$P[y=1|x] = E[y|x]:$$

$$E[y|x] = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m = P[y=1|x]$$

Following Angrist (2001) and Angrist and Pischke (2009) a non-linear model may fit the conditional expectation function more closely than a linear model. However when it comes to marginal effects, this should matter little. A downside of this method is that this regression is inherently heteroscedastic (Cameron and Trivedi 2005), which is why we use robust standard errors[3]. Before turning to the results of the LPM, it is important to stress that the large sample size (31,501 observations) of the dataset poses an additional challenge. With such large samples, estimations based on small-sample statistical interferences can be ineffective at best and misleading at worst. An extremely large sample will make the standard errors extremely

small, so that even minuscule distances between the estimate and the null hypothesis become statistically significant (Lin, Lucas and Shmeli, 2011). To overcome this issue, we run our models on a random sample existing of 20% of the initial dataset or approximately 6300 observations. We reiterate this process (drawing a sample with replacement and running the LPM) 50 times. The results of our analyses are presented in Table 2.

Table 2: LPM results for the implementation of innovation

Variable	(1)	(2)	(3)
Gender	0.022	0.022	0.022
	(2,193)	(2,200)	(2,198)
Age	14,48***	15,16***	14,73***
Under 40 years	-0,028*	-0,028*	-0,028*
	(-2,178)	(-2,178)	(-2,201)
55 years or older	0.002	0.002	0.002
	(0,164)	(0,171)	(0,167)
Senior Executive Service	0,077***	0,08***	0,081***
	(4,783)	(4,916)	(4,997)
Organizational size	18,60***	17,86***	19,27***
Medium (251 to 1,000 employees)	0,044**	0,044*	0,045**
	(2,757)	(2,776)	(2,804)
Small (Less than 250 employees)	0.028	0.028	0.029
	(1,251)	(1,286)	(1,296)
Climate for creativity	0,155***	0,174***	0,155***
	(24,878)	(10,959)	(24,74)
Collaborative diversity	0,04***	0,04***	0,124***
	(6,206)	(6,214)	(3,972)
Interaction collaborative diversity & climate for creativity		-0,008	
		(-1,332)	
Collaboration diversity (squared term)			-0,022**
			(-2,792)
Original Sample		31501	
Sample sizes used (with replacement)		20%	
Iterations		50	
Average R^2	0.107	0.109	0.109

Average robust standard errors in parentheses. *p<.1. **p<.05.***p<.01. F tests are used to test the joint significance of Age and Organizational size.

Based on the first column of this table, we notice positive significant effects for climate for creativity as well as for collaborative diversity. This finding is in line with Hypothesis 1 and Hypothesis 2. As an organization's climate for creativity is more strongly developed, the likelihood of implementing innovations increases. The same holds for collaborative diversity.

The more diverse the collaborations, the higher the likelihood that this results in innovation. However, surprisingly, the interaction effect between a climate for creativity and collaborative diversity, theorized in Hypothesis 3, is not significant (Table 2, second column).

What could explain the absence of the expected interaction effect? We believe that the explanation can be found within the intricacies of the effect of collaborative diversity on innovation. Indeed, literature also suggests drawbacks of collaboration and collaborative diversity, which can cause the relationship with innovation to be non-linear. For instance, literature indicates that collaborations entail a lot of complexities, which creates lengthy and sometimes underperforming processes (Huxham 2003; Klijn and Koppenjan 2015). Cinar et al. (2019) show in a recent literature review that interaction barriers between public organizations, caused by a lack of shared understanding, a lack of effective network management, inadequate communication and information sharing, and a lack of involvement of the partners, damage the innovation process. The more diverse the collaboration partners, the more likely that these interaction barriers will emerge, as diversity might incite conflict, distrust, miscommunication and information asymmetries, and might reduce group cohesion, which all inhibit the innovation process (Hambrick, Cho, and Chen 1996; Pelled, Eisenhardt, and Xin 1999; Mannix and Neale 2005). Increasing this diversity by establishing different collaborations with different target groups might aggravate the drawbacks of team diversity and provoke difficult to manage and, therefore, underperforming innovation processes.

Collaborative diversity might, hence, be expected to support innovation up to a point at which the complexities and interaction barriers inherent to an increasing collaborative diversity begin to inhibit innovation. The relation between collaborative diversity and innovation might therefore be non-linear; more specifically: *inverted U-shaped* (positive up to a certain point after which this effect decreases again). Such an effect explains why the interaction term is neutral or non-significant, as the effect of collaborative diversity on innovation implementation can in some instances be positive while in other instances it will be negative. If this effect is relatively well spread, it could make the interaction term non-significant. To further explore this line of reasoning, we also include a squared-term for collaborative diversity in column 3. The results in column 3 confirm that the relationship between collaborative diversity and innovation is non-linear. Collaborative diversity positively affects innovation, however only up to a certain point (inverted U-shaped). The effect of collaborative diversity until this variable reaches a value of 2.8 (mean of the variable equals 2.2 with a standard deviation of 0.9 and a maximum of 3). When the value of collaborative diversity surpasses this value of 2.8, its effect

on innovation becomes negative. In sum, when collaboration becomes too diverse, it will eventually inhibit innovation.

2.5. Discussion and Conclusions

This study contributed to literature and practice by combining internal and external exploration of ideas, knowledge and perspectives, and its effect on public service innovation. Two conditions related to internal and external exploration were studied. On the one hand, a climate for innovation inside the organization stimulates employees to explore new ideas without being at risk of sanctions if ideas should fail, which increases the divergent thinking of these employees (Anderson, Potočnik and Zhou 2014). On the other hand, collaborating with a diverse group of external actors increases the variety of ideas, knowledge, and perspectives, which also stimulates divergent thinking as individuals are inspired by each other's ideas (Harvey 2014). Positive relationships were expected between the two conditions and innovation in public service organization. Furthermore, a positive interaction effect between the two conditions was assumed, as collaborating individuals are highly skilled in divergent thinking during the collaboration because of their climate for creativity, and organizations are more likely to adopt new ideas from collaboration partners because of their climate for creativity.

Three main findings can be extracted from this article. First, our results confirmed Hypothesis 1, which means that the presence of a climate for creativity indeed positively affects innovation in public sector organizations. This implies that conditions related to organizational creativity have important consequences for innovation in public sector organizations and it illustrates the need for creativity research in the public sector (Kruyen and van Genugten 2017). It also shows the practical relevance of a climate for creativity in public sector organizations. Managers should recognize that the knowledge and creative potential of their own employees is one of the most important antecedents of innovation in the organization, and that novel and creative ideas often originate from internal sources (Paulus and Nijstad 2003; Paulus, Baruah and Kenworthy 2018). Actively creating a climate for creativity should therefore be pursued by the organization's managers.

Second, Hypothesis 2 was also confirmed, which indicates that collaborative diversity enhances innovation, as the knowledge and ideas accessed from external stakeholders facilitate learning processes out of which innovations can arise. This result matches findings from recent collaborative innovation studies in the public sector (e.g. Hartley, Sorensen and Torfing 2013; Stevens and Verhoest 2016; Brogaard 2017; Callens, Verhoest and Boon 2021), but it adds to

these studies the importance of collaborative diversity in order to create innovation. Whereas the previously mentioned studies focused on partnerships that produced innovation, our study shows that organizations that have diverse collaborations with different external actors are more successful in acquiring innovation. Hence, not only the diversity in involved actors is important, but also the diversity in collaborations with these external actors. This implies that managers can improve their innovation by collaborating with external actors, and that they should do this by increasing the diversity in types of collaborations (e.g. collaborations with other workgroups, other agencies, other government and other external stakeholders such as citizens and firms). In other words, managers should realize that diverse collaborations with external actors is a way to achieve innovation.

Third, our empirical evidence contradicted Hypothesis 3. We did not find an interaction effect between a climate for creativity and collaborative diversity, in their relationship to innovation. The absence of an interaction effect led us to consider the possibility of a non-linear relation between collaborative diversity and innovation. Although research confirms the positive effects of collaboration for innovation, literature also suggests some drawbacks related to collaborations, which might harm the innovation process. As collaborations with external stakeholders are complex endeavors in which perspectives, interests and resources have to be aligned, substantial efforts arise in managing these collaborations (Klijn and Koppenjan 2015). These complexities might result into underperforming processes and might damage the innovation process (Huxham 2003; Cinar et al. 2019). Increasing the diversity can also lead to conflict, distrust, miscommunication and information asymmetries, which all inhibit the innovation process (Hambrick, Cho, and Chen 1996; Pelled, Eisenhardt, and Xin 1999; Mannix and Neale 2005). At first, collaboration with a variety of different actors stimulates and enhances creative ideation and innovation, but an accumulation of complexities and interaction barriers later on in the project, inhibits the positive effects of collaborative diversity on innovation.

Private sector literature has pointed to this paradoxical nature of diversity for innovation, in that diversity stimulates innovation, but can also obstruct innovation as it undermines the stability of organizational processes, which are needed to produce innovation (Bassett-Jones 2005). Empirical research in the private sector has identified non-linear relationships between diverse collaborations and innovation. For instance, Dell'Era and Verganti (2010) found evidence of a curvilinear, inverted U-shape relationship between innovation and the number of products that were developed through collaboration with other companies. More recently, Vlaisavljevic et al.

(2016) discovered an inverted U-shape relationship in biotech companies between alliance partner diversity and innovation performance. Such a non-linear relationship is also echoed by Torugsa and Arundel (2016), who found an inverted U-shape relationship between 'search breadth' (i.e., 'the number of idea sources that an organization draws upon for its innovation activities', p. 397) and innovation complexity (i.e., 'the number of dimensions or innovation types that characterize a single innovation', p. 410). It seems that a similar mechanism applies for public sector organizations, as our findings indicate that collaborative diversity is positively related to innovation in public sector organizations until it reaches a point at which the drawbacks of the diverse collaborations become too great and innovation is inhibited. This implies that managers should be cautious to not overvalue the potential of collaborative diversity to achieve innovation. The benefits of collaborative innovation should always be evaluated against the costs of the complexities inherent to collaboration.

In sum, this article contributed on two aspects to the current literature and practice related to the conditions of innovation in public sector organizations. First, our focus on conditions related to both the internal and external exploration of ideas, perspectives and knowledge through a climate for creativity and collaborative diversity allowed us to test two distinct theories of innovation in one integrated framework on a large N, quantitative dataset. It enabled us to gain insights about creativity in public sector organizations and to deepen our understanding about processes of collaborative innovation. Second, our empirical analysis also revealed some critiques about collaborative innovation. It has been argued in recent literature that collaborative innovation is inherently paradoxical. 'While collaboration thrives on the presence of a certain similarity between the actors in terms of their background, education, values and opinions, innovation flourishes when different experiences, views and ideas complement and disturb each other, stimulating creative problem solving' (Torfing 2019, 5). The inverted u-shape between collaborative diversity and innovation provides evidence for this paradoxical nature, and also shows how the tensions between collaboration and innovation manifest themselves (i.e. as an inverted u-shape relationship).

However, this study is not without limitations. First, while the large dataset derived from the 2019 APS employee census used in this study allowed us to bring in much-needed quantitative perspective on public sector innovation (cf. de Vries et al. 2015), this quantitative approach is limited in terms of studying the mechanisms that causally connect our main independent variables (climate for creativity and collaborative diversity) with our dependent variable (innovation). For instance, with regard to collaborative diversity, this paper was particularly

interested in the cumulative effect of additional types of collaborations on innovation. Our research design did not allow to shed light on the underlying mechanisms of the observed non-linear relationship between collaborative diversity and innovation. Future research might untangle this relationship, for instance using more refined measurements on the precise types and combination of external stakeholders (public organizations, interest groups, citizens,…) that drive the retrieved effects.

Second, the APS is well-suited to examine organizations determinants of innovation in a public sector context that has long recognized the critical importance of pursing innovation in a rapidly changing environment. While the APS is far from unique in recognizing the importance of innovation (e.g. OECD, 2019), it does come with a particular political-administrative culture and traditions. Future studies should analyse whether the dynamics uncovered in this study are generalizable in different contexts.

Third, although the APS data are unique in offering an insight in the innovation processes of a large sample of public organizations, they only allow for cross-sectional analyses. Such analyses are limited in terms of demonstrating causality and are sensitive to common method bias. While the risk of common method bias was minimized by relying on objective items wherever possible (e.g. asking respondents whether innovations or collaborations occurred, rather than their subjective perceptions on the quality of these innovations or collaborations), future studies should address these risks by relying on panel data which can even more confidently rule out common method bias and endogeneity risks.

Endnotes

[1] Further information on the survey methodology is available at: https://www.apsc.gov.au/aps-employee-census-2019

[2] The items used were formulated in the following way: Please rate your level of agreement with the following statements regarding your immediate workgroup: [This survey uses immediate workgroup, workgroup and team interchangeably. Your immediate workgroup, and/or team are the people you currently work with on a daily basis]

[3] Note that we also estimated logit and probit models. These models led to identical outcomes. Given that interpretation becomes more difficult for maximum likelihood models (one has to employ odds ratios or marginal effects), we prefer to present the LPM. Our preference for this type of model is further strengthened by the fact that we employ a squared term. An addition that makes interpretation more complicated (especially for maximum likelihood models).

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Chapter 3

Combined effects of procurement and collaboration on innovation in public-private-partnerships: a Qualitative Comparative Analysis of 24 infrastructure projects

Chesney Callens, Koen Verhoest and Jan Boon

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Abstract

Different public sector innovation literatures tend to focus on either contractual stimuli or collaborative interactions as sources of innovation. This article argues for a combined approach that integrates these literatures. Using an fsQCA design that exploits rich survey and interview data on 24 PPPs in Belgium and the Netherlands, we confirm the combined effect of contractual stimuli and collaboration. Since PPPs are long-term, contractual collaborations, contractual stimuli and collaborative activities (information sharing, network management) complement and even reinforce each other to create novel ideas. Managers in PPPs that only consider contractual stimuli may therefore fail to innovate.

Keywords: public-private partnerships, PPP, innovation, collaborative innovation, fsQCA

3.1. Introduction

The emphasis in public service literature has recently been directed to the search for innovation through collaborative partnerships (Osborne and Brown 2013). In order to meet the growing demands of citizens, address environmental issues such as global warming, and stimulate economic activity, societies across the world are in need of innovative and reliable public infrastructures and services. Due to more traffic, a rising demand for better quality of services and the need for more services, the pressure on existing public infrastructure and services increases and public authorities realize that their own knowledge and resources are insufficient to overcome these issues. Long-term collaboration of governments with the private sector is often beneficial to address these issues, as private partners are able to introduce new knowledge and resources (e.g. finances) into infrastructure projects, hence increasing the feasibility of ambitious infrastructure projects and facilitating the creation of innovative services. Public-private partnerships (PPP) are ubiquitous examples of such collaborations, as they are long-term collaborations between public and private actors that enable the joined development of services and the sharing of risks, costs and resources between the public and private partners (Van Ham and Koppenjan 2001, 598).

PPPs have attracted the attention of innovation scholars as several characteristics of PPPs have been suggested to stimulate innovation: the transfer of risks, the contractual integration of project phases (design, build, maintain/operate), the long-term commitment of the private companies, contractual incentives, design freedom, and the focus on output specifications (Grimsey and Lewis 2004; Leiringer 2006; Rangel and Galende 2010). Yet, research on whether and how PPPs lead to innovation is scarce (Himmel and Siemiatycki 2017), with some studies pointing at positive relations between PPPs and innovation (e.g. Himmel and Siemiatycki 2017) but others also observing negative relations (e.g. Barlow and Köberle-Gaiser 2008). More research is, therefore, needed to shed light on the conditions that cause innovation creation by PPPs. This article uses insights from 'public procurement for innovation' literature (e.g. Edquist, Vonortas, and Zabala-Iturriagagoitia 2015) and 'collaborative innovation' literature (e.g. Torfing 2019) to contribute to the discussion on how PPPs create innovations. We propose the following research question:

> How do conditions related to 'procurement for innovation' logics and conditions related to 'collaborative innovation' logics stimulate the creation of innovation in PPPs and what is their combined effect on this innovation?

PPPs are ideally suited to study innovation in that they entail both *procurement logics* and *collaboration logics*, which both have been shown to foster innovation. Innovation in PPPs is *procured* as the deliverables of the PPP are contractually defined, but it is also created through *long-term collaboration* between the public procurer and private contractor. Although a public procurer might stipulate demanded, innovative results in a contract (procurement for innovation), achieving these results is only possible through long-term collaboration (e.g. design, maintenance, exploitation), causing synergies and learning processes, which might in turn generate innovative ideas (collaborative innovation, Torfing 2019). These collaborative interactions are absent in other kinds of arrangements. For instance, pre-commercial procurement (PCP) (Edquist and Zabala-Iturriagagoitia 2014) lacks a long-term commitment between the partners, which might prevent collaborative interactions between the partners that generate new ideas.

These two logics refer to two streams of literature that are linked to innovation, namely the 'public procurement for innovation' literature (e.g. Edquist, Vonortas, and Zabala-Iturriagagoitia 2015) and the 'collaborative innovation' literature (e.g. Torfing 2019). First, from the perspective of *procurement for innovation* literature, PPPs are highly structured, long-term contractual arrangements that provide a service or good to a procuring government (Hodge and Greve 2007). In this line of reasoning, innovation is stimulated by contractual incentives of the public procurer. Stimulating innovation occurs through the formulation of the demand in the procurement stages of the process (e.g. Rangel and Galende 2009). As such, it is a demand-side instrument as opposed to a supply-side instrument (Ferrari and Forastieri 2018). Part of this demand can be explicitly formulated towards achieving something innovative (i.e. contract incentives), but the procurement instruments can also allow for more freedom in the development stages by reducing the amount of design restrictions, which fosters creative processes that lead to innovations (i.e. design freedom).

Second, from the perspective of *collaborative innovation* literature, PPPs are a mode of collaborative governance (Brogaard 2017). Because of their long-term engagement, the public procurers and private contractors in a PPP have to collaborate with each other to generate the outcome. This multi-actor collaboration stimulates innovation, as interaction dynamics create synergy and learning processes which might generate new ideas (Torfing 2019). Studies in PPPs acknowledge these logics. For instance, Koppenjan (2005) and Warsen et al. (2019) emphasize the importance of interaction between the public and private partners (e.g. information sharing) and enhancing relationships (e.g. network management) between the partners in the early stages

of a PPP to establish mutual trust and common understanding.

Recent studies confirm the importance of procurement-related conditions (e.g. contract structure) and collaboration-related conditions (e.g. cooperation and trust) to stimulate innovation through PPPs (Carbonara and Pellegrino 2018). However, most studies that investigate innovation through PPPs look at either procurement for innovation logics (e.g. Barlow and Köberle-Gaiser 2008), or collaborative innovation logics (e.g. Brogaard 2017). Little research is oriented towards the combination of both logics. Some of the studies that do so, have only a small number of cases, which limits the generalizability of the studied conditions (e.g. Parrado and Reynaers 2020). Other studies, such as the recent articles of Verweij, Loomans and Leendertse (2020) and Carbonara and Pellegrino (2020) focus largely on the amount of structural aspects of collaboration-related conditions (the presence of a stakeholder manager in the project, or the length of the concession period as a proxy for the trust and cooperation between partners). Although these studies provide indications that collaboration is necessary in PPPs to foster innovation, they remain vague as to which specific collaborative activities are necessary (e.g. information sharing and network management). These activities are however crucial in multi-actor collaboration as they stimulate learning processes which allow new ideas to emerge (e.g. Sorensen and Torfing 2011, Cinar et al. 2019, Torfing 2019).

In short, this article contributes to the discussion on how PPPs can stimulate innovation and which conditions are responsible for this (e.g. Rangel and Galende 2010; Himmel and Siemiatycki 2017). It contributes to this discussion in two aspects. First, it brings together insights from 'public procurement for innovation' literature and 'collaborative innovation' literature to theorize how procurement-related and collaboration-related conditions cause innovation creation in PPPs. Second, the article examines the combined effect of these conditions on innovation created in PPPs, using a fsQCA design that exploits rich survey and interview data of 24 infrastructure PPPs in Belgium and the Netherlands, which exceeds earlier qualitative studies that were limited by their number of cases.

In the remainder of the article, we start by introducing the concept of innovation and describing the 'procurement for innovation' logics and 'collaborative innovation' logics. We subsequently present the selected conditions related to these logics, and our cases and methodology. We then outline the results of our fuzzy set Qualitative Comparative Analysis (fsQCA) and discuss these results using in-depth qualitative data. In our discussion and conclusion, we reflect on the results and formulate implications for research and practice.

3.2. Two logics to enhance innovation in public-private partnerships

3.2.1. Innovation

Rogers' (2003, 12) definition of innovation as an 'idea, practice, or object that is perceived as new by an individual or other unit of adoption' is widely shared in the innovation literature (de Vries, Tummers, and Bekkers 2016). We restrict ourselves in this section to how we perceive innovation in this study using Rogers' definition. For a broader discussion on the concept of innovation, see the literature review of de Vries, Tummers and Bekkers (2016).

Two dimensions of innovation can be extracted from Rogers' definition: 1) innovation is something that is perceived as new, and 2) innovation is something that needs to be adopted. The first dimension of this definition ties into the case dependency of innovation. The same idea, practice or object might be regarded as very innovative in one case, but as not innovative at all in another case. Thus, we need to look at how the actors in the project perceive this idea, practice or object in order to say something about its innovativeness for that case. Second, since innovation is something that needs to be adopted, measuring innovation before it is totally implemented, for instance by using innovation evaluation scores of bids (Himmel and Siemiatycki 2017), only displays how public procurers evaluate the innovativeness of the proposed solution, but not of the implemented one. It also confines the measurement of innovation as something that is determined by the public procurer, and ignores how the private contractor perceives this innovation. Furthermore, innovation literature confirms the difficulty of quantifying innovation in an absolute way because of the difficulty of measuring something new, given the lack of standards against which to compare it, and the ambiguity in the meaning of the word 'new' (i.e., new for whom) (Smith 2006). Hence, we consider innovation as the *perceived newness of an implemented solution, evaluated by both the public procurer and the private contractor.*

We focus on *product and service* innovations and *process* innovations (de Vries, Tummers and Bekkers 2016), both of which are innovations developed within the PPP itself, and not within the involved organizations. Product and service innovations focus on the output of the collaborative process (new product or service) (Damanpour and Schneider 2009), whereas process innovations are innovations in the way the output is generated (Walker 2014). Examples of the former are design innovations and the use of innovative building materials in the

infrastructure, whereas smart construction phasing and modular construction systems are examples of process innovations. These examples also indicate that, due to the specific nature of the financial schemes and risk allocations, PPPs are more prone to produce modest and piecemeal innovations instead of more systemic and radical innovations since the latter imply higher risks (van den Hurk and Siemiatycki 2018; Himmel and Siemiatycki 2017).

3.2.2. Procurement for innovation logics

Public-private partnerships are methods of procurement (Grimsey and Lewis 2007), in which the properties of the procurement process affect the outcome of the project. Public procurement for innovation refers to the demand-side rationale in which an order is placed by the public sector to fulfil particular needs (Edquist, Vonortas, and Zabala-Iturriagagoitia 2015). Public procurers are viewed as lead users who translate perceived social needs (e.g. policy goals) into new market demands through innovation (Edler and Georghiou 2007; Hueskes, Verhoest and Block 2017; Ferrari and Forastieri 2018).

The instruments that lead to this translation of (innovation) demands are synthesized by Uyarra et al. (2014). Two of the most widely recognized instruments are 1) the level of *tender specification* (i.e. level of detail of demands in tenders) and 2) the kind of *incentives for supplying innovative solutions* (i.e. contractual incentives to provide innovation). These instruments are, according to this literature, crucial to generate innovation as they direct contractors towards creative thinking (since innovation is part of the procurer's demands) and provide room for exploration (since the procurer's demands are less explicitly stipulated).

Together, these conditions provide stimuli for creativity and innovation. They do this in two ways. First, rigid specifications push away innovative organizations because they might think that the procurer is not amenable to innovative solutions (Leiringer 2006; Uyarra et al. 2014). The absence of rigid specifications to stimulate innovation might be especially important in PPPs because of the long-term engagement of the partners, which means that partners have more time to experiment and are less risk averse in comparison to similar short-term projects. These conditions refer to what we will call '*design freedom'*. Second, '[…] by placing a sophisticated demand upon market, […] public procurers can introduce strong incentives for private providers to come up with new solutions' (Lember, Kattel, and Kalvet 2015, 405). Because of the inherent fuzziness of the demand in long-term projects such as PPPs, this should give more direction to the private partners about what the procurer actually wants. This set of conditions pertains to what we will call '*stimulating tender award criteria'*.

Design Freedom

Design freedom is defined as the lack of restrictions in the design of the project in the form of planning restrictions, physical restrictions, spatial planning procedures, and reference designs (Leiringer 2006). These restrictions are necessary for setting specific boundaries within which the private contractor has to operate (Tadelis and Bajari 2006). By defining such restrictions, the public procurer can control the behaviour and performance of the private contractor in order to ensure the desired outcomes. However, rigid restrictions and specifications can be harmful for the innovative potential of the project because innovative organizations are less likely to engage in such contracts (Uyarra et al. 2014); moreover, they impede the creative search for solutions of the contractor (Matthews 2005). A lack of rigid restrictions increases the design freedom of the contractor and hence stimulates innovations in the project.

Stimulating Tender Award Criteria

'Stimulating tender award criteria' refers to the criteria that the procuring authority uses – before contract close – for assessing the tenders in order to ensure that desirable outcomes are attained (Georghiou et al. 2014). Merely focusing on price is insufficient for stimulating the private partners in the PPP to be innovative. For example, Georghiou et al. (2014) reported that 60% of the surveyed firms in their procurement study perceived the sole evaluation on price of tenders as significantly reducing the potential of innovation in the PPP projects. Stimulating tender award criteria are part of a larger group of control instruments with which the procuring authority attempts to intentionally influence the behaviours of private actors to achieve the goals of the public procurer (Hueskes, Verhoest, and Block 2017). These procurement instruments enable the public procurer to stimulate markets in adopting innovations (Edler and Georghiou 2007), which are subsequently applied in cases where the perceived needs for the innovation are high. The use of innovation measures in tender evaluations should, therefore, stimulate the likelihood of innovation in the later project.

3.2.3. Collaborative innovation logics

Innovation is not only produced by demand instruments, but is also determined by the interaction between the procurer and the contractor (Edler et al. 2015). The customer depends on information about the supplier's abilities and expertise, whereas the supplier relies on information about the customer's needs (von Hippel 1986). The more the partners exchange information with one another or are encouraged to productively interact with each other, the higher the likelihood of achieving innovative outcomes. Recent research of Brogaard (2017)

for instance, already indicated a link between ‘collaborative innovation’ and ‘innovation in PPPs’.

The collaborative innovation conditions are established in recent public administration research into the generative mechanisms for collaborative innovation (Ansell and Torfing 2014). Following these authors, two of the most important generative mechanisms are synergy and learning. Synergy refers to the combination of skills, perspectives, and resources of actors with the purpose of jointly creating something new (Lasker 2001); by contrast, learning refers to the process of using prior interpretations to construct new interpretations that direct people’s actions (Mezirow 2000), which is stimulated in group interactions (Van den Bossche et al. 2011). Both of these mechanisms have been linked to PPP construction projects (Grotenberg and van Buuren 2018). To create synergistic dynamics and learning processes, individuals need to exchange information with each other and they need to be encouraged to interact with each other (Sorensen and Torfing 2011). Two conditions are therefore linked to these mechanisms, namely *information sharing* (i.e. the informal exchange of information) and *network management* (i.e. the management of collaborative interactions).

Information Sharing

This study considers the relevance of *voluntary* information sharing between public and private actors in the project for innovation, because it refers to the sharing of knowledge and experiences to stimulate mutual learning (Hartley and Rashman 2018) and to inducing synergetic opportunities by combining different ideas and perspectives (Wegrich 2018). The exchange of various opinions, perspectives, experiences, and knowledge, stimulates transformative learning between the partners, which generates novel solutions (Torfing 2019). Even in rather simple collaborative arrangements with only public organizations, a lack of communication and knowledge sharing can be a barrier for innovation (Cinar et al. 2019). In more complex arrangements such as PPPs, we expect an even larger impact on the innovative capacity of the partnership because the perspectives and knowledge of actors in a cross-sectoral collaboration are more diverse due to the varied backgrounds of the stakeholders (Hartley and Benington 2006). Alam et al. (2014) concluded that the sharing of knowledge and information about the PPP project between the partners increased their collaboration and encouraged innovative ideas.

Network Management

The effectiveness of network management on innovation in collaborations has been reported in multiple studies (see e.g. Stevens and Verhoest 2016). Network management is defined as 'the deliberate attempt to govern processes in networks' (Klijn et al. 2010, 1065). This can relate to the intention to connect people in the partnership (connecting network management) and the intention to discover various opinions and interpretations (exploring network management) (Klijn et al. 2010). Examples of the first strategy are the efforts of actors to align opposing interests, whereas attempts that render the visibility of different assumptions illustrates the exploring strategy. These network management strategies directly match the generative mechanisms of learning and synergy because the connections between the stakeholders at which network management is aimed, constitute ties of social interactions, which are the vehicles of learning and synergy processes.

3.2.4. Hypotheses

This study conceptualizes the relation between the aforementioned conditions and innovation in terms of set relations (Schneider and Wagemann 2012). While we will later introduce Qualitative Comparative Analysis as a set-theoretic method in more detail (cf. section 'fuzzy-set Qualitative Comparative Analysis'), it is important at this point to understand that set relations are typically understood in terms of sufficiency and necessity, and not in terms of significance, and that this has implications for thinking about the relations between conditions.

A condition is *necessary* if the outcome cannot be produced without that condition, whereas a condition is *sufficient* not only when it consistently leads to the outcome, but also when the outcome can be produced by combinations of other conditions. Schneider and Wagemann state that 'arguments about set relations are pervasive in the social sciences, but this is not always obvious' (2012, p. 1). We will now argue that debates on the relations between procurement for innovation logics and collaborative innovation logics in the PPP literature implicitly uses set-theoretic argumentation, which are, however, hardly translated into set-theoretic research designs. For reasons explained in the methodological section, we consider how (combinations of) conditions lead to 'high levels' of innovation in PPPs.

First of all, although the literature recognizes the potential benefits of combining procurement and collaboration (Edler et al. 2015), studies that combine both of these logics underline the importance of procurement as opposed to collaboration. It has been argued that large DBFM

projects are little conducive of collaborative behaviour because of the strict separation of public and private management roles (Verweij, Loomans and Leendertse 2020). Recent empirical evidence of Parrado and Reynaers (2020) on innovation in three PPPs reveals that the partners in the PPP predominantly follow the contract at the expense of collaborative efforts. Research from Carbonara and Pellegrino (2020) confirms this view, as the authors are unable to find a significant positive relationship between what the authors call 'network structure' (i.e. length of concession period, indicating the level of trust between the partners) and innovation through PPPs. This suggests that the 'procurement for innovation' logics might be necessary for high levels of innovation.

> Hypothesis 1: Stimulating tender award criteria (STAC) and design freedom (DF) are necessary for high levels of innovation in PPPs.

However, Parrado and Reynaers (2020) indicate that collaborative behaviour between the private and public actor occasionally spurred innovation, but this was only possible if the innovation did not clash with contractual clauses. Other authors have suggested the complementarity of procurement and collaboration in PPPs. Poppo and Zenger (2002) show that formal contracts are combined with high amounts of relational management. Similarly, Roberts and Siemiatycki (2015) show how the combination of project management (procurement-related) and process management (collaboration-related) in PPPs allows for a coherent end goal while facilitating meaningful collaboration, which together leads to successful projects. This suggests that, at the very least, we would expect to observe the presence of both logics in PPPs with high levels of innovation.

> Hypothesis 2: The combined presence of stimulating tender award criteria (STAC), design freedom (DF), information sharing (INFOS) and network management (NM) is sufficient for high levels of innovation in PPPs.[1]

3.3. Cases and Methodology

3.3.1. Public-private partnerships in Belgium and the Netherlands

We used data from 24 PPPs in Belgium and the Netherlands, in the form of Design, Build and Maintain (DBM), Design, Build, Finance and Maintain (DBFM) and Design, Build, Finance, Maintain and Operate (DBFMO). Before we started the data collection, a project database was created with 71 DBM/DBFM(O) projects which included all the Dutch and Belgian projects which had achieved a contract close between 2007 and 2015. We selected projects based on

three characteristics: policy sector, contract type and size. The selected projects reflected the variation across the projects in the database. Two types of projects were therefore selected: transport infrastructure projects (railways, roads, and sluices) and social infrastructure projects (swimming pools, prisons, and government buildings). We selected projects in Belgium and the Netherlands because they are quite similar. This has two reasons. First, PPPs are politically supported by government in a similar manner in Belgium and the Netherlands. Second, Belgium adopted some of the manuals and instruments (e.g. contract templates) from the Netherlands when it started exploring the possibilities of PPPs, which resulted in similar projects in the two countries. Furthermore, as PPP projects are rather scarce in both countries, the scope of comparative research is limited when only focusing on one country.

We collected data through 71 semi-structured interviews of 74 professionals who were closely involved in one or more of the stages of the projects. These professionals included both public procurers and private contractors. Prior to each interview, each professional was sent a survey in which the concepts of theoretical interests were addressed in a standardized manner. The interviews were transcribed and coded in Nvivo, which added rich qualitative data.[2] Both the survey and interview materials were used in the operationalization of conditions (see section on calibration). Each of the conditions present in the transcribed interviews were coded in NVivo, after which a table was produced with synthesized information about each of the conditions (per interview). This synthesis of the interviews not only provided information from the transcribed interviews (i.e. quotes), but also provided information about the interviewer's assessment on what was said by the respondent and extra contextual information, needed to correctly interpret the answers of the respondents. This rich interview data was therefore complementary to the more standardized survey data, and both data sets were used in the calibration process. The interviews are in addition used to illustrate more concretely how conditions came to have an effect. In doing so, we benefited from QCA's ability to shed light on both cross-case patterns in the data *and* stay close to the original case data (Schneider and Wagemann 2010). The QCA method is further discussed in the next sections.

3.3.2. Fuzzy-set Qualitative Comparative Analysis (QCA)

Qualitative Comparative Analysis (QCA) is a set-theoretic and case-based method that uses insights from multiple cases (Ragin 2008). It helps to think of QCA as a rigorous comparative approach that seeks to meet two apparently contradicting goals (Ragin 1987): do justice to the complexity of each case by gaining in-depth knowledge, but also revealing regularities and

patterns across cases that are to some extent generalizable. Familiarity with cases is very important, both before, during and after the analytical moment of QCA (Schneider and Wagemann 2010).

As the method is based on the principles of set theory, formal logic, and Boolean and fuzzy algebra, QCA uses a specific terminology: the word '*condition*' is used instead of 'independent variable', '*outcome*' instead of 'dependent variable', and results are called '*solution terms (or formula)'* (Schneider and Wagemann 2010). In QCA, cases receive membership scores for each condition and outcome, which are all sets. These membership scores, or 'case scores', have to be calibrated to reflect the presence of a case in a certain set of conditions or outcomes. This article utilizes *fuzzy-set QCA (fsQCA)* in order to allow conditions to display different degrees of membership in sets. A thorough introduction to the fsQCA method is outside the scope of this article, yet a detailed overview can be found in Schneider and Wagemann (2010).

The choice to apply fsQCA is theoretically and empirically grounded. First, theoretically, we demonstrated that we have reasons to assume that the conditions we use will have a combined effect on our outcome (innovation) (Schneider and Wagemann 2012, 78). Second, empirically, the advantage of using fsQCA is that we are able to examine these potential combined effects on a medium-sized dataset of 24 observations, which is extremely small for a regression analysis and very large for in-depth case studies. Different from the correlation coefficient in regression analysis, *QCA provides two central measures as parameters of fit, namely consistency and coverage*. *Consistency* reflects the degree to which cases sharing a combination of conditions have the same outcome. *Coverage* indicates the extent to which the outcome is covered by a condition or a solution term (Ragin 2008).

3.3.3. Operationalization and calibration of outcome and conditions

Operationalization

We consider innovation as the *perceived newness of an implemented solution, evaluated by both the public procurer and the private contractor*. These solutions can be technologies, products or maintenance solutions (Hueskes and Verhoest 2016). We make a distinction between innovations related to technologies, materials, smart designs, adjustments to the environment and sustainability solutions. We asked both the public procurer and the private contractor to indicate on a bipolar 10-point scale if they thought that there were no innovative solutions or there were many innovative solutions in their project. We did this for all five of the

mentioned solutions. Table A2 of the Annex shows the items used for this question. In the interviews, we asked the public procurer and private contractor for examples of these innovations, in order to ensure that there were concrete examples of such solutions.

The procurement for innovation logics are operationalized through two conditions, design freedom and stimulating tender award criteria. First, design freedom is defined as the lack of restrictions in the design of the project in the form of planning restrictions, physical restrictions, and restrictions due to previous outcomes, spatial planning procedures, and reference designs (Leiringer 2006). We asked the respondents in the interviews to indicate whether there were restrictions present in the design of the project in the form of five types of restrictions: 1) planning restrictions, 2) physical restrictions, 3) restrictions due to previous outcomes, 4) spatial planning procedures, and 5) reference designs. Second, stimulating tender award criteria are defined as the criteria the procuring authority uses – before contract close – for assessing the tenders in order to ensure that desirable outcomes are attained (Georghiou et al. 2014). To measure these criteria, we used a 7-point Likert scale with which we asked the respondents to indicate how much they agreed with the following statement: 'In the tender award criteria, market actors could make a difference by proposing creative solutions' (see table A2, Annex)

The collaborative innovation logics are operationalized through the conditions information sharing and network management. For information sharing, we used the voluntary information sharing between public and private actors in the project. We used a 10-point scale to measure the answers of the respondents on three questions. The respondents were asked 1) to what extent the contract partners were willing to share relevant information with each other, 2) to what extent the contract partners were keeping the other partners posted about events or changes that might be relevant for these partners, and 3) to what extent the private or public partners shared all relevant information with their organization. Network management was defined as 'the deliberate attempt to govern processes in networks' (Klijn et al. 2010, 1065). We used validated survey scales of Klijn et al. (2010) which refer to two types of strategies, namely 1) exploring strategies, and 2) connecting strategies (see table A2, Annex).

Calibration

The membership scores of cases in each set are generated in the calibration procedure based on the assessment of the cases and theory (Schneider and Wagemann 2012). Three anchor points define a set: full membership (score of 1), full non-membership (score of 0), and a crossover point (score of 0.5). Furthermore, most conditions are considered multi-dimensional, and are

therefore composed of several items. Tables A1 and A2 of the annex illustrate the calibrated data set, the type of data used for measuring and calibrating the outcome and the conditions. Depending on the richness of the data the surveys and interviews provided, we worked with survey items, interview data, or both to calibrate our conditions.

Our reliance on multiple data types (survey and interview), multiple sources (different respondents per project), and multiple items poses a paradox. On the one hand, triangulation creates for a rich data environment on which to rely for assigning and cross-checking membership scores against cases, thus doing justice to the case-sensitive nature of the QCA method. On the other hand, the diversity in data complicates the development of a calibration procedure that is systematic across conditions. To address this issue, we developed a conservative calibration procedure in which we placed strict requirements on cases before they could be incorporated in a set. Additionally, we conducted a robustness check for the presence of our outcome, on which we elaborate in the next section of the article.

The conservative calibration standard imposed strict demands on cases before they could be included in a set. In practice, cases had to exhibit high levels of the outcome or a certain condition before they could be part of a set. In other words, a case that was present in a set, would indicate that it had a high level of the particular condition or the outcome of that set (i.e., high levels of innovation, high levels of information sharing, …). We relied on different levels of calibration to ensure the quality of the data for the condition. For detailed accounts of the calibration procedure per condition, we refer to table A6 of the annex. We will only discuss in more detail the calibration process with respect to our outcome, high levels of innovation.

We used both quantitative (survey) and qualitative (interview) data to calibrate the outcome. The calibration procedure comprised out of two levels, namely the calibration at the level of the respondents and the calibration at the level of the cases. We calibrated the individual scores of the respondents because each case constituted several respondents (up to four). The calibration of the scores of the individual respondents subsequently allowed for the calibration of the case-scores. As a qualitative check on the survey answers, we asked the respondents to elaborate on their survey answers in the interviews, which were evaluated by the case knowledge of the researchers. We checked how many examples of innovations the respondents could give to verify their survey answers. Once the case scores were calibrated for the survey and interview answers of the respondents (see table A6 of the annex for the calibration rules),

we combined the two case scores following specific rules (see also table A6 of annex) to obtain one case score that describes the extent of the perceived innovation in the project.

The calibration procedures that we adopted, resulted in the qualitative selection of specific answers of case respondents. Only the answers of private actor respondents for the conditions 'design freedom' and 'stimulating tender award criteria' were included because the private respondents were most susceptible to those conditions and could provide the most correct and consistent answers to our questions. Marx and Dusa (2011) propose a threshold table with probability measurements in which the probability of generating solution paths on random data cannot be greater than 10%. With four conditions and 24 cases, the probability of generating results on random data is 2%, which is well below the threshold that the authors suggest.

3.4. Results

The analyses were performed using the fs/QCA 3.0 package. After the calibration procedure, a *truth table* was constructed, which lists all the logically possible combinations of causal conditions (*configurations*), and sorts all the cases along these combinations (Ragin 2008). Each possible combination of conditions (2^k; k = number of conditions) is presented as a row in a truth table (see table A4 of the annex). According to standards of best practice (Schneider and Wagemann 2010), we first present and discuss the results for the analysis of necessary conditions, after which we turn to the analysis of sufficient conditions. In table 1 we report the number of cases with high levels of innovation (scores above the cross over point of 0.5) and the number of cases with low levels of innovation.

Table 1: Set membership of cases for the outcome

Levels of innovation in the projects		Number of cases
Low levels of innovation	Below 0.5	12
High levels of innovation	Above 0.5	13

First, we examined the necessity of the conditions to explain innovation (see table 2). For necessary conditions, a consistency threshold of at least 0.90 is advised (Schneider and Wagemann 2012). Table 2 indicates that neither the presence nor the absence (~) of any of the conditions is necessary for the outcome. We also explored the necessity of conditions for the absence of the outcome, for which similar results were visible (see table A3, Annex).

Table 2: Analysis of the necessary conditions

Presence of high levels of innovation		
Conditions	**Consistency**	**Coverage**
High levels of information sharing (INFOS)	.726860	.649109
Absence of high levels of information sharing (~INFOS)	.452813	.427959
High levels of network management (NM)	.606171	.715203
Absence of high levels of network management (~NM)	.603448	.453615
High levels of design freedom (DF)	.788566	.578562
Absence of high levels of design freedom (~DF)	.361161	.443207
High levels of stimulating tender award criteria (STAC)	.727768	.668333
Absence of high levels of stimulating tender award criteria (~STAC)	.451906	.415000

We then reviewed the sufficient conditions for the presence of high levels of innovation. We constructed the truth table for the conditions that were assumed to explain the high levels of innovation in PPPs (see annex, table A4). Particularly in small- and medium-N studies, no empirical evidence is available for all possible combinations, or rows (16 or 2^4 in our study). We followed standards of practice. First, we only included rows with at least one case that was relevant for the empirical analysis (Ragin 2008), thereby resulting in 11 rows (see annex, table A4). Second, we selected only those combinations with a raw consistency level of 0.80 or higher (Schneider and Wagemann 2012). Third, we observed a substantial drop in the raw consistency between the lowest consistency level of the selected paths (above 0.80) and the highest consistency level of paths that were not selected (below 0.80), which was also an indication that the threshold was reached (Schneider and Wagemann 2012, 128).

The results of our intermediate solution are illustrated in table 3. The intermediate solution generates solution paths based on theoretical assumptions. Our directional expectations are outlined in Hypothesis 2, and essentially mean that we expect that the selected conditions will all be present in the solutions paths. The intermediate solution generated one distinct solution path. The path in table 3 was present for 7 of the cases. Our coverage score of 0.52 reveals that more than half of the cases are described by the path in table 3. With a consistency level of ca. 0.90, the path accurately depicts the presence of high levels of innovation in those cases. There were no tied prime implicants, hence there was no model ambiguity.

Table 3: Intermediate solution for high levels of innovation

	Consistency	Raw coverage	Unique coverage	# Cases in path
INFOS * NM * DF	.895899	.515427	.515427	7
Solution consistency	**.895899**			
Solution coverage	.515427			

Maggetti and Levi-Faur (2014) argue that solution paths for fsQCA always have to be interpreted using the intermediate, complex and parsimonious solutions. The parsimonious solution generated an identical solution path and consistency/coverage scores (see table A5, annex). There were no complex solution paths generated by our analysis. Furthermore, no contradictory cases emerged (i.e. cases that exhibit the solution path but not the outcome). The results in table 3 can be described as follows:

> PPPs that display high levels of information sharing (INFOS), network management (NM) and design freedom (DF), have high levels of innovation.

We applied a robustness check to ensure that the paths we observed in our data were adequately robust to withstand some small changes in the calibration procedure. We adjusted the calibration for the outcome by making the interview data more important than the survey data (i.e. starting from the interview data and correcting with the survey data). Our previous calibration rules only corrected the survey data with the interview data when the data were not interpretable using only the survey data (i.e., answers both above and below the cross over point for the same case). This approach yielded an identical solution path of INFOS * NM * DF for the presence of innovation, with a coverage score of 0.42 and a consistency score of 0.84, hence confirming the explaining power of this path for the presence of high levels of innovation. Additionally, even when we dropped the raw consistency level in the truth table slightly below the recommended point of 0.75 (Schneider and Wagemann 2012, 127), we still observed our identified solution path.

A qualitative analysis of the interviews sheds light on the underlying mechanisms of this solution path. From the interviews, it seems that the contract conditions were not always desirable anymore for the procurer at the time of the construction process. Innovations often spontaneously emerged from interactions between partners because of random events in the phases after contract close. The following quote illustrates this:

> The point was that there was a bid on the old output specifications. But after the procurement phase, the discovery came that in specific places, we actually wanted something else. There are several concrete examples of this. […] One example is a self-service system for multiple things. […] This was initially not included, but it was eventually included in this manner [after contract close, ed.]. Everything was squeezed into a mobile device. But such devices did not exist. It had to be designed.

Furthermore, the interviews indicate that all of the respondents in the cases covered by the solution path experienced the collaboration between the partners as positive. Words such as constructive, positive, pleasant and smooth collaboration were frequent answers to this question. The interviews exhibited that the openness towards each other, together with the design freedom, fosters creativity and innovation in the project.

> The collaboration was constructive. It was really a municipality that was open for ideas. Even though we had a contract with each other, they were always curious if we had some new techniques [and] new innovations in our expertise.

The interviews also seem to indicate a mutually reinforcing effect of design freedom, information sharing and network management. In cases where a detailed design was drafted after contract close, the induced design freedom for the private partners created opportunities for information sharing, exploring other's ideas and connecting people in the partnership, which led to innovative outcomes. The following quote from a public partner of one of the cases covered by the solution path indicates the mutually reinforcing nature of these innovation mechanisms:

> Our initial program with demands wasn't very detailed. The detailed design [which came after contract close, ed.] was however drafted in detail. At that moment, the plans were discussed thoroughly and there were some changes left and right, [for example, an expansion of the cafeteria of the adjacent sport complex, ed.].[…] The collaboration with [the private contractor] was very open. Even before the exploitation phase, the project was very open. We had a steering committee in which we and [the private contractor] were represented to discuss issues that were suggested in work meetings. […] As our location is adjacent to [a river], we didn't know exactly how to keep this site dry. [The private contractor] found something that could work with a draining system. Although we knew this problem was evident because our consulting firm had already confronted us with it in the procurement phase, the innovation was established especially in the detailed design.

3.5. Discussion

Contributing to the recent literature on innovation creation through PPPs, we aimed to address what makes that PPPs create innovations. Scholars in fragmented literatures have pointed at the importance of conditions related to 'procurement for innovation' logics and conditions related to 'collaborative innovation' logics. Yet we lacked an empirical understanding on whether and how these conditions combine in facilitating innovations, and the relative importance of conditions within these combinations. Scholars underline the necessity of procurement-related conditions for innovation in PPPs, as the strict separation of public and private management roles is considered a limiting factor for collaborative behaviour (Verweij, Teisman and Gerrits 2017), as is the tendency of actors to primarily follow the contract at the expense of collaborative efforts (Parrado and Reynaers 2020). However, scholars have also suggested that collaborative conditions complement procurement-related conditions to create innovation in PPPs (Poppo and Zenger 2002; Roberts and Siemiatycki 2015; Parrado and Reynaers 2020).

The QCA method was applied in this article, which is well suited to shed light on the relative importance of conditions by distinguishing necessary from sufficient conditions. As QCA is a case-based method, it uses insights from multiple cases. This study uses different data sources, which does justice to the complexity of each case, and returns to the interview materials to make sense of the observed patterns. Yet QCA's key operations rely on Boolean algebra, where each case is reduced to a series of conditions. This study, too, is very transparent in the calibration process (see table A6) as a standard of good practice to allow for replication (Schneider and Wagemann 2010). As such, we were able to study a large number of cases (24 projects), which creates opportunities for cautious generalization of the results. Future studies can formulate and apply propositions to cases that share a reasonable number of features with the cases observed here (transport and social infrastructure PPPs and/or DBM/DBFM(O) projects in Western democracies) (Ragin 1987).

Rejecting our first hypotheses, results showed that neither of the 'procurement for innovation' logics (design freedom and stimulating tender award criteria) were necessary for the presence of high levels of innovation. Additionally, and largely supporting our second hypothesis, we found that design freedom, information sharing and network management *together* lead to high levels of innovation in PPPs. The fact that procurement-related conditions are not necessary for innovation in PPPs, introduces more nuance in the discussion about the benefits of contractual stimuli to stimulate innovation in PPPs. It seems that designing the proper contract (i.e. a

contract which formulates explicit innovation demands and ensures design freedom) is not enough to create innovation in PPPs. As the qualitative results from the interviews show, conditions related to the contract are especially important in the early phases of the project, while a lot of situational dynamics are created in the collaborative phases of the project. This might explain why the effect of contract related conditions on innovation is weakened in later stages of the project.

Still, the results indicate that the combination of design freedom, information sharing and network management is sufficient to create high levels of innovation in PPPs. This confirms literature that suggests that procurement and collaboration complement each other (e.g. Poppo and Zenger 2002; Edelenbos and Teisman 2008; Roberts and Siemiatycki 2015). Especially after contract close, collaborative innovation logics come into play, and they can enhance innovation during the execution of the project. Interview data confirms this, as all of the respondents in the cases covered by the solution path experienced the collaboration between the partners as positive, which is contradictory to the non-collaborative nature of large PPP projects that the literature suggests (Verweij 2015; Verweij Teisman and Gerrits 2017). As such, positive collaboration caused by high levels of information sharing, exploring ideas and connecting individuals (i.e. network management) causes, together with the presence of design freedom, synergy and learning processes to occur in the stages after contract close.

We could, however, not fully accept our second hypothesis. The interviews hinted at the importance of the specific circumstances under which PPPs work, which might explain why 'stimulating tender award criteria' is not part of the solution path. The rationale behind stimulating tender award criteria is to influence the behaviour of the private partners at the start of the project to produce innovative outcomes (Hueskes, Verhoest, and Block 2017). However, as PPPs are long-term collaborative arrangements between actors operating in relatively diverse settings, the likelihood of having to adapt to unforeseen circumstances is a lot higher in comparison to traditional procurement of products and services[3]. A consequence might be that the effect of stimulating conditions introduced at the start of the project (e.g. stimulating tender award criteria) diminishes throughout the lifespan of the project as dynamic changes require other stimuli (e.g. design freedom, information sharing and network management) to achieve innovation. These stimuli have in common that they facilitate creative discovery and exploration, which are crucial properties of innovation creation (Crosby, 't Hart and Torfing 2017). The results therefore emphasize the special importance of collaborative innovation logics in long-term projects such as PPPs.

The fact that PPPs are long-term, collaborative arrangements also supports an additional, compelling mechanism, as the assessment of the interviews indicates that design freedom, information sharing and network management not only complement but also *reinforce* each other. Research has argued that innovation is created by establishing an open and flexible environment in which stakeholders can collaborate with each other and which fosters synergy and learning dynamics (Ansell and Torfing 2014; Torfing 2019). Design freedom, information sharing and network management are mutually reinforcing when design freedom is an enabler for flexible contract interpretation, exploited through thorough information sharing, exploring ideas and connecting individuals (i.e. network management). Design freedom facilitates the formulation of a detailed design *after* contract close, during which information sharing and network management are particularly important for aligning the stakeholders' visions about that detailed design, thus spurring learning and synergy dynamics. By enhancing the flexibility in contract interpretation through design freedom, exploration activities such as learning and synergy, which are stimulated by collaboration (information sharing and network management), are stimulated.

3.6. Conclusion

This article aimed to contribute to the current literature on two aspects. First, it brings together insights from 'public procurement for innovation' literature and 'collaborative innovation' literature to theorize how procurement and collaboration cause innovation creation in PPPs. Second, the article examines the combined effect of these conditions on innovation creation in PPPs, using a fsQCA design that exploits rich survey and interview data of 24 infrastructure PPPs in Belgium and the Netherlands, which exceeds earlier qualitative studies that were limited by their number of cases.

Multiple explanations for innovation processes were developed in this article. We started from the premise that both 'procurement for innovation' logics and 'collaborative innovation' logics might cause the creation of innovation in PPPs. None of these conditions were however necessary to create high levels of innovation. Particularly, the conditions related to procurement for innovation logics were not necessary, which goes against the assumptions in the literature that procurement for innovation is more important in PPPs than collaborative innovation. However, procurement and collaboration seem to have combined effects on innovation in PPPs. Design freedom complements and reinforces information sharing and network management in the phases after contract close and exhibit effects on the innovations. Innovation in PPPs is a

process situated in a dynamic environment and influenced by combinations of multiple types of conditions, acting on multiple points throughout the lifetime of the project.

Methodologically, we relied on the fsQCA method, which benefited from the triangulation of different data collection methods (survey and interviews). This approach allowed us to propose claims about both the combined effects of procurement for innovation and collaborative innovation logics in 24 cases, and the reinforcing nature of these conditions. By going back to the interviews, we were also able to better understand and explain these results. Furthermore, our calibration procedures were based on in-depth descriptions of the conditions, available through the interviews, which made a rigorous calibration possible and allowed us to perform a robustness check on the results. Moreover, because of the specific properties of our case selection and the QCA method, we believe that cautious generalization of our results to similar projects (i.e. transport and social infrastructure PPPs and/or DBM/DBFM(O) projects in Western democracies) is possible.

Our results have important implications for theory and practice. First, innovation through PPPs does not solely depend on contractual stimulation. Researchers and practitioners need to consider innovation as something that is not simply controlled for by procurement-related conditions at the start of a project. Innovations might emerge from dealing with random challenges in the design and construction processes. Hence, both public and private managers need to be aware of these innovation opportunities during the processes after contract close, instead of solely relying on the stipulated conditions in the contract. Private managers need to be open for feedback of the public partner during the construction phases and public managers need to recognize the importance of real collaboration with the private partner to develop innovative ideas, instead of just ‘demanding’ innovation through the contract. Policy makers need to be aware that setting up PPPs to create innovative services only works if the public and private partners are willing to invest time and resources into collaborative activities. Our research indicates that PPPs that do not stimulate these collaborative activities are less likely to generate innovation.

Second, design freedom, information sharing and network management not only complement but also reinforce each other in enhancing innovation. Designing an environment in which exploration can occur (through design freedom), reinforces the potential impact of information sharing and network management on generating innovation. Public and private managers need to be aware that stimulating design freedom opens the door for additional innovation dynamics

that work in conjunction with design freedom (i.e. exchange of information, exploring ideas and connecting people).

However, our research is not without limitations. First, we conducted a study on 24 cases, which restricted us in the level of detail that we could obtain. Consequentially, our research was more focused on the presence of the conditions and the outcome itself, and less on the mechanisms that resulted in these observations. In particular, the collaborative innovation mechanisms (e.g. synergy and learning) are not adequately understood in PPPs. Future research should consider these mechanisms more directly, for instance through longitudinal research or process tracing. Second, we concluded that innovation in PPPs evolves in a dynamic environment, which creates boundaries for which combinations of conditions work (i.e., produce high levels of innovation). However, due to our research design, we were unable to map the changes in the contracts or the relationships between the public and private partners. Future research should thus focus on the dynamical nature of PPPs and the way this affects the procurement and collaborative mechanisms and conditions. Lastly, not only conditions in the project itself can affect how innovation occurs, but also environmental conditions such as the financial context or the type of industry involved in the process. Future studies on innovation through PPPs should recognize the specific environment in which PPPs occur and how this can affect the innovation process itself.

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Endnotes

[1] In QCA terms: conditions related to procurement for innovation logics and collaborative innovation logics are an insufficient but necessary part of a solution which is itself unnecessary but sufficient for innovation in PPP. These conditions are called *INUS conditions* (Schneider and Wagemann 2012, 79).

[2] The dataset was also used in the recent article of Warsen, Klijn and Koppenjan (2019), in which the authors focused on how certain conditions influenced the performance of PPP projects. In our article, we focus exclusively on the influence of conditions on *innovation* in PPPs, not on PPP performance.

[3] A couple of instruments are commonly used in PPP projects to adapt the contract to dynamics in the environment. First, changes in the environments of and relationships between the actors can incite the partners to open-up the contract again in formal renegotiations (Cruz and Marques 2013). Second, less drastic and more common alignments include on the one hand contractual adjustments or expansions (e.g. by utilizing the flexibility in the contract to modify contract conditions). On the other hand, there might also be room for the partners to reinterpret the contract conditions, or for informal agreements between the partners that adjust small, technical, and operational issues.

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Annex

Table A1: Calibrated data set

	Information sharing	Network management	Design freedom	Stimulating tender award criteria	Innovation
Case 1	0.67	0.33	0	0.33	0
Case 2	0	0.33	0.67	0.33	0
Case 3	0.67	0.67	0.67	0.33	0.67
Case 4	0.67	0	0	0	0.67
Case 5	1	0.67	0.67	1	1
Case 6	1	0.33	0.67	0.33	0.33
Case 7	0	0	0.67	0.67	1
Case 8	0	0.67	1	0	0.33
Case 9	0.33	0	1	0.33	0
Case 10	0	0	0.67	0.33	0.67
Case 11	0.67	1	1	0.67	0.67
Case 12	0.33	0.33	1	1	0.67
Case 13	0.67	0.67	0	0.67	1
Case 14	0.33	0	0.67	1	0.67
Case 15	0.33	0.67	0.33	0	0.33
Case 16	0.33	0	0	0	0
Case 17	0	0	0	0	0
Case 18	0.67	0.33	0	0.33	0
Case 19	1	0.67	1	0.67	1
Case 20 (excluded)	0.33	1	N/A	N/A	0.33
Case 21	0	0	1	0.67	0
Case 22	0.67	0.33	1	1	0
Case 23	1	1	1	1	0.67
Case 24	1	0.67	1	0.67	0.67
Case 25	1	0.67	1	0.67	0.67

Table A2: Survey and interview items of conditions

Condition	Survey items	Interview items
High levels of innovation	• No/many innovative solutions are devised in this project (compared to similar projects). • No/many innovative technologies are developed or used in the realization in this project. • No/many new materials are used (or existing materials that have been used innovatively) • No/very innovative design or smart design is used (e.g. smart use of space) • (No) smart adjustments in the environment are used (e.g. in neighbourhood or landscape) • No/very innovative approach to sustainability is used *(bipolar 10-point scale statements, based on work by Hueskes and Verhoest 2016)*	Examples of practices which are according to the respondents innovative
High levels of design freedom	N/A	The presence of a reference design, planning restrictions, physical restrictions, restrictions because of previous outcomes, spatial planning procedures (inverse measurement).
High levels of stimulating tender award criteria	'In the tender award criteria, market actors could make a difference by proposing creative solutions' *(7-point Likert scale question, from 'fully disagree', to 'fully agree')*	N/A
High levels of information sharing	• To what extent are the contract partners willing to share relevant information with each other? • To what extent are the contract partners keeping the other partners posted about events or changes that might be relevant for these partners? • To what extent do the private/public partners share all relevant information with your organization? (question about public partners was asked to private partner and vice versa)	N/A

	(10-point scale questions, from 'not at all', to 'very much')	
High levels of network management	• In this project, there are attempts to make as many different views as possible visible • In this project, there is sufficient attention for involving external organizations that can bring in new ideas and solutions • In this project, much emphasis is placed on common principles in the collection of information • In the event of deadlocks and problems in the project, it is sought to bring together conflicting interests between procurer and contractor. • The project leaders in this project have an eye for relationships between organizations and individuals and the way in which they develop • The project management involves the implementers in their decisions, so that there is joint decision-making *(7-point Likert scale statements, from 'fully disagree', to 'fully agree', based on Klijn et al. 2010)*	N/A

A3: Analysis of necessary conditions (absence of high levels of innovation)

Absence of high levels of innovation		
Conditions	**Consistency**	**Coverage**
High levels of information sharing (INFOS)	.486132	.511345
Absence of high levels of information sharing (~INFOS)	.666410	.741852
High levels of network management (NM)	.382897	.532120
Absence of high levels of network management (~NM)	.795069	.703956
High levels of design freedom (DF)	.614792	.531292
Absence of high levels of design freedom (~DF)	.512327	.740535
High levels of stimulating tender award criteria (STAC)	.459168	.496667
Absence of high levels of stimulating tender award criteria (~STAC)	.693374	.750000

Table A4: Truth table for high levels of innovation

INFOS	NM	DF	STAC	Innovation	#cases	Raw consist.	PRI consist.
1	1	1	0	1	1	1	1
1	1	1	1	1	6	.883598	.803572
1	0	1	0	0	1	.74717	.33
1	0	1	1	0	1	.725275	.39759
1	1	0	1	0	1	.715517	.60241
0	1	1	0	0	1	.66317	0
0	0	1	1	0	4	.616628	0.448505
1	0	0	0	0	3	.543716	.286325
0	0	1	0	0	3	.543716	.286325
0	0	0	0	0	2	.426724	.198795
0	1	0	0	0	1	.426724	.198795

Table A5: Parsimonious solution for high levels of innovation

	Consistency	Raw coverage	Unique coverage	# Cases in path
INFOS * NM * DF	.895899	.515427	.515427	7
Solution consistency	.895899			
Solution coverage	.515427			

Table A6: Detailed account of the calibration procedure per condition/outcome

Conditions/outcome	Individual scores	Case scores	Aggregation of items
Innovation	*Survey* • If the respondent gave an answer between 1 and 4, the calibration score of 0 was assigned; • If the respondent gave an answer of 5 or 6, the calibration score of 0,33 was assigned; • If the respondent gave an answer of 7 or 8, the calibration score of 0,67 was assigned; • If the respondent gave an answer of 9 or 10, the calibration score of 1 was assigned. *Interview* • 0 = typical 'status quo' project 0 examples mentioned which are – according to the respondent – innovative • 0,33 = project with some gradual developments (resembles continuity with the past / in comparison to status quo projects) at least 1 example mentioned which is – according to the respondent – innovative • 0,67 = introduction of some new elements in project (resembles discontinuity with the past / in comparison to status quo projects) at least 2 examples mentioned which are – according to the respondent – innovative • 1 = introduction of many new elements in project and/or (few) elements with radical change (resembles revolutionary change in comparison to status quo projects) at least 3 examples mentioned which are – according to the respondent – innovative	*Survey* • If all respondents in the cases have a score of 1, the case receives a score of 1 • If all respondents in the cases have a score of 1 OR 0,67, the case receives a score of 0,67 • If the scores of the respondents are scattered above and under the cross over point of 0,5, the case receives a score of 0,33 • If all respondents in the cases have a score under the cross over point, the case receives a score of 0 *Interview* Calculate the average score for 'innovativeness' per case.	*Survey* • If all items in the case have a score above the cross over point of 0,5, the case receives a score of 1; • If half of the items or more of the items in the case have a score above the cross over point, the case receives a score of 0,67; • If less than half of the items in the case have a score above the cross over point, the case receives a score of 0,33; • If none of the items in the case have a score above the cross over point, the case receives a score of 0. *Survey + interview* • If the qualitative and quantitative scores are both above the cross over point of 0,5, the case receives the quantitative value (0.67 or 1); • If the qualitative score is above the cross over point, but the quantitative is not, or vice versa: in-depth case consideration and amending the case value with maximum 1 step (e.g., from 0.33 to 0.67, not from 0.33 to 1); • If the qualitative and quantitative scores are both below the cross over point, the cases receive the quantitative score (0.33 or 0).
Design freedom	*Interview* • 0 = strong presence of design restrictions; • 0,33 = presence of design restrictions; • 0,67 = Low presence of design restrictions; • 1 = Very low presence of design restrictions.	*Qualitative check* • Controlling for social desirability by selecting the lowest answer in cases where the answers of the respondents are equally reliable and generally quite consistent;	

		• Use only answers of private sector stakeholders because they are directly subjected to design restrictions	
Stimulating tender award criteria	*Survey* • 0 = 'strongly disagree' or 'partially disagree'; • 0,33 = 'neither agree nor disagree' or 'partially agree'; • 0,67 = 'agree'; • 1 = 'fully agree'.	*Qualitative check* • Use only answers of respondents that were involved in the biding process; • Use only answers of private sector stakeholders because they are directly subjected to stimuli in tender criteria • Still diverging score between respondents were solved by using qualitative data	
Information sharing	*Survey* • If the respondent gave an answer between 1 and 4, the calibration score of 0 was assigned; • If the respondent gave an answer of 5 or 6, the calibration score of 0,33 was assigned; • If the respondent gave an answer of 7 or 8, the calibration score of 0,67 was assigned; • If the respondent gave an answer of 9 or 10, the calibration score of 1 was assigned.	*Qualitative check* Controlling for social desirability by selecting the lowest answer in cases where the answers of the respondents are equally reliable and generally quite consistent	*Survey* • If all of the items per case are above the cross over point of 0,5, the case receives a score of 1; • If three out of four of the items per case are above the cross over point, the case receives a score of 0,67; • If two out of four of the items per case are above the cross over point, the case receives a score of 0,33; • If one or none out of four of the items per case are above the cross over point, the case receives a score of 0.
Network management	*Survey* • 0 = 'fully disagree' or 'disagree'; • 0,33 = 'partially disagree'; • 0,67 = 'partially agree'; • 1 = 'agree' or 'fully agree'.	*Survey* If all respondents in the cases have a score of 1, the case receives a score of 1 • If all respondents in the cases have a score of 1 OR 0,67, the case receives a score of 0,67 • If the scores of the respondents are scattered above and under the cross over point of 0,5, the case receives a score of 0,33 • If all respondents in the cases have a score under the cross over point, the case receives a score of 0	*Survey* • If all of the items per case have a score of 1, the case receives a score of 1 • If all of the items per case have a score of 1 OR 0,67, the case receives a score of 0,67 • If the scores of the items per case are scattered above and under the cross over point of 0,5, the case receives a score of 0,33 • If all respondents in the cases have a score under the cross over point, the case receives a score of 0

Chapter 4

Unpacking generative processes of collaborative innovation in public-private collaborations

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Abstract

In recent years, collaborative innovation of public services has become a growing research field. Although scholars have discovered various conditions related to collaborative innovation, current research fails to explain the generative processes of collaborative innovation. We propose four interrelated processes of collaborative innovation: diversity of ideas and perspectives, learning through interaction, consensus building and implementation commitment. The processes are tested through QCA on 19 European eHealth partnerships. The results indicate the combined effect of the processes on service innovation, and further qualitative analysis reveals the intertwined and complex nature of the processes.

Key words: Collaborative innovation, public service innovation, eHealth innovation

4.1. Introduction

Ever since Schumpeter (1934) introduced the concept of innovation to the broader (research) community, it has been understood as one of the principal mechanisms of organizational renewal and growth. It helps organizations to respond to pressures from the external environment (e.g. competition, resource scarcity, user demands, isomorphism, etc.), and to obtain distinctive competencies, enhanced reputation and a better quality of processes and services (Damanpour, Walker and Avellaneda 2009). Innovation is seen as a major source of competitive advantage in the private sector (Tsou, Cheng and Hsu 2015), and as a primary condition to create valuable public services (Osborne and Brown 2013; Crosby, 't Hart and Torfing 2017). As public services are increasingly provided by a broad range of actors (e.g. governments, private contractors, citizen or user groups) (Di Meglio 2013), the sources to achieve public service innovation become more complex (Cruz, Paulino and Gallouj 2015). As a result, governments increasingly involve a wide variety of stakeholders in the innovation process, which has led to a rise of interest in 'collaborative innovation' (Hartley, Sorensen and Torfing 2013; Torfing 2013; Sorensen and Torfing 2018; Torfing 2019).

Studying how innovation is produced through collaboration is important for understanding how innovation emerges in the public sector, because multi-actor collaborations between public and private stakeholders are becoming more ubiquitous in our highly connected and intertwined societies. Collaborative innovation encourages creative ideation and enhances the actors' capacities to successfully implement a novel solution (Torfing 2019). The perspective reflects the rationale that the involvement of a broad range of stakeholders (including citizens and users) is necessary to mobilize resources, tackle wicked problems, and discover inventive solutions (Sorensen and Torfing 2011, 2015). Complex societal problems are often multidimensional as they extend across multiple policy sectors, governments and spheres of society, and have no obvious solutions. This requires multiple actors to work together in order to find proper solutions. It also enables the mobilization of a large variety of resources and capabilities, which enhances creativity and increases implementation capacities. This unique connection between collaboration and innovation is echoed in organizational learning and business management research, where concepts such as 'open innovation' (Chesbrough 2003), 'open collaborative innovation' (Baldwin and von Hippel 2011), 'triple-helix innovation' (Leydesdorff and Meyer 2003) and 'group innovation' (Anderson and West 1998) have received a lot of attention over the past decades.

While collaborative innovation is still a young research field in the public sector, it has become firmly established over the last decade as a crucial enabler for public service innovation (Cinar et al. 2019). A wide range of conditions that influence innovation in collaborations have been identified, including process management (Stevens and Verhoest 2016; Callens et al. 2021), mutual trust (Brogaard 2017; Cinar et al. 2019), user involvement (Baldwin and von Hippel 2011), psychological safety (Anderson et al. 2014; Paulus et al. 2018) and organizational support (West et al. 2003). However, literature on the underlying mechanism of collaborative innovation is scarce and remains quite conceptual in nature. For instance, Sorensen and Torfing (2011) and Ansell and Torfing (2014) propose processes such as synergy, learning, consensus building and commitment, which are important to explain the emergence of innovation from collaboration. We build further on these conceptual tools to better understand how innovation arises from collaboration and how different processes create innovation in conjunction with one another.

This article extends current conceptualizations and research by unpacking the combined effect of generative processes of collaborative innovation. Our framework builds on evolutionary theories of innovation and models of creative problem solving, which explain how innovation arises out of complex processes of idea generation and idea implementation (Campbell 1960, 1969; Basadur and Finkbeiner 1985; Simonton 1999, 2010; Puccio et al. 2006; Brophy 2001). These theories are used to propose and integrate four interconnected processes of collaborative innovation: 1) diversity of ideas and perspectives, 2) learning through interaction, 3) consensus building, and 4) implementation commitment. We show that the combined effect of these processes is responsible for the creation of highly innovative services in public-private collaborations, by testing this through qualitative comparative analysis (QCA) on 19 eHealth partnerships. Hence, this article contributes both theoretically and empirically to current research on the mechanism of collaborative innovation.

In the next section, the theoretical framework is proposed. We first elaborate on the definition of innovation, as it is of primary importance to understand how innovation is created. Next, we introduce the processes of collaborative innovation of Sorensen and Torfing (2011) and Ansell and Torfing (2014), which we then complement by considering inherent dynamics of the innovation process. Next, we introduce our cases and methodology and test our theoretical model on the 19 eHealth partnerships. The results of the qualitative analyses are described using both the QCA results and the qualitative data from the cases. Finally, a discussion and

conclusion section summarizes the most important insights from this study and formulates implications for research and practice.

4.2. Theory

4.2.1. Defining innovation

Innovation can be defined as an idea that is perceived as new for a specific unit of adoption (Rogers 1995, 2003; Anderson et al. 2004, Walker 2007). It is, therefore, not necessarily 'totally new', and can be adopted/adapted from other organizations, as long as it is new for the individual or organization that adopts the innovation (Anderson et al. 2014). It is also generally accepted that innovation comes about through a process of ideation and adoption (Damanpour and Schneider 2008). The innovation process generates and selects new ideas, and implements these ideas into real products, services, processes or structures/concepts (cf. different types of innovations, de Vries et al. 2015). The fact that innovation is something that is implemented as new products, services, processes or concepts sets it apart from concepts such as 'invention' or 'creativity' (Amabile 1988). As innovations are implemented technologies or solutions (Anderson et al. 2014), they are expected to directly affect the implementation context (i.e. the service users). Moreover, innovation also indirectly affects the end user in that it triggers the creation of new routines, which are needed to use the innovation (Rogers 2003; Piening 2011). The innovativeness of a new service includes therefore not only the perceived newness of the created idea, but also its level of adoption into and impact on the implementation context.

This article focuses on how service innovation is created through a process of idea generation and idea implementation, specifically in collaborative partnerships. In the next sections, we elaborate on the mechanism of collaborative innovation and on the processes that make up this mechanism.

4.2.2. Mechanism of collaborative innovation

Sorensen and Torfing (2011) and Ansell and Torfing (2014) suggest four interrelated processes of collaborative innovation[1]. First, *synergy* allows the collaboration 'to combine the perspectives, resources, and skills of a group of people and organizations' (Lasker et al. 2011, 183). Synergies stimulate the creation of new ideas as a variety of knowledge and perspectives are shared and combined, and they enable collective capacity as resources and skills from multiple actors are united in an effort to create an innovation (Waldorff et al. 2014; Stevens and Verhoest 2016). Second, learning stimulates cognitive changes as individuals interact with each

other, which stimulates the development of new ideas (Ansell and Torfing 2014; Stevens and Verhoest 2016). Transformational learning enhances innovative idea generation as individuals transform their ideas and believes by building on the knowledge and perspectives from individuals with which they interact (Sorensen and Torfing 2011; Sørensen and Torfing 2017; Hartley and Rashman 2018). Third, *consensus building* corresponds to the 'joint assessment of the content and the potential gains and risks of competing ideas' (Sorensen and Torfing 2011, 852), and includes the search for agreement between stakeholders and the identification of similarities between perspectives (Innes and Booher 1999). Fourth, *commitment* refers to the search for support, a sense of joint ownership, and the willingness to implement certain ideas (Skelcher and Torfing 2010; Sorensen and Torfing 2011; Hartley, Sorensen and Torfing 2013; Ansell and Torfing 2014; Waldorff et al. 2014; Trivellato et al. 2020).

Ansell and Torfing (2014, 12) argue that these processes are 'closely interconnected and perhaps mutually reinforcing'. However, it is unclear from the current conceptual work which overarching mechanism controls the behavior of the four processes (i.e. which principles interconnect the processes?). This question is key for any explanation of the interconnected and potentially reinforcing effect of the processes, and answering this question enables the formulation of an integrated framework for the mechanism of collaborative innovation. To understand this mechanism, we need to take a step back and consider how new ideas are actually generated and implemented.

4.2.3. Processes of ideation and idea adoption

Innovation literature recognizes that the generation and adoption of new ideas present remarkable similarities to how biological evolution works (Campbell 1960, 1969; Nelson and Winter 1982; Simonton 1999, 2010; Zollo and Winter 2002). The Darwinian process of variation and selective retention poses a mechanism for how a variety of new ideas arise and only a selected few are implemented as an innovation (Simonton 1999). In this logic, variation of ideas is achieved as new ideas are produced out of changes in perceptions or ideas (i.e. 'mutations'), or existing ideas are combined with each other, generating 'new combinations' (Schumpeter, 1939, 88; Nelson and Winter 1982, 130). This variation of ideas is subsequently subjected to a selection environment in which the ideas that are best adapted to this environment (e.g. an organization, a government, a policy sector, etc.) are retained, and become part of that environment (i.e. they are implemented) (Zollo and Winter 2002). Through a process of variation and selective retention, a variety of ideas dynamically develop and evolve in the minds

of individuals and are evaluated (i.e. selected/retained) against their effectiveness in solving the given problem (Simonton 1999).

These insights tie into theories of creative problem solving. Models of creative problem solving generally constitute two mechanisms to create creative solutions. On the one hand, deliberate idea divergence through, for instance, divergent thinking, stimulates novel and original ideas to emerge (Basadur and Finkbeiner 1985; Runco and Basadur 1993; Acar and Runco 2012). On the other hand, active convergence through, for instance, convergent thinking, is necessary to obtain a supported and realizable solution (Basadur and Finkbeiner 1985; Brophy 2001; Coskun 2005; Basadur et al. 2012). These sequential phases of idea divergence and idea convergence explain how creative ideation is possible by increasing the variation of ideas, while simultaneously allowing the evaluation of the proposed ideas against some selection criteria (e.g. effectiveness, feasibility, support, etc.), in order to prevent that the process is being trapped in an endless cycle of divergent ideation (Brophy 2001; Puccio et al. 2006; Basadur et al. 2012).

4.2.4. Processes of collaborative innovation

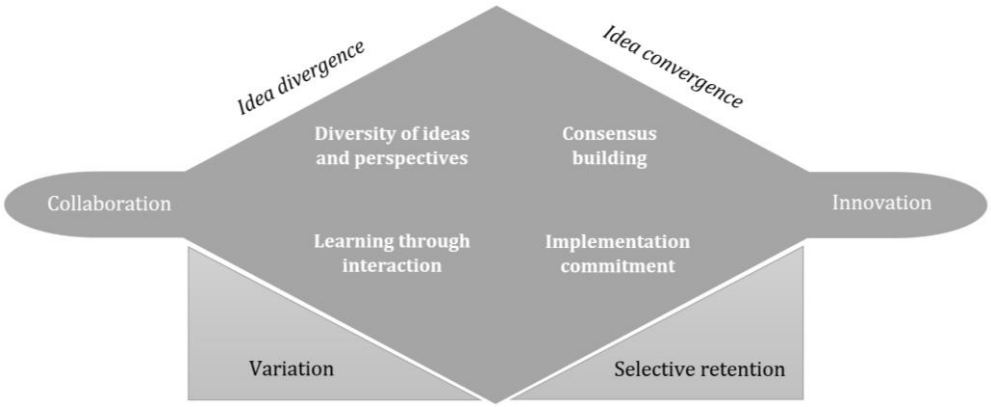
The mechanisms proposed in the evolutionary approach and the creative problem solving approach highlight the advantages of collaboration as a basis for innovation. Innovation can be created through a social interaction process, in which individuals share ideas and perspectives with one another in a group effort to generate innovative solutions (Paulus and Dzindolet 2008; Windrum and Koch 2008; Anderson et al. 2014; Perry-Smith and Mannucci 2015). Such social processes exponentially increase the variation of ideas and perspectives and stimulate individual learning and creative expression (Hirst et al. 2009), which facilitates idea divergence and creative ideation. In collaborative partnerships, this variation in ideas and perspectives increases even more due to the different backgrounds of the involved actors (i.e. competencies, knowledge, resources, etc.). The potential for idea divergence subsequently rises, as multiple ideas and perspectives are shared and combined with each other. This combination of ideas and perspectives allows the creation of new associations between concepts and knowledge elements, out of which new ideas arise (Kurtzberg and Amabile 2001; Muira and Hida 2004; Larson 2010; Korde and Paulus 2017).

Social interactions also improve the quality of idea evaluation and selection, and of convergence to and implementation of a desired solution, as more individuals are part of the innovation project and collective action becomes possible through the shared willingness to implement the solution. Collaborative innovation provides a broadened platform for critical reflection and

collective action, which helps to evaluate and select ideas, and retain them into innovative products and services. Active convergence is stimulated in collaboration processes as actors build consensus between each other by connecting their ideas and stimulating the adoption of a shared perspective (Innes 1996; Innes and Booher 2010, Sorensen and Torfing 2011; Ansell and Torfing 2014). This active convergence culminates in the actual implementation of a solution. Because of the shared resources and interests, collaborative innovation increases the capacity to retain and realize the solution. Collaborative innovation allows the collective implementation of the developed solution, and the shared ownership of the solution reduces implementation resistance (Sorensen and Torfing 2011).

We can extract four interrelated processes from these ideas, which are in line with the processes suggested by Sorensen and Torfing (2011) and Ansell and Torfing (2014). First, the *diversity in ideas and perspectives* of the involved actors in the collaboration reflect the initial variation in the collaboration, and is also the starting point of idea divergence. Second, *learning through interaction* increases this variation and idea divergence by developing new associations between concepts and generating new ideas. Third, *consensus building* allows critical reflection, evaluation and selection of proposed ideas, and initiates idea convergence as ideas are connected and shared understanding is formed. Fourth, securing *implementation commitment* represents the search for maximal convergence, in which the actors search for the willingness to collectively implement the solution, which ultimately enables the involved actors to retain the solution. Figure 1 illustrates these processes.

Figure 1: Four processes of collaborative innovation



Diversity of ideas and perspectives

In collaborative partnerships, a multitude of distinct actors join the innovation process, each with their own perspectives and ideas on the solution (Hartley et al. 2013; Torfing 2019). The diversity of ideas and perspectives functions as a starting point from where creative processes can emerge (Page 2014; Paulus et al. 2018). The generation of ideas is stimulated 'when different experiences and ideas are circulated, challenged, transformed, and expanded' (Sorensen and Torfing 2011, 852). Diversity of perspectives and ideas allows the emergence of new associations between concepts and knowledge elements, and introduces variation in the innovation process, from where new solutions can arise (Kurtzberg and Amabile 2001; Muira and Hida 2004; Larson 2010; Korde and Paulus 2017). An increased diversity in ideas and perspectives not only enlarges the collection of potential solutions, but also extends the amount of new combinations that are possible between these ideas. Some of these combinations might be 'superadditive', which means that they are more than the sum of the individual ideas (Davis and Thomas 1993; Page 2007, 2017). Collaborative innovation literature in the public sector suggests that such superaddivity or 'synergy' is vital in innovation processes as it introduces and connects new and fresh perspectives and empowers actors in the collaboration to use ideas and perspectives of each other (Waldorff et al. 2014; Stevens and Verhoest 2016; Stevens 2017).

Learning through interaction

At a general level, learning is a change of 'beliefs based on lived or witnessed experiences, analysis or social interaction' (Dunlop and Radaelli 2013, 599). In collaborative partnerships, individuals learn from each other in interaction processes, as existing ideas and perspectives of individuals are challenged by those of other individuals (Agranoff 2007; Sorensen and Torfing 2011; Crosby et al. 2017; Trivellato et al. 2020; Riche et al. 2020). Constructive interference between ideas and perspectives of multiple individuals in the collaboration causes individuals to transform their beliefs and create new knowledge, which enables the individual to generate creative ideas (Sorensen and Torfing 2011; Sørensen and Torfing 2017). For instance, Hirst et al. (2009) show that learning activities stimulate the creative expression of individuals in groups, which is crucial in creative ideation. Learning through interaction also allows the collaboration to reframe issues and approach the problem from novel directions (Hartley, Sorensen and Torfing 2013; Ansell and Torfing 2014). New ideas emerge in the collaborative innovation process as individuals build further on ideas of others or are inspired by the ideas and perspectives of others (van Knippenberg et al. 2004; Harvey 2014; Coursey et al. 2017;

Paulus et al. 2018). Hence, learning further increases the diversity of ideas in the collaboration and stimulates the variation in the innovation process.

Consensus building

Innes and Booher (1999, 11) define consensus building as processes 'in which individuals representing differing interests engage in long-term, face-to-face discussions, seeking agreement'. Preventing deadlocks in the process and mitigating veto power of stakeholders by facilitating the creation of compromise and agreement is of crucial importance for effective collaborative innovation processes (Sorensen and Torfing 2011, 852). As we mentioned, diversity of ideas and perspectives, and learning through interaction, stimulate idea divergence, which is of primary importance for the development of novel and creative ideas. However, too much divergence leads to stalemates as the interconnectivity of the ideas is lost due to the increasing amount of solution alternatives. This interconnectivity between ideas is enhanced when collaborating individuals try to identify similarities between ideas and perspectives through constructive discussion and dialogue (Innes and Booher 1999; Harvey 2014). Similar to how learning enables the reframing of issues (Hartley, Sorensen and Torfing 2013; Ansell and Torfing 2014), consensus-building allows frame alignment and joint image building, which are crucial connective capacities in collaborative networks (Van Meerkerk and Edelenbos 2014; Klijn and Koppenjan 2015; Giekse et al. 2016).

Implementation commitment

The concept of innovation is closely related to the implementation of a new solution in a certain context (Rogers 2003; Anderson et al. 2004; Walker 2007). In a collaborative partnership, the involved partners are not only responsible for the idea generation and idea selection phases of the innovation process, but are also part of the implementation of the novel ideas. Collaborative innovation presents advantages over other forms of innovation as capacities of multiple actors are shared and collective action empowers the actors to implement the solution. This, however, suggests the importance of a joint commitment to realize the innovation. Retaining a solution by the collaborating stakeholders requires collective commitment, as the proper resources need to be mobilized, and the partners need to support the implementation of the solution (Sorensen and Torfing 2011; Ansell and Torfing 2014). Collectively implementing a new solution means that the partners engage in the creation of new routines that enable the use of the innovation (Rogers 2003; Piening 2011), which means that the implemented solution needs to be feasible and realizable for those affected by the innovation.

4.2.5. Hypothesis

As is illustrated in figure 1, the combination of the four processes of collaborative innovation generates innovation out of collaboration. The diversity of ideas and perspectives, and learning through interaction stimulate idea divergence and variation in the innovation process. Through processes of consensus building, the collaboration partners manage to evaluate and select relevant ideas and construct a shared perspective of the innovation. Ideas are, however, only retained in case of sufficient implementation commitment to realize the solution. These combined processes explain why some collaborative partnerships produce highly innovative solutions and others do not. We propose the following hypothesis:

Hypothesis 1: Collaborative partnerships that show the combination of diversity of ideas and perspectives, learning through interaction, consensus building and implementation commitment, produce highly innovative public services.

4.3. Cases and methodologies

4.3.1. European eHealth partnerships

Although the European Union prioritizes the development of health solutions through the use of digital technologies and data analytics (European Commission 2018), current research fails to properly explain the mechanism responsible for creating successful eHealth innovations (Andreassen et al. 2015). This article contributes to this by analyzing data from a total of 19 eHealth partnerships. To enable a thorough comparative analysis of European eHealth partnerships and a (cautious) generalization of our results to similar partnerships in Europe, five European countries from the different European administrative traditions (Pollitt and Bouckaert 2017) were selected: Belgium, the Netherlands, Estonia, Denmark and Spain[2]. Although there can be differences between European health systems (see e.g. Blank and Burau 2018), the selected cases and their eHealth innovations were still comparable, as is indicated in table A1. Table A1 gives an overview of the case selection and data collection, with a short description of the composition of the partnerships and the eHealth innovations the partnerships generated.

To ensure a valid comparison between the cases, we adopted strict case selection criteria. First, we conducted our analysis on public-private collaborations, which meant that only partnerships between public actors (e.g. governments, public hospitals, etc.) and private actors (e.g. firms, private health care organizations, etc.) were selected. Second, all cases exhibited some level of

user involvement. Third, only cases that had implemented or at least extensively tested the solution were selected. Fourth, all cases created the innovation relatively recently (i.e. within the last five years). Fifth, all partnerships were formally established and organized (i.e., no informal partnerships). Sixth, all projects concerned innovation in eHealth services (and not in eHealth policy). Seventh, as public-private collaborations can be coordinated by the public actor or the private actor, both 'types' of partnership were included in the case selection.

In order to generate insights on 'eHealth innovation', the selected cases represented a mixture of two types of eHealth technologies that are generally recognized by researchers and practitioners: eHealth technologies related to administrative simplification and the digitalization of information, and eHealth technologies related to telehealth and mobile health tools, and smart devices (Scholz 2015; Van Waes 2017; Wouters et al. 2018). Examples of the former include virtual networks for patient information exchange, central patient registration platforms, and central communication systems for monitoring patients, while examples of the latter include health technologies using motion sensors, mobile apps, smart cameras, robots, and security systems..

We collected data from 132 respondents using 132 semi-structured interviews and 124 surveys. The respondents included project coordinators, public partners (representatives of e.g. government agencies, local governments, public hospitals, …), private partners (representatives of e.g. private home care organizations, consultants, ICT-companies, …) and service users (e.g. physicians, patients, medical professionals, citizens, …). The interviews added rich qualitative data to the analysis, while the surveys provided more standardized and highly consistent data. The interview data was structured per condition for each interview. This standardized processing of the interview data enabled a consistent calibration of the conditions (see later). Both the interview and survey data were used to calibrate the conditions, but the qualitative richness of the interview data was also used to shed more light on the dynamics of collaborative innovation. Hence, employing both survey and interview data allowed us to uncover patterns across the cases, but also stay close to the case data (Schneider and Wagemann 2010). Detailed information about the data collection can be found in table A1.

4.3.2. Qualitative comparative analysis (QCA)

We analyzed the data through fuzzy-set qualitative comparative analysis (QCA). QCA is a set-theoretic method that uses Boolean logic to investigate whether or not a (combination of)

condition(s) (i.e. independent variable) corresponds to a certain outcome (i.e. dependent variable) (Ragin 2008). QCA has three important features that are important for this study (see Ragin 2008). First, QCA searches for 'configurational causation', which means that a combination of conditions can lead to a certain outcome (i.e. innovative services). Second, QCA implies equifinality, which means that there might be more solution paths that result in a certain outcome. Third, QCA results can be asymmetric, which means that the same outcome can be produced by the presence or absence of a certain condition, depending on the specific combination of those conditions. Because of the interrelatedness of the suggested processes of collaborative innovation, QCA is particularly interesting to analyze the combined effect of these processes on innovation. Methodologically, the standardized features of QCA facilitate a broader comparative study, without losing the qualitative richness of an in-depth case-study. This enables us to test our hypothesis in multiple European partnerships, which enhances the generalizability of the results to similar projects in Europe, while simultaneously enabling a deeper qualitative interpretation of the findings.

This article uses fuzzy-set QCA which means that the boundaries of the sets representing the outcome and conditions are 'fuzzy' and, instead of being in or out of the set (resp. 1 or 0), some cases may be partially in or partially out of a set (indicated as resp. a 0.67 or 0.33). The cross-over point of 0.5 presents a point of maximal indifference towards membership or non-membership of a case in a set (Schneider and Wagemann 2012). QCA uses two measures to assess the relationship between condition(s) and outcome. *Consistency* measures the overlap between the studied sets. High consistency between a condition and the outcome means that the cases in the sets share the same membership of the sets (i.e. presence/absence in the sets). A very high consistency (i.e. 0.9 and higher) between a single condition and the outcome reflects that every time the condition is present, the outcome will be present too. Such a condition is called a *necessary condition*. However, the membership of cases in multiple sets might also be consistent with the set membership of the cases in the outcome. Such conditions are called *sufficient conditions.* A second measure of QCA is the *coverage* of overlapping sets. The more cases are present in these overlapping sets, the more prevalent the relationship between the condition(s) and the outcome.

4.3.3. Operationalization and calibration of outcome and conditions

Operationalization

Innovation can be described as an idea that is perceived as new for a specific unit of adoption (Rogers 1995, 2003; Anderson et al. 2004, Walker 2007). How actors involved in and impacted by the innovation process experience the newness of the innovation, is therefore essential in measuring the innovativeness of the created services. For this reason, the actors involved in and impacted by the innovation process (i.e. coordinator, public partners, private partners and users) were asked about the newness of the created solutions. Additionally, innovation requires the implementation of a solution, which implies that an innovation needs to be adopted into and impact a specific implementation context. As such, we measured the degree to which the adopted innovation affected the users and the problem it was meant to tackle. A seven-point scale was used to measure both the newness and adoption of the innovation. Table A2 of the annex visualizes the used items.

We also used a similar seven-point scale for the measurement of our conditions. As we mentioned, the *diversity of ideas and perspectives* comes from the multitude of distinct actors that join the innovation process, each with their own perspectives and ideas on the solution (Hartley et al. 2013; Torfing 2019). This diversity is present in the collaboration at the moment the involved partners initiate the innovation process. As such, the respondents were asked two survey questions about the diversity of ideas and perspectives at the start of the project. *Learning through interaction* occurs when individuals build further on ideas of others or are inspired by the ideas and perspective of others (van Knippenberg et al. 2004; Harvey 2014; Coursey et al. 2017; Paulus et al. 2018). We, therefore, asked the respondents three survey questions on how they were influenced by the ideas of others. We defined *consensus building* as a way to regain interconnectivity between diverse ideas as collaborating individuals try to identify similarities between ideas, align different perspectives and build support for ideas (Innes and Booher 1999; Harvey 2014; Van Meerkerk and Edelenbos 2014; Klijn and Koppenjan 2015; Giekse et al. 2016). We therefore asked respondents three survey questions about processes related to the connection of ideas and the generation of support for certain ideas. *Implementation commitment* was defined as the capacity to implement the innovation by ensuring the mobilization of resources, the willingness of the partners to implement the generated ideas, and the feasibility of the implemented solution for those affected by the

innovation (Sorensen and Torfing 2011; Ansell and Torfing 2014). Three survey questions were asked to the respondents related to these concepts.

The items used to operationalize the four conditions are visualized in table A3 of the annex. These questions were not asked to the users, because not all users were involved from the start of the project, or were intensively enough involved to make an accurate estimate of these conditions. Additionally, interview questions for each of the four conditions were asked to the respondents. These interview questions addressed several components of the idea generation and implementation processes, including whether or not ideas were created through interactions, whether or not individuals were trying to discover similarities between ideas, if the individuals in the partnership were highly committed to realize the innovation, and if they considered how realizable and feasible certain ideas were.

Calibration

QCA calibration allows the researcher to assign a value for the membership of each case for the conditions and outcome. As we collected rich information on the conditions and outcomes (i.e. multiple items asked to these respondents, multiple types of respondents, multiple sources, i.e. interviews and surveys), proper triangulation is necessary to obtain correct membership scores. Three general rules were applied for each condition/outcome. First, as each of the items used for the conditions/outcome described a single concept (e.g. the innovativeness of services), the mean score of these items was applied to calculate the answer for a single respondent in a case (which was also checked through a factor analysis). Second, based on the survey scales and qualitative case information, a cross-over point was defined for each condition/outcome[3]. Third, specific calibration rules were used to calculate the case membership scores (see table A8 of the annex). These rules allowed to calculate case membership scores out of the multiple types of respondents. These rules also accounted for the different data sources used in the study (i.e. surveys and interviews).

4.4. Results

4.4.1. QCA results

We performed the analyses with the fsQCA software version 3.1b[4] (Ragin 2017). Table A4 of the annex shows the calibrated dataset. Table 1 visualizes the distribution of cases above and below the cross-over point for high innovativeness. From this table, it is clear that even with

the conservative calibration rules, more cases exhibit high innovativeness of the created services.

Table 1: Set membership of the cases for the outcome

Innovativeness of created services in the projects		Number of cases
High innovativeness	Above 0.5	12
Low innovativeness	Below 0.5	7

We follow standards of practice in reporting the results (Schneider and Wagemann 2010). We first discuss the analysis of necessary conditions. As we do not expect any of the studied conditions to be necessary for the outcome, we will not elaborate a lot on this analysis. Next, we discuss the analysis of sufficient conditions, on which our hypothesis applies, as it examines whether the combination of conditions affect the innovativeness of the created services in the studied cases.

Table 2 illustrates the analysis of necessary conditions. A consistency threshold of 0.90 is advised when assessing the necessity of conditions for the outcome (Schneider and Wagemann 2012). None of the conditions in table 2 exhibit consistency levels of at least 0.90, which indicates that none of these conditions are necessary for the presence of high innovativeness.

Table 2: Analysis of necessary conditions

Presence of high innovativeness		
Conditions	**Consistency**	**Coverage**
Diversity of ideas and perspectives	0.530938	0.639423
~Diversity of ideas and perspectives	0.699601	0.656367
Learning through interaction	0.800399	0.727768
~Learning through interaction	0.463074	0.581454
Consensus building	0.798403	0.749064
~Consensus building	0.596806	0.718750
Implementation commitment	0.764471	0.741530
~Implementation commitment	0.564870	0.652826

Next, we perform the analysis of sufficient conditions by constructing a truth table in which all the logically possible combinations of the conditions are presented. The truth table of this analysis is illustrated in table A5 of the annex. Following standards of practice (Schneider and Wagemann 2012), we only report the truth table rows with at least one case covered, which

means that only 12 rows are retained in the truth table. The raw consistency values in the truth table are a measure to assess the relationship between the truth table rows and the presence of the outcome. A threshold of 0.80 for the raw consistency is advised to evaluate this relationship (Schneider and Wagemann 2012). Additionally, we observe a strong decrease in raw consistency from row 2 to row 3, which also indicates that the consistency threshold is reached (Schneider and Wagemann 2012).

Table 3 illustrates the intermediate solution, obtained after the logical minimization of the truth table rows, which takes directional expectations into account. The directional expectations for this analysis are given by the theoretical assumptions of the hypothesis, which essentially mean that we expect that all conditions are present when the outcome is present. A single solution path is presented in table 3, which indicates that *partnerships in which the combination of learning through interaction, consensus building and implementation commitment is present, exhibit high innovativeness of the created services*. A high solution consistency and coverage of resp. 0.86 and 0.63 supports the strength of this solution path. A total of 6 cases are covered by this solution path, of which none is contradictory (i.e. a case that is present in the solution path but does not exhibit the outcome). There were no tied prime implicants, which means that there was no model ambiguity.

Table 3: Intermediate solution for the presence of high innovativeness

	Consistency	Raw coverage	Unique coverage	Cases in path
Learning through interaction * Consensus building * Implementation commitment	0.864754	0.631737	0.631737	D3, S2, E2, S1, S4, B4
Solution consistency	**0.864754**			
Solution coverage	0.631737			

According to Maggetti and Levi-Faur (2014), QCA results should always be interpreted using the intermediate, parsimonious and complex solutions. The complex solution turns out to be exactly the same as the intermediate solution, but the parsimonious solution is slightly different. The parsimonious solution path shows a combination of consensus building and implementation commitment (see table A6 in the annex). The solution consistency and coverage values are also slightly altered in the parsimonious solution (resp. 0.88 and 0.70). Of course, these results do not account for theoretical expectations and are purely based on the Boolean logic of combining sets and the available empirical information.

We applied a robustness check to assess the stability of the intermediate solution. We lowered the raw consistency threshold to a minimum of 0.75 (Schneider and Wagemann 2012) to check whether the solution remained stable. We still observe the solution path of our original intermediate solution (i.e. combination of learning, consensus building and commitment), but a new solution path also emerges in this analysis (see table A7 of the annex). This solution path combines diversity of ideas and perspective with an absence (~) of the conditions learning through interaction, consensus building and implementation commitment (solution consistency and coverage resp. 0.85 and 0.73). However, we have to realize that the second solution path has a very low consistency of 0.75 and only one case is covered by this solution path. Furthermore, we also observed a substantial drop in raw consistency from truth table row 2 to row 3 in the original analysis, which urged us to exclude row 3. This should be taken into account when interpreting the results of the robustness check. However, the main conclusion from the robustness check is that the original solution path remains stable when the raw consistency threshold is lowered.

4.4.2. Insights from qualitative data

Qualitative information (i.e. interview data) should be leading when researchers want to better understand the QCA solution paths and potentially infer causal relations between conditions and outcome (Schneider and Wagemann 2010). We analyzed the qualitative data of the cases covered by the solution path in more detail to better understand how the observed combination of conditions causes the creation of highly innovative services. The qualitative data revealed a relatively equal distribution between the countries of origin, the types of eHealth innovations and the types of partnerships of the cases covered by the solution path. Three main insights were extracted from this data. First, all of the cases covered by the solution path have very pronounced ideation phases. An active search for new and desirable ideas was of high priority for all these cases. For instance, the involved partners organized brainstorm sessions in which individuals developed new ideas, or established environments in which ideation was enabled through trial-and-error. A good example of the latter is the experimental testing environment of case B4 in which new ideas were directly tested in a real-life setting.

Second, learning through interaction, consensus building and implementation commitment were never totally disconnected from each other. Intentional phases of ideation were almost always connected to intensive deliberation, in which the involved actors tried to find similarities between ideas and connect different perspectives. Learning through interaction unfolded

naturally towards the creation of shared perceptions and mutually supported ideas (i.e. consensus building), through the use of deliberation platforms, bilateral dialogue and project teams. Strongly conflicting ideas were prevented by early connecting ideas, or postponed so they would not push away some partners, which enabled a strong basis for idea sharing and learning. Learning through interaction and consensus building caused early involvement of all of the relevant actors (including users), which proved to be crucial to establish the proper capacity for implementation as it gave these actors the opportunity to share their motivations and interests, which were then taken into account during the development of the innovation.

Third, the qualitative information shows a more complicated role of the diversity of ideas and perspectives in the innovation processes of the covered cases. Three observations are made. First, the covered cases show that the diversity in ideas and perspectives often has a cultural or organizational origin (e.g. different organizational cultures, procedures, routines, interests, etc.), which can lead to conflicts between the involved partners. This, in turn, can harm the innovation process. For instance, in case D3, the differences between the partners were so substantial that they led to the premature termination of the collaboration with this partner. Second, when such differences in ideas and perspectives were apparent from the start of the project, the involved partners were more cautious in forcing ideas upon others and were stimulated to discuss these differences early on in the process. These early discussions evolved into an open ideation process in which learning and consensus building created novel and feasible ideas, which enhanced the innovation process. Third, diversity in ideas and perspectives was actively searched for by many of these partnerships. For instance, some partnerships (e.g. case B4) organized work visits to other organizations to collect new ideas and perspectives, or worked together with specialized organizations, which could enrich their own knowledge pool and stimulate the innovation process.

4.5. Discussion

The general objective of this article was to explain why and how public-private collaborations create highly innovative public services. Based on the work of Ansell and Torfing (2014) and colleagues, evolutionary theories of innovation, and models of creative problem solving, we proposed a theoretical framework to explain the inner workings of the collaborative innovation mechanism. From this framework, we hypothesized that four interrelated processes of collaborative innovation – diversity of ideas and perspectives, learning through interaction,

consensus building, and implementation commitment – exhibit combined effects on the innovation process in public-private collaborations.

The QCA results and qualitative findings of the case data provided two key insights into the collaborative innovation process. First of all, our hypothesis in which all four of the processes are present when highly innovative services are created, was only partially confirmed. The QCA results confirmed the combined effect of learning through interaction, consensus building and implementation commitment, but the diversity of ideas and perspectives could be both present and absent in this configuration. The literature suggests that the diversity of ideas and perspectives facilitates the emergence of new associations between concepts and introduces variation in the innovation process, from where new solutions can arise (Kurtzberg and Amabile 2001; Muira and Hida 2004; Larson 2010; Korde and Paulus 2017). However, our qualitative results showed that a lot of this diversity was related to differences in organizational cultures and characteristics, which caused conflicts between the partners. This result fits well with innovation research that claims that diversity in innovation teams might also cause conflict, distrust, miscommunication and information asymmetries, and might reduce overall group cohesion (Hambrick et al. 1996; Pelled et al. 1999; Mannix and Neale 2005). However, the diversity of ideas and perspectives did also stimulate the innovation process, as new knowledge bases were accessed, and the diverging perspectives stimulated early discussions and idea exchange, which were crucial components for the subsequent ideation process. In sum, the relationship between the diversity of ideas and perspectives and innovation is ambiguous, which is reflected in the inconclusiveness of innovation scholars on the effect of, for instance, group diversity on creativity and innovation (Reiter-Palmon et al. 2012; Paulus et al. 2012; Anderson et al. 2014).

Second, with a solution consistency of 0.86, the combination of learning through interaction, consensus building and implementation commitment has a strong relationship with public service innovation in European public-private eHealth partnerships. The qualitative data also indicated the intertwined nature of the three conditions, which adds to the complexity of the collaborative innovation process. Learning new perspectives and building on the ideas of others was often directly connected to building agreement and consensus, and securing support and commitment from the partners. Collaborative interactions between the involved actors spurred learning dynamics, which increased the variation in the innovation process through idea generation. However, at the same time these interactions also provoked intensive consensus building activities and secured support and commitment from the partners for the exchanged

ideas and perspectives, which relates to the selective retention of ideas. The parsimonious solution of our QCA analysis actually indicates that, when disregarding all theoretical assumptions, the combination of consensus building and implementation commitment leads to highly innovative services. This might point to the relative importance of achieving a implemented solution in comparison to divergent thinking, as both consensus building and implementation commitment are directed towards achieving a shared solution.

These results shed new light on the strong emphasis in creativity literature on divergent thinking activities to prevent premature convergence (e.g. Basadur and Finkbeiner 1985; Runco and Basadur 1993, Acar and Runco 2012). While creativity research points to the crucial relevance of divergent thinking (Acar and Runco 2012), from the moment that an idea needs to be implemented, processes directed towards convergence melt into this divergent thinking. While some models of creative problem solving seem to suggest this (Basadur 1995; Basadur et al. 2012), our results indicate that there exists no strict separation between divergent thinking and convergent thinking in collaborative innovation processes because innovation requires a combination of both creative and realizable solutions. These findings attest empirical evidence that suggests that innovation processes are cyclical, messy and chaotic, some steps are repeated a number of times, and feedback loops between the different stages of the innovation process allow a revisit of some steps of the innovation process in later stages of the process (King 1992; Van de Ven et al. 1989; Anderson et al. 2014). This complex behavior of the generative processes has also been suggested by Ansell and Torfing (2014), who suspect the processes to be interconnected and mutually reinforcing. This article provides the first evidence for these reinforcing processes, and provides an overarching mechanism for their behavior.

4.6. Conclusion

This article aimed to contribute on three relevant aspects of collaborative innovation. First, we aimed to deepen our understanding about the mechanism of collaborative innovation, by developing a theoretical framework that proposed and integrated generative processes of collaborative innovation. Theories related to the evolutionary approach on innovation, creative problem solving and collaborative innovation enabled us to define four interrelated processes of collaborative innovation: 1) diversity of ideas and perspectives, 2) learning through interaction, 3) consensus building, and 4) implementation commitment. The four processes combine with each other through dynamics of variation and selective retention, and idea divergence and idea convergence. This model may prove valuable for subsequent research into

the collaborative innovation process, as each of the four processes in themselves may be the focus of further empirical research.

Second, we aimed to provide empirical evidence for the combined effect of the processes of collaborative innovation on the innovativeness of created services, by testing those processes in 19 eHealth partnerships. Our QCA analyses indicated that there is a strong combined effect of learning through interaction, consensus building and implementation commitment on the innovativeness of the created services, but no strong isolated effects (i.e. none of the conditions were necessary). This suggests that project coordinators should facilitate all of these processes. A sole focus on idea generation (e.g. through brainstorming activities) may result in processes of divergent thinking that never settle into a realizable solution, while only focusing on idea implementation (e.g. through consensus building) may result in premature idea convergence with solutions that lack originality, creativity and novelty. As our analysis is based on 19 eHealth partnerships from five different European countries, including five public administration regimes (Pollitt and Bouckaert 2017), and including a wide range of eHealth innovations, our results enable cautious generalizations to similar European projects.

Third, the article unveiled the inherent complexities of the processes and intended to explain how these processes influence the innovation process, by diving into the qualitative case information. The qualitative data showed that diversity of ideas and perspectives can work in different ways, which impact the process differently. Moreover, the four processes exert complicated effects on the innovation process, as they become intertwined with each other, each provoking simultaneous responses from the other processes, which creates a highly complex and turbulent innovation process. This suggests that an activity related to one of the processes might provoke a (un)desired outcome for another process, which eventually influences the innovativeness of the created services. Project coordinators might use this to their advantage, as stimulating an open ideation process not only stimulates idea divergence through learning, but also encourages thorough deliberation and consensus building, which eases the convergence towards a single, supported solution, and enhances the collective capacity to implement the created solution.

However, our research is not without limitations. The QCA method enabled a comparative case study analysis on 19 European eHealth partnerships. This comparative analysis and the incorporation of different European administrative regimes and eHealth technologies (which were all represented in the final results), allowed cautious generalization to similar European

projects. However, the method sometimes loses valuable in-depth knowledge related to the causal relationship between the conditions and the creation of innovation. The qualitative analysis helped us to uncover these relationships in the cases that were covered by the QCA solution, but this was limited to a retrospective analysis, and a lot of questions remain as to how these complex dynamics arise and evolve throughout the innovation process. Qualitative process tracing in a limited number of cases might provide more insights into the causal relationships between the processes and the produced innovation, and is regarded as a standard of good practice to complement QCA research (see Schneider and Rohlfing 2013). Furthermore, this study is only related to European countries that fall within the covered administrative traditions of public administration and only covers eHealth related partnerships, and as such, generalizations to other contexts should be made with appropriate caution.

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Endnotes

[1] There are some slight differences in the way the authors represent these processes. For instance, Ansell and Torfing (2014) mention only three processes, and integrate consensus building and commitment in one process. We separate these two processes because they have different functions in the collaborative innovation process. Sorensen and Torfing (2011) also mention the diffusion of innovation, which can be regarded as part of the implementation phase.

[2] The selected countries broadly represent administrative traditions in (continental) Europe: Nordic (Denmark), Central and Eastern Europe (Estonia), Continental (the Netherlands/Belgium) and Napoleonic (Spain/Belgium) (Pollitt and Bouckaert 2017).

[3] Conservative cross-over points were selected for the outcome and the conditions as we selected projects from partnerships that were involved in innovating eHealth technologies, in order to observe the collaborative innovation processes. Moreover, a slightly higher cross-over point was selected for the outcome, learning through interaction, consensus building and implementation commitment to prevent validity issues because of the social desirability of scoring high on these questions (proper framing of the questions could only partially address this issue). We also checked the selection of the cross-over point for these conditions/outcome with the qualitative case information.

[4] http://www.socsci.uci.edu/~cragin/fsQCA/software.shtml

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Annex

Table A1: Selected cases and data collection

Case ID		Short description of the case[1]	Data collection	
			Surveys	Interviews
Belgium	B1	Multiple national government agencies, ministerial cabinet, multiple hospital networks, regional governments, private health suppliers, and insurance organizations, and user organizations created a portal website which provides patient information for citizens at a national level.	Government agency, ministerial cabinet, public hospital, private ICT company, representatives of patient organizations, physician association, and user groups	Government agency, ministerial cabinet, public hospital, private ICT company, representatives of patient organizations, physician association, and user groups
	B2	Private nursing organizations and federation, ministerial cabinets, national government agencies, hospital networks, individual GPs, and several private health organizations created a tool which provides access for general practitioners (GPs) to home care organisations' patient information.	Project coordinator, government agency, private service provider, ICT company, GPs	Project coordinator, government agency, private service provider, ICT company, GPs
	B3	Universities, private health organizations, national and regional government agencies, red cross organizations, knowledge organizations, ICT suppliers, and individual health professionals created a way of creating, validating, and disseminating official evidence-based guidelines for health care providers.	Chairman and CEO network, representative government steering committee, private service providers, ICT company, GPs	Chairman and CEO network, representative government steering committee, private service providers, ICT company, GPs
	B4	Public nursing home (local government), private construction companies and contractors, consultant companies, nurses, and patients created a nursing home which implemented several technologies (wearables, smart cameras, etc.) to support residents and nurses in their daily activities.	Manager nursing home, municipality, nurses	Manager nursing home, municipality, external private consultant, nurses
	B5	Municipalities, communal network, private hospitals, private ICT companies, consultant companies, citizens, and health professionals created a platform which brings people with health/social care demands together with volunteers who provide help.	Project coordinator municipality, employee municipality, ICT company, citizens	Project coordinator municipality, employee municipality, ICT company, citizens
The Netherlands	N1	Municipality, public hospital, and several private health organizations created a ICT platform which facilitates the exchange of health information between partners and patients.	Project coordinator, public service organization, ICT company, service organization, physicians	Project coordinator, public service organization, ICT company, service organization, physicians
	N2	Municipality (departments of social affairs, ICT, and service quality), private health care provider, neighbourhood teams, citizens created a digital platform designed to foster neighbourhood collaborations between clients and consultants.	Project coordinator municipality, coordinator private service provider, employee municipality, social workers and other professional users	Project coordinator municipality, coordinator private service provider, employee municipality, social workers and other professional users

[1] The descriptions of the eHealth innovations in the cases are strongly based on the European Horizon 2020 research report of Callens et al. (2020, 18-19).

Case ID		Short description of the case[1]	Data collection	
			Surveys	Interviews
	N3	Semi-private association, software developer, and patient organization created a tracking technology which allows an open floor and the possibility for dementia patients to walk around freely.	Manager/project coordinator, public service provider, ICT company, representative user organization, nurse, physician	Project coordinator, public service provider, ICT company, representative user organization, nurse, physician
	N4	Semi-private association, ICT company, consultant company created a smart diaper which automatically detects defecation and signals this to the nurses.	Manager/project coordinator, public service, provider	Manager/project coordinator, public service, provider, nurses
Spain	S1	Several public hospitals, private ICT companies, several patient organizations, university created an electronic prescription system, a patient appointment system for the Outpatient Dispensing Unit, a robot for automatic storage and dispensing in assisted and unassisted mode.	Public hospital, public hospital, ICT company, health professionals	Public hospital, public hospital, ICT company, health professionals
	S2	Public hospital/health service, regional government, ICT companies, consultancy companies, several other private companies, universities, health professionals and patients created advanced ICT systems designed to enable an integrated patient-centred care model to deliver home health care for chronic patients.	Innovation director ICT company, public hospital, private service organization, patient, physician, social worker	Innovation director ICT company, public hospital, private service organization, patient, physician, social worker
	S3	Public hospitals and healthcare services, public research institute, private technology centre, several health professionals (e.g. psychiatrist, psychologists, physicians, etc.) created a computerised cognitive behaviour therapy (CCBT) through a web application which allows for self-administered treatment regardless of time or place.	Public hospital, public hospitals/health care organization, ICT company, physicians, nurse and technician	Public hospital, public hospitals/health care organization, ICT company, physicians, nurse and technician
	S4	Public hospitals, ICT and telecom companies, physicians created an AI application to diagnose uncooperative patients. It serves to determine whether they have any problems with their eyesight. In some cases, it also enables the diagnosis of the problem.	Public hospital, public hospital, ICT company, health professionals	Public hospital, public hospital, ICT company, health professionals
Estonia	E1	Ministry, government agencies and public authorities, ICT companies, private health care providers, physician associations, hospital associations, individual physicians created a centralised registration system within the national patient portal where patients can book appointments with all health care providers that have partnered with the project.	Project coordinator, ministry, ICT company, ICT technicians	Project coordinator, ministry, ICT company, ICT technicians
	E2	Ministries, public health insurance authority, government agencies, physician association, interest groups created a redesigned service process that combines three standalone services (application for disability; application for rehabilitation services; application for aids) into one logical service. It is achieved through changes in data processing and analytics.	Project coordinator, ministry, physicians association, representatives of users and individual user	Project coordinator, ministry, physicians association, representatives of users and individual user

Case ID		Short description of the case[1]	Data collection	
			Surveys	Interviews
	E3	Ministry, public health insurance authority, colleges, network of healthcare providers, ICT companies, several health care organizations created an app with a voice command function that supports the health care provider in carrying out procedures through digitalised guidelines.	Project coordinator, ministry, private health network, representatives users, nurse	Project coordinator, ministry, private health network, representatives users, nurse
Denmark	D1	Regional government, municipalities, public hospitals, ICT company, representatives of health professionals created an e-learning programme that provides health professionals with knowledge about dysphagia.	Program manager, public hospital, ICT company, health professionals	Program manager, public hospital, ICT company, health professionals
	D2	Public hospital, ICT company, health professionals created a smartphone app for patient reported outcomes.	Project coordinator, public hospital, physician, nurse	Project coordinator, public hospital, physician, nurse
	D3	Public hospital, university, ICT and health service companies, patient associations, health professionals created a smartphone app that helps convey the results of bone scans to patients with osteoporosis.	Project coordinator, public hospital and ICT company, health professional, social worker, user representative	Project coordinator, public hospital and ICT company, health professional, social worker, user representative

Table A2: Operationalization of *innovativeness*

Newness	**Adoption**
No/A lot of innovative ideas are developed in this project	The frequency of use will typically be very low/high
The innovativeness of the developed innovation is very low/high	The effect on a user's life will be very small/extensive
The innovative character of the project is lower than/exceeds my initial expectations	Only a selective subgroup of users/All users that would benefit from this innovation can use it
The users could do exactly the same thing with other tools/would be unable to do those things without this innovation	The innovative ideas that are developed in the project are not feasible at all/very feasible
It is very easy/difficult (or impossible) to find tools that have the same functionalities as this innovation (at the moment of implementation)	The innovation does not deal with the problems at hand at all/really deals with the problems at hand

Table A3: Operationalization of the conditions

Diversity of ideas and perspectives								
There were no differences in opinions or perspectives of the actors	1	2	3	4	5	6	7	There were a lot of differences in opinions and perspectives of the actors
My own ideas and opinions were very similar to the ideas and opinions of other actors	1	2	3	4	5	6	7	My own ideas and opinions were very distinctive from the ideas and opinions of the other actors
Learning through interaction								
The involved actors stayed close to their initial ideas	1	2	3	4	5	6	7	The involved actors built further on the ideas of other involved actors
When interacting with each other, the involved actors did never come up with new ideas or insights regarding the innovation	1	2	3	4	5	6	7	When interacting with each other, the involved actors came up a lot with newly developed ideas and insights regarding the innovation
The information or ideas mentioned by the other involved actors never inspired my own ideas	1	2	3	4	5	6	7	The information or ideas mentioned by the other involved actors often inspired my own ideas
Consensus building								
The involved actors were increasingly emphasizing the differences between their ideas and perspectives on the innovation, and the ideas of other involved actors	1	2	3	4	5	6	7	The involved actors were increasingly trying to detect the similarities between their ideas and the ideas of the other involved actors in order to come to a shared solution
The involved actors were increasingly trying to prevent that a general support for certain ideas emerged	1	2	3	4	5	6	7	The involved actors were increasingly trying to ensure there was general support in the partnership for certain ideas
My ideas started to diverge more and more from the ideas of the other actors	1	2	3	4	5	6	7	My ideas started to converge more and more towards the ideas of the other actors
Implementation commitment								
Realizing and implementing the proposed innovation was of no concern for the involved actors	1	2	3	4	5	6	7	Realizing and implementing the proposed innovation was of high concern for the involved actors
In developing the innovation, the involved actors departed strongly from what was realizable for those they represented (e.g. own organization)	1	2	3	4	5	6	7	In developing the innovation, the involved actors stayed close to what was realizable for those they represented (e.g. own organization)
My organization was not committed to invest time/resources in the implementation (by itself or by others) of the innovation	1	2	3	4	5	6	7	My organization was fully committed to invest time/resources in the implementation (by itself or by others) of the innovation

Table A4: Calibrated dataset

Case	Diversity of ideas and perspectives	Learning through interaction	Consensus building	Implementation commitment	Innovativeness
N3	0.67	0	0.67	0.33	0.33
B5	0.33	0.67	0.33	0.67	0
E1	0.33	0.33	0.33	0.67	0
E3	0	0.33	0.67	0.33	0
D1	1	1	0.67	0.33	0.67
B3	0.67	0.67	0.33	0.33	0.67
N4	0	0.67	0.67	0.33	0.33
N2	0.33	0.33	0.33	0.33	0.67
S3	0.33	0.67	0.67	0.33	0.67
B1	0.67	0	0.33	0.33	0.67
B2	0.33	0.67	0.33	1	0.67
D3	0.33	1	0.67	1	0.67
S2	0	0.67	0.67	0.67	0.67
E2	1	0.67	0.67	0.67	0.67
D2	1	0.33	0.33	0.67	0.33
S1	0.33	0.67	1	0.67	1
S4	0.33	0.67	0.67	0.67	1
B4	0	1	0.67	1	1
N1	0.67	0.67	0.67	0	0

Table A5: Truth table

	Diversity of ideas and perspectives	Learning through interaction	Consensus building	Implementation commitment	Innovativeness[1]	#cases	Raw consist.	PRI consist.
1	1	1	1	1	**1**	1	**0.846512**	0.60241
2	0	1	1	1	**1**	5	**0.834725**	0.730978
3	1	0	0	0	0	1	0.75063	0.403615
4	1	0	0	1	0	1	0.748111	0.24812
5	1	1	0	0	0	1	0.728022	0.403614
6	0	1	0	1	0	2	0.713362	0.429185
7	0	0	0	0	0	1	0.693023	0.336683
8	1	1	1	0	0	2	0.691415	0.429185
9	1	0	1	0	0	1	0.690698	0.331658
10	0	0	0	1	0	1	0.690698	0.198795
11	0	0	1	0	0	1	0.641469	0.284483
12	0	1	1	0	0	2	0.614849	0.37594

[1] The 1 in the columns indicates that only rows 1 and 2 consistently lead to the outcome.

Table A6: Parsimonious solution for the presence of high innovativeness

	Consistency	Raw coverage	Unique coverage	Cases in path
Consensus building * Implementation commitment	0.87594	0.697605	0.697605	D3, S2, E2, S1, S4, B4
Solution consistency	**0.87594**			
Solution coverage	0.697605			

Table A7: Robustness check for the intermediate solution for the presence of high innovativeness

	Consistency	Raw coverage	Unique coverage	# Cases in path
Learning through interaction * Consensus building * Implementation commitment	0.864754	0.434132	0.631737	D3, S2, E2, S1, S4, B4
Diversity of ideas and perspectives * ~Learning through interaction * ~Consensus building * ~Implementation commitment	0.75063	0.297405	0.0998004	B1
Solution consistency	**0.847399**			
Solution coverage	0.731537			

Table A8: Calibration rules for outcome and conditions

Innovativeness of services (outcome)	**Diversity of ideas and perspectives**	**Learning through interaction**	**Consensus building**	**Implementation commitment**
Survey data leading *Questions*: see table A1 *Measurement*: seven-point scale, cross-over point = 5 • All answers of the respondents above the cross-over point → 1 • More than half of the answers above the cross-over point → 0.67 • More than half of the answers below or on the cross-over point → 0.33 • More than half of the answers below the cross-over point → 0 • Equal amount above and below/on the cross-over point → Larger distance to the cross-over point of answer resp. above and below/on cross-over point is indicative for assigning case score above or below cross-over point (i.e. 0/0.33 or 0.67) + qualitative interpretation to assign 0 or 0.33 Qualitative check of the assigned scores using the interview data	Survey data leading *Questions*: see table A2 *Measurement*: seven-point scale, cross-over point = 4 • All of the answers of the respondents above the cross-over point → 1 • More than half of the answers above the cross-over point → 0.67 • Less than half of the answers above the cross-over point → 0.33 • None of the answers above the cross-over point → 0 • An equal amount of answers above and below/on the cross-over point, consider the distance of the answers towards the cross-over point → larger distance is indicative Qualitative check of the assigned scores using the interview data	Survey data + interview data *Survey data:* *Questions*: see table A2 *Measurement*: seven-point scale, cross-over point = 5 • All of the answers of the respondents above the cross-over point → 1 • More than half of the answers above the cross-over point → 0.67 • Less than half of the answers above the cross-over point → 0.33 • None of the answers above the cross-over point → 0 • An equal amount of answers above and below/on the cross-over point, consider the distance of the answers towards the cross-over point → larger distance is indicative *Interview data:* Number of examples of learning through interaction/consensus building is used: • 3 or more examples → 1 • 2 examples → 0.67 • 1 example → 0.33 • 0 examples → 0 *Case membership score*: • Calculate the mean of the survey and interview score → intermediate score • Qualitative assessment of the interview data → qualitative score • Intermediate score exactly (or very close to) 0; 0.33; 0.67; 1 → use intermediate score, but qualitative score is still indicative above and below cross-over point (qualitative score should always be indicative if there is doubt). • Intermediate score not exactly (or very close to) 0; 0.33; 0.67; 1 → qualitative score is leading in assigning case score		Interview data leading *Interview data:* Number of examples of implementation commitment is used: • 3 or more examples → 1 • 2 examples → 0.67 • 1 example → 0.33 • 0 examples → 0 *Survey data:* *Questions*: see table A2 *Measurement*: seven-point scale, cross-over point = 5 • All of the answers of the respondents above the cross-over point → 1 • More than half of the answers above the cross-over point → 0.67 • Less than half of the answers above the cross-over point → 0.33 • None of the answers above the cross-over point → 0 • An equal amount of answers above and below/on the cross-over point, consider the distance of the answers towards the cross-over point → larger distance is indicative *Case membership score*: • Calculate the mean of the survey and interview score → intermediate score • Intermediate score exactly (or very close to) 0; 0.33; 0.67; 1, use intermediate score; if not, use interview score

Chapter 5

User involvement as a catalyst for collaborative public service innovation

Chesney Callens

This chapter has been submitted to an international, peer-reviewed journal in Public Administration

Abstract

Innovation in public services is propelled by collaborations between public actors, private actors and service users. A substantial literature has centered on the benefits of user involvement in public services, but how user involvement can stimulate collaborative innovation is still largely unknown. This article develops and tests a theoretical framework based on the combined effect of 1) the empowerment of users, 2) specialized knowledge of the users, and 3) the absence of restricting rules and procedures. Qualitative data from 19 public-private eHealth collaborations in five European countries are analyzed through QCA, and the results indicate that innovation in these partnerships is influenced by the combined effect of these conditions, but that this combined effect is also contingent on the roles the users take on in the innovation process.

Key words: User involvement, collaborative innovation, qualitative comparative analysis (QCA), coproduction, public service innovation, collaborative governance.

5.1. Introduction

Governments face new challenges regarding the organization of public services, which are caused by the growing aspirations of public managers in delivering services of high-quality, the rise of complex problems which have no obvious solutions, the rising demands from citizens and firms, and governments' realization that their own knowledge and resources are limited, which drive them to create new, innovative services in collaboration with various actors (Sorensen and Torfing 2011; de Vries, Tummers and Bekkers 2015). Service innovation refers to the development and implementation of new services that are qualitatively different from earlier services (Damanpour et al. 2009; Sorensen and Torfing 2011). Collaboration with external stakeholders allows access to a large collection of skills, resources and knowledge, and facilitates synergies and learning, out of which innovation can emerge (Huxham 1996; Prahalad and Ramaswamy 2004; Dooley et al. 2015; Sorensen and Torfing 2017). Such 'collaborative innovation' not only encompass public actors, but also private actors such as firms and non-profit organizations, and users and citizens.

Users and citizens play a crucial role in these collaborations as governments can increase their legitimacy when being responsive to the demands of citizens (Easton 1965; Dahl 1988), and users possess key knowledge which is necessary to optimize and innovate products and services (Simmons and Brennan 2017). Although literature has focused extensively on how users can participate in policy and service creation (e.g. Verschuere, Brandsen, and Pestoff 2012; Brandsen and Honingh 2016; Pestoff 2014; Nabatchi et al. 2017), and scholars suggest that user involvement in collaborative partnerships stimulates innovation processes (e.g. 'coproduction for innovation', Nesti 2018; 'quadruple helix', Carayannis and Campbell 2009), much is still unknown about the specific conditions under which user involvement leads to collaborative service innovation.

This article relies on theories of user-driven innovation (von Hippel 1986; Baldwin and von Hippel 2011) and coproduction (Ostrom 1996; Bonvaird 2007; Alford 2009) to explain how user involvement leads to innovation in public-private collaborations. It proposes three conditions of user involvement, which affect the innovation process. First, high user empowerment has been linked to an increased quality of services and the absence of empowered users in the innovation process is seen as a critical barrier for public service innovation (Voorberg, Bekkers and Tummers 2015; Cinar, Trott and Simms 2019). Second, the specialized service knowledge of users is related to the processes of learning and knowledge creation

(Simmons and Brennan 2017), and to the innovativeness of created services (Prahalad and Ramaswamy 2000; Lettl, Herstatt and Gemuenden 2006; Greer and Lei 2012). Third, reducing the rules and procedures that hinder the activities of involved users, increases the ease of involvement and motivates the users to be extensively engaged in the process (Alford 2009; Pestoff 2012; Verschuere, Brandsen and Pestoff 2012; Ianniello et al. 2019). We contribute to the current literature by integrating these conditions and by showing how they synergize with each other to affect the innovativeness of services created in public-private collaborations.

The theoretical model is tested on 19 eHealth partnerships in five European countries. The European Union prioritizes the search for innovative health solutions in digital technologies and data analytics (European Commission 2018). However, research has pointed to the lack of understanding regarding the mechanisms to achieve successful eHealth innovations (Andreassen, Kjekshus and Tjora 2015). This article contributes to this by considering tested and implemented eHealth innovations. Examples of such eHealth innovations include integrated data sharing platforms, central communication and monitoring systems, and technologies based on motion sensors, mobile apps, smart cameras, and robotics. Data from 132 respondents, including project coordinators, public partners, private partners and service users were used in this study, collected through both semi-structured interviews and surveys. Five European countries were involved in this study: Belgium, Denmark, Estonia, Spain and the Netherlands. The article uses fuzzy-set qualitative comparative analysis (QCA) to exploit the rich empirical data.

In the remainder of the article, we first present the theoretical framework, which combines aspects of user-driven innovation and coproduction, and introduce our three conditions of user involvement, with which we formulate our hypothesis. Next, we explain our used methodologies, with special attention to the QCA method. We subsequently present our results, both using QCA and qualitative interview information, and elaborate on these results in a discussion section. The conclusion summarizes the key insights of the article and provides implications for theory and practice.

5.2. Theoretical framework

5.2.1. User-driven innovation

In his seminal work in the 1980s, Eric von Hippel noticed as one of the first scholars that innovations which were externally created by users, were often adopted and commercialized by firms (von Hippel 1986). Adopting innovations from users was counter-intuitive at that time as the service provider was supposed to protect the service production, delivery, and renewal processes from external influences in order to safeguard its competitive advantage. However, von Hippel discovered that users can drive the innovation process with their knowledge about the quality of the services, their experience in using similar services, and their motivation to improve services they use (von Hippel 1986), and that they are often ideally positioned to sense new trends and introduce new ideas (von Hippel 2005; Pongtanalert and Ogawa 2015).

The basic argument of 'user-driven innovation' is that service users have a good understanding of their own service needs, which implies that they are best placed to introduce service innovations (Oliveira and von Hippel 2011). They obtain crucial knowledge about how services perform and how they are supposed to perform in a given local context because of their user experiences, which gives them an advantage over other innovators, such as the government or the market (von Hippel 1994). Users exploit this knowledge by introducing new services for their own use (Lüthje, Herstatt and von Hippel 2005), or by modifying innovations after they are launched (Sundbo 2008). Such user-driven innovation has been found in both the public and private sector (Jæger 2013). For instance, in the private sector, user-driven innovation has been identified in various sectors, including construction, ICT, and sport products (Ozer 2009). In the public sector, user-driven innovation has been used to explain service innovation in smart cities and living labs (Schaffers et al. 2011; Nesti 2018), in 'quadruple helix' partnerships (Arnkil et al. 2010), and in the healthcare sector (Røtnes and Staalesen 2009; Jenhaug 2020).

5.2.2. Collaborative innovation

The discoveries made by von Hippel were set at a time that management scholars were increasingly appreciating the influence of the constellation of actors that operate in the environment of organizations on the performance of these organizations. In public management particularly, the increased attention towards meta-governance and network theories of the public sector, and the rise of the New Public Governance (NPG) rationale (Osborne 2006),

increasingly emphasized the importance of effective coordination of the 'whole of government' (Ansell and Gash 2007). One of the primary characteristics of the NPG is the push towards inter-organizational collaboration, both between government agencies (e.g. 'interagency collaboration', Bardach 2001) and between government agencies and private sector organizations (e.g. 'collaborative governance', Ansell and Gash 2008), with the aim to increase the effectiveness of public policy making and service delivery.

Driven by these collaboration-oriented theories on public management, researchers have started to unpack the significance of collaboration for public sector *innovation* (Bommert 2010). Collaboration between different organizations, from both the public and private sector, allows innovators to explore and connect new ideas and knowledge bases, share resources and capabilities, and foster the capacity and commitment to implement novel and bold ideas (Sorensen and Torfing 2011). This 'collaborative innovation' is founded on the principle of 'partnership synergy', which argues that the combination of different perspectives, resources and skills can create something more than the mere sum of what the individual organizations can achieve (Lasker et al. 2001). The collaboration itself is a stimulating condition for innovation, as new resource and knowledge pools are accessed and synergistic processes can emerge between the collaborating partners.

However, knowing that users can also drive the innovation process, involving users in partnerships between public and private sector organizations might raise the likelihood of achieving innovation even further. Collaborating with users is highly beneficial for the public and private service providers in the partnership, as they can acquire knowledge and experiences of the users, and information about the users' needs, preferences, and demands, which would otherwise be very difficult and costly to obtain (von Hippel 1994). On the other hand, users also benefit from engaging with public and private service providers, as introducing innovations on their own is a difficult and costly endeavor, especially in complex service systems. As a result, both service providers and users dependent on each other to realize desired innovations.

5.2.3. Coproduction of service innovation

Because of the interdependency of the users and the services providers, a natural partnership synergy can emerge between the users and the service providers, which might result into the coproduction of services. Coproduction is defined as the creation and provisioning of services through the establishment of collaborative relationships between professional service providers

and service users (Bonvaird 2007, 847). Note that the concepts of coproduction and collaborative innovation are closely intertwined (Wegrich 2019), and stimulating conditions of coproduction might therefore increase the capacity of a public-private collaboration to produce innovative services (Lindsay et al. 2020). Indeed, research shows that active user involvement is linked to the increase in quality of services (i.e. effective, efficient and client oriented service delivery), the increased democratization of services, and the improvement of social cohesion (Voorberg, Bekkers and Tummers 2015), but also that inadequate engagement of users in the innovation process is one of the most important barriers of public sector innovation (Cinar, Trott and Simms 2019).

We specifically look at the *co-design* and *co-innovation* of services. Co-design refers to the intentional involvement of service users in the *improvement* of certain services, while co-innovation refers to the involvement of service users with the purpose to jointly create *new services* (Osborne 2016). Co-design and co-innovation can be particularly prominent in public-private collaborations because the public-private-user context shortens feedback loops between designers and users, and increases the innovators' grasp on the problem, as all relevant stakeholders are part of the same innovation system (Sorensen and Torfing 2018). Such multidisciplinary collaborations of coproducing users and service providers enhance creative ideation (Trischler et al. 2019), unite relevant problem-solving capabilities (Skålén et al. 2018), introduce advanced testing opportunities (Criado et al. 2021), and propel processes of mutual learning (Voorberg et al. 2017).

However, proper involvement of users to co-design or co-innovate services is not a straightforward endeavor. Two hindering factors are important to consider. First, users might receive insufficient support or power to genuinely engage in the service design process (Osborne 2016). 'Tokenism' in coproduction has been found in several studies in the health sector (e.g. Gremyr et al. 2018; Sangill et al. 2019; Daya et al. 2019), which is the main focus of this article. On the one hand, increasing the empowerment of users in the design of health services is a viable strategy to counter this tokenism (Ocloo and Matthews 2016). Empowering users opens bilateral communication channels between the users and the service providers through which they can better negotiate and engage with each other (Farr 2016). Empowering users in service design processes also improves the quality of the user interfaces in ICT-enabled services (Smith and Dunckley 2002), and enhances prototyping, usability evaluation, and the accuracy of user requirements (Kujala 2003). On the other hand, tokenism may also be

provoked by regulatory and procedural rigidness. Formal rules and procedures might increase the rigidity and risk aversion of the service providers, which raises barriers for user engagement and might stifle creative experimentation (Sønderskov et al. 2021). Bold and creative ideas from the users might for this reason be deemed unacceptable for the service providers. The absence of such hindering rules and procedures might give the users more opportunities to freely engage in the innovation process.

Second, in complex and technologically rich service systems such as the healthcare sector, innovators are often inhibited by the limited availability of specialized knowledge (Tien and Goldschmidt-Clermont 2009). Innovating complex health services requires extensive knowledge of the intricacies of the services and the broader service system, which not all users possess. Knowledge synergies between the service providers and the users that lead to innovations might therefore only emerge when the involved users have a thorough understanding of the services (Greer and Lei 2012). Hence, users which possess specialized knowledge about the services are more valuable for co-design and co-innovation processes, as they can better respond to the knowledge demands associated with these service innovation activities.

This article studies the conditions related to these two hindering factors, i.e., whether or not users are 1) sufficiently empowered, 2) not restricted by rules and procedures, and 3) possess specialized knowledge about the services. In the following, we elaborate on these three conditions, and propose our hypothesis.

Empowerment of users

As we mentioned before, empowering users counteracts tokenism and enhances both the process of co-design/co-innovation and the outcome of this process. In order to study its impact on collaborative innovation, we consider two general 'levels' of empowerment (based on Karlsson et al. 2012). On the one hand, users can be involved as advisors in the process of service design, which means that they share information and knowledge with the individuals involved in the design process, but are not actively participating in the process themselves. This user involvement can be purely informative (Damodaran 1996), which means that the service provider informs the users about the service process, and the users can react to this information by providing advise. However, this type of user involvement can also be more consultative (Damodaran 1996), by involving the users more proactively through interviews or focus groups,

and obtain the necessary information from the users (Arnkil et al. 2010). On the other hand, users can also participate as 'active agents' in the process of service design (Marti and Bannon 2009). Users can actively participate in the service process on equal footing with the service provider, by providing information regarding the local user context and being involved in decision making (Arnkil et al. 2010; Holgerssona and Karlsson 2014). However, they can also be involved as 'user-innovators' (Baldwin and von Hippel 2011), which means that they have extensive responsibilities and power to lead the service process and are involved in the actual development of the services (Arnkil et al. 2010; Holgerssona and Karlsson 2014).

Restricting rules and procedures

Research suggests that flexible, decentralized structures and clear organizational rules and procedures for collaboration are beneficial for collaboration and coproduction (Alford 2009; Klijn et al. 2010; Verschuere et al. 2012). However, a large emphasis on predetermined rules and procedures may also inhibit the freedom of the user in the innovation process, thus limiting the learning potential for the service organization, and demotivating the involved users to actively engage in the innovation process (Moon and Bretschneider 2002; Van de Vrande et al. 2009). Coproduction research also indicates that the 'ease' of involvement, and, hence, how much hindrances users experience during their involvement, is an important motive for users to participate in coproduction activities (Alford 2009; Pestoff 2012; Verschuere, Brandsen and Pestoff 2012; Bonvaird, and Loeffler 2012; Ianniello et al. 2019). High levels of restrictions of users activities due to rules and procedures may therefore limit the capacity of users to propose new and bold ideas, engage in experimentation, and generally add value to the innovation process (Sønderskov et al. 2021).

Specialized knowledge

In collaborative settings, knowledge of diverse actors is combined through the interaction between these actors, which creates knowledge synergies (Torfing 2019). Close interaction between actors allows the emergence of new perspectives and knowledge as existing believes are challenged and new ideas are proposed (Sorensen and Torfing 2011; Crosby et al. 2017; Trivellato et al. 2020). Users have a central position in these dynamics as they are assumed to have experiences and knowledge which are relevant for the innovation process (Oliveira and von Hippel 2011; Simmons and Brennan 2017). However, the depth of knowledge regarding the particular issues and complexities surrounding a service might vary amongst different users.

For instance, research has connected the presence of specialized knowledge of users to the creation of radical innovations in health care technologies (Lettl, Herstatt and Gemuenden 2006), and concludes that the variety of the extent of innovation with users across industries is connected to the depth of knowledge of these users (Prahalad and Ramaswamy 2000; Greer and Lei 2012). User that lack specialized knowledge about the service might have perceptions that are limited to their individual use, might have difficulties evaluating broader concepts and prototypes, and might have problems understanding the inherent complexities of the service process or technologies, all of which restrict users to formulate radically new and feasible ideas (Lettl 2007). The level to which users introduce specialized knowledge into the collaborative innovation process should therefore be crucial for the creation of service innovations.

5.2.4. Hypothesis

Public-private collaborations that involve users to co-design or co-innovate services pursue partnership synergies, which create value for both the users and public/private service providers that would not be achievable outside of this collaboration (Lasker et al. 2001; Sorensen and Torfing 2011). However, the interdependency of the users and service providers in the collaboration requires an adequate balance of value creation. Users benefit from being empowered without being restricted by rules and procedures, as they gain power and influence in the innovation process. In parallel, service providers benefit from the users' knowledge that is introduced in the innovation process. The more specialized this knowledge, the more valuable the users become for the service providers. In order to be successful in innovating services, this balance should be uphold, which means that we expect that only the combination of these conditions will lead to highly innovative services. Hence, we propose the following hypothesis:

Hypothesis 1: Collaborative partnerships that involve users who are highly empowered, have specialized knowledge about the services, and are not hindered by rules and procedures in the innovation process, create highly innovative services.

5.3. Cases and methodologies

5.3.1. Case selection

The European Union prioritizes innovation in health related digital solutions, but also recognizes the slow progress that is being made in developing eHealth innovations (European Commission 2018). This can be partially traced back to the lack of knowledge regarding the

conditions under which these eHealth innovations are created (Andreassen, Kjekshus and Tjora 2015). This article aims to contribute to this question by conducting empirical research regarding user involvement in public-private eHealth collaborations in Europe.

In order to ensure the comparability between the cases, three case selection criteria were used. First, all cases were public-private collaborations between public actors (e.g. governments, public hospitals, etc.) and private actors (e.g. non-profits, firms etc.), which all had a formal structure and management (i.e. no informal collaborations). Second, all collaborations involved service users to some extent. Third, all of the innovations were related to eHealth *services* (and not to eHealth policy), which were all recently implemented or at least tested (within the last five years). While there are some differences in healthcare systems between European countries (see e.g. the typologies of Blank and Burau 2018, and Reibling et al. 2019), the eHealth innovations pursued by the selected cases were comparable and displayed no fundamental differences in how well-suited user involvement was for the different eHealth innovations. This is evidenced by the detailed case information in table A1, which gives an overview of the partners, the user involvement and the eHealth innovations of the selected cases.

Furthermore, additional case selection criteria were applied to properly represent the variety of eHealth collaborations in Europe. First, five European countries were selected: Belgium, the Netherlands, Estonia, Denmark and Spain, which roughly represent different administrative regimes in (continental) Europe[2] (Pollitt and Bouckaert 2017). Second, we included the two types of eHealth technologies that are most often recognized by researchers and practitioners: 1) eHealth technologies related to administrative simplification and the digitalization of information, and 2) eHealth technologies related to telehealth and mobile health tools, and smart devices (Scholz 2015; Van Waes 2017; Wouters et al. 2018). Third, as public-private collaborations can be coordinated by either the public actor or the private actor, we selected an equal number of both 'types' of collaborations (see next section). Fourth, we ensured that both larger collaborations (i.e. more than 10 partners) and smaller collaborations (i.e. less than 10 actors) were included in our case selection. A total of *19 eHealth collaborations* were eventually selected. The features of these cases are elaborated in table A1.

5.3.2. Coordinating actors in the partnerships

Project coordinators are crucial actors in public-private collaborations. They are responsible for many aspects of the collaboration process, including aligning perspectives, interests and goals,

resolving conflicts and tensions between the partners, and controlling the progress of the project (Klijn and Koppenjan 2015). In public-private collaborations, either the public actor (i.e. government actors such as national governments, public agencies, local governments, public hospitals, etc.) or the private actor (i.e. societal actors such as non-profit actor, for-profit actor, user group, etc.) may adopt the role of coordinator. We controlled for this variance in our set of cases by including both '*government coordinated' partnerships*, and '*societally coordinated' partnerships.* For instance, case B1 was coordinated by a federal government agency and ministerial cabinet, while case E3 was coordinated by a private ICT company that builds health care applications for health professionals and patients (see table A1).

These 'types' of partnerships are important in this article, as different types of actors (i.e. the coordinating actors, which can be public or private) will potentially engage more frequently with the users (since they are coordinating the innovation process). We, therefore, consider these types of partnerships as an additional condition in our analysis. However, we do not expect differences in the way the configuration of selected conditions of user involvement will impact the innovation process when the partnership is coordinated by a public or private actor, as the extensive use of the mechanisms of user-driven innovation and coproduction in both the public and private sector suggests that there are no fundamental discrepancies between these two types of coordinating actors. For this reason, the type of partnership is not part of Hypothesis 1, but we still control for it in our QCA analysis.

5.3.3. Fuzzy-set qualitative comparative analysis (QCA)

This article uses fuzzy-set qualitative comparative analysis (QCA). QCA is a set-theoretic and case-sensitive methodology that uses Boolean logic to examine whether or not a (combination of) condition(s) corresponds to a certain outcome (Ragin 2008). Three characteristics are important in QCA (see Ragin 2008). First, QCA searches for the ways in which a *combination* of conditions lead to a certain outcome (i.e. 'configurational causation'). Second, in QCA, *multiple solution paths* can lead to a certain outcome (i.e. 'equifinility'). Third, depending on the specific combination of the *presence or absence* of certain conditions, the same outcome can be produced (i.e. 'asymmetry'). The *calibration* procedure assigns specific values for the conditions and outcome to each of the cases, which reflect the presence (typically indicated as a 1) or absence (typically indicated as a 0) of the conditions/outcome in that case (e.g. presence of user empowerment in Case A, absence of specialized knowledge of the user in Case B). As we use *fuzzy-set* QCA, the sets representing the outcome and conditions can have fuzzy

boundaries, which means that some cases might be in or out of a set (resp. 1 or 0), but might also be *partially* in or out of a set (resp. 0.67 or 0.33). The cross-over point of 0.5 is crucial as it presents a point of maximal indifference towards membership or non-membership of a case in a set (Schneider and Wagemann 2012).

Cases that share the same membership in these sets, have a high *consistency*, which is a measure of fit. A very high consistency (i.e. 0.9 and higher) between a single condition and the outcome reflects that every time this condition is present, the outcome will be present too. This condition is called a *necessary condition*. When multiple combined conditions lead to an outcome, these conditions are called *sufficient conditions*. A second measure of QCA corresponds to the number of cases that are covered by these relationships, which indicates how prevalent the relationship between the condition(s) and the outcome is. This measure is called *coverage*.

There is a particular importance to apply QCA in this study, both theoretically and methodologically. Theoretically, the analysis of sufficient conditions holds promise as our hypothesis predicts that the creation of highly innovative services is affected by the combination of user empowerment, the specialized knowledge of users, and the rules and procedures that hinder the activities of the users. An assessment of the combined effect of the mentioned conditions on the created innovations is therefore needed to confirm or reject our hypothesis. Methodologically, an in-depth comparative analysis of European eHealth partnerships requires us to study more cases than is convenient using qualitative case-study research, but also less than is needed for regression analyses. QCA allows us to translate our findings to similar partnerships in Europe, but also retains the in-depth nature of qualitative case studies.

5.3.4. Data collection

Data was collected through semi-structured interviews of 132 respondents, including project coordinators, public partners (representatives of e.g. government agencies, local governments, public hospitals, …), private partners (representatives of e.g. private home care organizations, consultants, ICT-companies, …) and service users (e.g. physicians, patients, medical professionals, citizens, …). Different research teams for each of the five countries conducted these interviews. Prior to the interviews, survey data was collected from 124 respondents. In order to prevent common method bias, the surveys and interviews each posed questions regarding the conditions and outcome of the respondents. A full account of the data collection instruments can be found in table A2. The results presented in this article were yielded from the

combination of interview data and survey data. The surveys were used to ask standardized questions regarding the conditions of user involvement and innovation, which allowed a more consistent calibration. However, as QCA results are often quite abstract, researchers are encouraged to collect in-depth, qualitative data in order to correctly interpret particular QCA patterns in the data (Schneider and Wagemann 2012).

Hence, the interview data was used in two ways. First, the interviews provided in-depth information about the conditions and outcome, which was impossible to extract from survey questions. This allowed an advanced calibration of the conditions and outcome, as using both survey and interview data prevented potential biases in our calibration. Second, the interviews were also used as standalone data sources, which provided contextual information and in-depth information regarding the dynamics of user involvement in the projects. This allowed the researchers to better explain patterns that resulted from the QCA analyses. In order to use the interview data accordingly, a highly standardized processing of the interviews was required. The interviews were recorded and processed by the research teams, who used a standardized questionnaire to provide all the relevant details obtained in the interviews. Each subsection of this questionnaire addressed information regarding specific conditions, which created a easily accessible dataset of rich qualitative information that could be used to gain understanding about the cases. Research teams also wrote a concise summary of each case, in order to provide a more general description of the cases. To ensure proper consistency in the calibration of the conditions and outcome, only one research team performed the calibration. In the next section, we provide more detailed information regarding the calibration procedure.

5.3.5. Operationalization and calibration

Operationalization and calibration of the outcome

This article defines innovation as ‘an idea, practice or object that is perceived as new by an individual or other unit of adoption’ (Rogers 2003, 12). The perceived ‘newness’ of the created service is an important criterion in the assessment of its ‘innovativeness’, but it is not the only one. Innovation scholars agree that innovation is something that is adopted and implemented in a certain context, meaning that it directly affects users and other stakeholders (Amabile 1988; Anderson, De Dreu and Nijstad 2004, Walker 2007; Anderson, Potočnik and Zhou 2014). Therefore, two criteria were used which reflect the innovation concept, namely the degree of novelty and the level of adoption. A seven-point scale was used to measure the innovativeness

of the created services. Table A3 of the annex visualizes the used items. As each of the items represented the same concept (i.e. innovativeness)[3], the mean of the answers of the same respondent was calculated. Further details concerning the calibration can be found in table A9 of the annex.

Operationalization and calibration of the conditions

The operationalization of the *empowerment of users* was based on the framework introduced in the theoretical section regarding the four types of user involvement (i.e. informative user involvement, consultative user involvement, participative user involvement and user innovation), from which we developed six levels of user involvement from the perspective of the involved users: 1) being informed by the partnership; 2) being consulted by the partnership; 3) advising the partnership; 4) collaborate and co-produce with the partnership; 5) making decisions; 6) leading the process. These levels of empowerment were also inspired by the ladder of participation of Arnstein (1969). These questions were asked to the coordinators, public/private partners and involved users during the interviews, which allowed us to collect examples of these activities. This introduced rich qualitative information, which was used to calibrate the case membership scores. Additionally, respondents were asked to reflect on the level of freedom the users had to act in the project. This question allowed the respondents to give their own evaluation on how much the users could do in the collaboration. A qualitative interpretation of the interview material was also performed to avoid oversimplification of the data, as respondents might interpret the levels of user involvement differently. Details regarding the calibration are illustrated in table A9 of the annex.

For the other conditions, a seven-point scale was used to measure the concepts. To measure the level of *specialized knowledge* of the involved users, the respondents were asked if the involved users brought no relevant knowledge in the project or if they brought crucial knowledge in the project. Additionally, because 'knowledge' might be anything from experiences and perspectives to detailed knowledge about services and processes, a subsequent question was asked in the interviews about the kind of knowledge that was provided. Specialized knowledge about the services received higher scores than experiences and perspectives about the services. Additional interview data was used to check whether the provided answers matched the overall case information. The respondents were also asked whether or not they experienced that *user's activities were hindered by the rules and procedures* of the actors in the partnership. Details of the calibration of both conditions are illustrated in table A9 of the annex.

As we mentioned before, two different *types of partnerships* are present in our cases. To control for this variance, we defined a fourth condition, which indicates if a partnership is 'government coordinated or 'societally coordinated. The government coordinated partnerships are partnerships that are coordinated by a public actor, while the societally coordinated partnerships are coordinated by a private/societal actor. The types were calibrated using a continuum from the presence of a public coordinator to the presence of a private coordinator. For instance, governments (ministries, municipalities, agencies, etc.), were considered to be public, whereas firms, private health care providers and other non-profit organizations were considered to be private. More information regarding the calibration is visualized in table A9 of the annex.

5.4. Results

5.4.1. QCA results

The analyses were conducted using the fsQCA software version 3.1b[4] (Ragin 2017). The calibrated dataset is illustrated in table A4 of the annex. To report the results, we follow standards of practice (Schneider and Wagemann 2010). We first discuss the analysis of necessary conditions and next the analysis of sufficient conditions. Because the combination of the conditions is of particular importance for this paper, we will only shortly discuss the analysis of necessary conditions, and we will elaborate in more detail on the analysis of sufficiency. Table 1 illustrates the number of cases above and below the cross-over point for 'high innovativeness'.

Table 1: Set membership of the cases for the outcome

Innovativeness of created services in the projects		Number of cases
High innovativeness	Above 0.5	12
Low innovativeness	Below 0.5	7

We first examine the analysis of necessary conditions. A condition is necessary when the outcome is always present when the condition is present. A consistency threshold of 0.90 is suggested to infer the necessity of a condition (Schneider and Wagemann 2012). Table 2 illustrates the results for the presence of highly innovative services. None of the conditions have a consistency value of 0.90 or higher, which means that none of the conditions is necessary to

create highly innovative services. We see a similar result for the absence (~) of highly innovative services (see table A5, Annex).

Table 2: Analysis of necessary conditions

Presence of highly innovative services		
Conditions	**Consistency**	**Coverage**
Government coordinated partnership	0.733533	0.667575
Societally coordinated partnership	0.431138	0.540676
High empowerment of users	0.731537	0.733000
Low empowerment of users	0.630738	0.702222
Presence of rules and procedures that restrict users' activities	0.731537	0.758015
Absence of rules and procedures that restrict users' activities	0.663673	0.712755
Presence of specialized knowledge from the user in the project	0.833333	0.781104
Absence of specialized knowledge from the user in the project	0.561876	0.677497

Second, the analysis of sufficient conditions is conducted. A truth table lists all the possible combinations of the different conditions (Ragin 2008). We only report the truth table rows with at least one case covered, as empirical evidence is rarely found for all possible logical combinations in small to medium sized studies (Ragin 2008). The truth table is illustrated in table A6 of the annex. Following best practices, we only select truth table rows with a raw consistency of 0.80 to explain the presence of highly innovative services (Schneider and Wagemann 2012). The threshold of 0.80 was also selected because of the relatively large number of contradictory cases (i.e. cases that are present in the solution path but do not exhibit the outcome) in the rows below the 0.80 threshold, which indicates that the threshold is reached (Schneider and Wagemann 2012). The rows are logically minimized during the minimization procedure, after which the intermediate solution is generated.

Table 3 shows the intermediate solution, which takes theoretical assumptions into account. The theoretical assumptions are summarized in Hypothesis 1. As the type of partnership was not part of our hypothesis, no theoretical assumptions were applied for this condition. Three distinct solution paths are identified by the analysis, which each lead to highly innovative services. A total of 12 cases are covered by the three solution paths, which translates into a solution coverage of 0.87. With a solution consistency of 0.84, the three solution paths show clear evidence in favor of the relationship between the specific combination of conditions and the

presence of highly innovative services. One contradictory case (i.e. a case that is part of the solution path but does not exhibit the outcome) emerged in the third solution path (indicated with ˜).

Table 3: Intermediate solution for the presence of highly innovative services

	Consistency	Raw coverage	Unique coverage	Cases in path
Government coordinated partnership * high empowerment of users * absence of rules and procedures that restrict users' activities	0.889632	0.530938	0.135729	D1, S3, D3, B4
Societally coordinated partnership * high empowerment of user involvement * presence of rules and procedures that restrict users' activities * presence of specialized knowledge from the user	0.857759	0.397206	0.166667	B2, B3
Government coordinated partnership * low empowerment of users * presence of specialized knowledge from the user	0.84985	0.56487	0.169661	N2, B1, E2, S1, S4, E1˜
Solution consistency	**0.839614**			
Solution coverage	0.867265			

To summarize, our analysis identified the following solution paths:

1. Government coordinated partnerships with a high empowerment of users and without rules and procedures that hinder the activities of the involved users, create highly innovative services;
2. Societally coordinated partnerships with a high empowerment of users with specialized knowledge about the services, but which use rules and procedures that hinder the activities of the involved users, create highly innovative services;
3. Government coordinated partnerships with low empowerment of users with specialized knowledge about the services, create highly innovative services.

QCA solution paths should always be evaluated through the intermediate, parsimonious and complex solutions (Maggetti and Levi-Faur 2014). The complex solution is identical to the intermediate solution (see table A8, annex). However, the parsimonious solution (see table A7,

annex) is slightly different, as the condition ‘high user empowerment’ is removed from path 2, and path 3 does not include government coordinated partnerships (nor societally coordinated partnerships). Because of logical minimization, the parsimonious solution might reduce the number of conditions compared to the intermediate solution, which might explain why ‘high user empowerment’ and ‘government coordinated partnership’ are removed resp. in path 2 and path 3. However, it might also suggest that the solution is not very stable.

To be certain of this stability, we applied a robustness check. As we mentioned before, the threshold for the raw consistency in the truth table was 0.80, partially because we noticed a lot of contradictory cases in the truth table rows below this threshold. However, even in the last truth table row we selected (i.e. row 5, see table A6), we observed one contradictory case. Although still above the threshold, we might test whether the removal of this truth table row affects the solution paths as a robustness check. The more stable the paths, the less alternations we would expect from these paths. When we select a raw consistency threshold of 0.85 (which removes truth table row 5), we observe that solution paths 1 and 2 remain identical, but that the configuration of conditions changes in path 3 of our original solution. The absence of high user empowerment, which we observed in solution path 3, is not part of this solution path, and is instead replaced by the absence of hindering rules and procedures. This indicates that we should be careful when interpreting solution path 3. Furthermore, the only contradictory case we have in our solution is present in solution path 3, which, again, urges a cautious interpretation of this solution path. Additionally, as is visible from table 3, solution path 3 has also the lowest consistency value of the three solution paths.

5.4.2. Qualitative deepening

Because of the sometimes abstract nature of QCA results, solution paths are best interpreted together with qualitative case information (Schneider and Wagemann 2010). We will primarily focus on the qualitative information of the cases covered by solution paths 1 and 2, as these paths are the most stable. With regard to solution path 1, we see that all the government coordinated partnerships covered by this path indeed show high empowerment of users, often exhibited in coproduction activities throughout the whole innovation process. Users were involved in workshops, project meetings, testing environments and coproduction sessions through which they had a real impact on the created services. In all the cases, the input from the users changed, sometimes profound, aspects of the innovation, such as the types of technologies used, the focus of the innovation and the breadth of use of the innovation. The

qualitative information also reflects a complicated relationship between the degree of specialized knowledge of the users and innovation, as not all users possessed specialized knowledge useful for the innovation process. In many cases, the fact that the involved user was indeed a user, was sufficient for their impact on the innovation process. This was especially pronounced when users were involved in testing phases of the innovation process. For instance, in a project that developed assisting technologies for elderly people (case B4), individuals with severe Alzheimer's disease were involved in the testing of the innovation, as they would enable a unbiased and realistic assessment of the functionalities of the innovation. These users did not possess specialized knowledge useful for the innovation process, but they did provide the collaboration partners with learning opportunities about how the innovation works in reality.

The qualitative case data also gives an explanation for why the respondents in the government coordinated partnerships experienced no hindering rules and procedures (solution path 1), while the respondents in the societally coordinated partnerships (solution path 2) did experience such hindering rules and procedures. Both of the cases (cases B2 and B3) covered by solution path 2 were projects that were initiated by user groups. These user groups consisted of general practitioners who had specialized knowledge about the new services they wanted to create. They had already experimented with new solutions and had sometimes even implemented some of these solutions on a limited scale. However, these users did not have the capacity to deploy these new solutions on the desired scale. As a result, the users initiated collaborative partnerships with service providers (governments and private health care providers) to implement their solutions on a large scale. At that moment, these users were confronted with the rules and procedures of the service providers that were now in charge of the innovation process. This was very different in the government coordinated partnerships. The government or public actor initiated these projects, and involved users in the innovation process to improve the quality of the services that were being created. The users did not participate in the innovation process to realize their own ideas on a large scale, but to contribute to the creation of the solution. The consequence of this was that the users were more likely to stay within the service design framework of the service provider and, therefore, experienced little hindrance from rules and procedures that were part of this framework.

5.5. Discussion

Collaborative innovation literature points to the advantages of user involvement in creating innovative services (Baldwin and von Hippel 2011; Voorberg, Bekkers and Tummers 2015;

Simmons and Brennan 2017; Cinar et al. 2019). However, which combinations of conditions of user involvement exactly influence the creation of innovation in collaborative partnerships, remained to a large extent unknown. The combined effect of three conditions of user involvement was linked to innovation: 1) the empowerment of users, 2) the specialized knowledge of the involved users, and 3) the rules and procedures that hinder users' activities. Following theories of user-driven innovation and coproduction for innovation (von Hippel 1986; Lüthje, Herstatt and von Hippel 2005; Arnkil 2010; Oliveira and von Hippel 2011; Verschuere, Brandsen, and Pestoff 2012; Baldwin and von Hippel 2011; Pestoff 2014) users collaborate with service providers in processes of open collaborative innovation because, because these service providers have the resources and capacities to implement services on a large scale. At the same time, the users can provide information and knowledge that is hard to come by for the service providers and, as such, stimulate innovative service development (von Hippel 1994; Oliveira and von Hippel 2011). We argued that innovation occurs in such processes of open collaborative innovation when both sides of the bargain are satisfied. We hypothesized that through the combination of three conditions, a synergy between the involved users and the service providers was possible. Indeed, the users obtained the freedom to translate their ideas into real services (through intensive user involvement and a lack of hindering rules and procedures), and the service providers received valuable knowledge and information from the users because of the specialized service knowledge of the involved users.

Our hypothesis was only partially confirmed, however. The QCA results demonstrate a complex relationship between the combination of the three user involvement conditions and innovation. Three observations can be made. First, a substantial difference between the government coordinated partnerships (solution path 1) and the societally coordinated partnerships (solution path 2) was observed. Our qualitative analysis showed that the societally coordinated partnerships covered by our solution were initiated by user groups. It seems that these users acted as real '*user-innovators'*, which are involved in the innovation process to introduce innovations for their own use (Bogers, Afuah and Bastian 2010; Baldwin and von Hippel 2011; von Hippel 2016), and that this has consequences for the hindrance of their activities by rules and procedures in the innovation process. A possible explanation for this increased perception of user hindrances might also be related to the resistance of the service provider to ideas from the user-innovators, which was recently shown by Jenhaug (2020) in Norwegian public care services. These users have a lot of knowledge about the services and participate in the innovation process to translate their own ideas, which might cause tensions

with the service provider. In the government coordinated partnerships, however, the users participated in the innovation process to jointly *coproduce* services (van Eijk and Steen 2014; Torfing, Sorensen and Røiseland 2016; Nesti 2018). In these partnerships, the involved users were less occupied with convincing the service provider to translate their own ideas into implemented services, as the joint participation in the coproduction of services was their primary driver. This suggests that users can have different roles in innovation processes, and that depending on these roles, their expectations towards the service provider and the actor's experiences about the presence of hindering rules and procedures might change.

Second, in the government coordinated partnerships, we also see that 'specialized knowledge of the involved users' can be present or absent. The condition, therefore, has no large contribution to the solution path. We see this reflected in the qualitative information collected in the case studies. Some partnerships in this solution path involved users such as physicians and specialists, which contributed a lot of their knowledge to the project, while other partnerships involved patients or employees with little specialized knowledge about the services. However, these latter partnerships specifically needed the experiences of the patients and employees in order to align the created services to the desires of the users. In contrast to what literature on service innovation has suggested (e.g. Lettl 2007), the specialized knowledge about the services is not always needed before users can be involved, as valuable user information may also be embedded in the experiences of involved users when testing particular services during the innovation process. This is, however, different in the societally coordinated partnerships covered by our solution, where user-innovators have by definition a lot of specialized knowledge useful for the innovation. This also explains the presence of this condition in the societally coordinated partnerships.

A third observation concerns solution path 3. As we thoroughly indicated in the result section, there are questions about the reliability of this solution path. However, it is still relevant to discuss the solution path, because the general solution is generated based on all three of these solution paths. In addition, more than half of the partnerships that created highly innovative services are covered by this solution path (6 cases in total), with high values for the raw coverage and unique coverage, which is indicative for the scope of the implications of the solution path. The solution path also demonstrates that in particular configurations of conditions, the presence of specialized knowledge from the involved users is important in government coordinated partnerships to produce innovation. While 'specialized knowledge

from involved users' could be both present or absent in the cases covered by solution path 1, this condition becomes an essential part of the solution path once the users are less empowered. It appears that in cases in which users are less empowered, government coordinated partnerships rely on the specialized knowledge of users, and select users as *advisors* for the service innovation process (i.e. high specialized knowledge, low empowerment). Following the parsimonious solution, this seems to be true for societally coordinated partnerships as well.

5.6. Conclusion

Although collaborative innovation literature has expanded greatly in the last decades, little is known about the influence of specific conditions of user involvement on technological innovations in public-private collaborations. Furthermore, little is known about the combined influence of certain conditions of user involvement on collaborative innovation. We used theories of user-driven innovation and coproduction to unveil the conditions of user involvement that influence the innovation process in collaborative partnerships. We tested the combined effect of three interrelated conditions on the innovativeness of the created services in collaborative partnerships, which revealed a more complicated combined effect than we initially expected. Our contribution is, therefore, twofold: 1) this article tested the combined effect of the empowerment of users, the level of specialized knowledge of involved users, and the presence/absence of hindering rules and procedures on innovation in collaborative partnerships, and 2) the article unveiled the contingent nature of these conditions of user involvement and proposed a more nuanced depiction of how user involvement can impact the collaborative innovation process.

Our theoretical framework was tested on 19 eHealth partnerships in Belgium, the Netherlands, Estonia, Denmark and Spain, which represented different administrative traditions and eHealth technologies, and as such, allows cautious generalizations to similar European eHealth partnerships. Our QCA analyses showed that government coordinated partnerships create highly innovative eHealth services when they empower users in the innovation process without hindering the users' activities with rules and procedures. Societally coordinated partnerships create highly innovative eHealth services in case of high empowerment of users, which possess specialized knowledge about the services and are hindered by rules and procedures of the actors in the partnership. This difference between the combinations of the conditions depended on two aspects. First, users had different roles in the two types of partnerships (i.e. 'user-innovators' vs. 'co-producers'), which contributed to the differences in perceptions regarding the hindering

rules and procedures. Second, while users involved in the societally coordinated partnerships always possessed specialized knowledge because they were user-innovators, this was not always the case in the government coordinated partnerships, where the users were sometimes only involved to capture their experiences with a certain service, in, for instance, testing phases of the innovation process. In other cases, however, specialized knowledge was important to innovate when users were not highly empowerment, which might suggest a third type of user (i.e. the advisor).

These results have also practical implications. First, the results indicate that there is indeed a combined effect of the three conditions of user involvement on innovation in collaborative partnerships. Coordinators of such partnerships should be aware that this combination of conditions affects the innovation in their partnership. Second, the combination of conditions is contingent on the partnership, which means that coordinators should be aware of the role of the users in the partnership (i.e. user-innovators, co-producers, or even advisors), and user-innovators should be aware that a perfect translation of their ideas into real services is far from obvious. Third, specialized knowledge of users about the services is crucial in partnerships that are dependent on this knowledge to innovate. However, partnerships that acquire this knowledge through other means (e.g. collaborating with experts), should not hesitate to involve users that lack this specialized knowledge. Such users are still able to provide valuable information in the form of their experiences with using a certain service, which is a crucial asset in the testing phase of the innovation process.

Our research is not without limitations. First, we collected data from 19 eHealth partnerships in five different countries, which restricted us in the level of detail we could obtain. Our research design therefore only allows very specific types of partnerships, in which either public actors or private actors coordinate the partnership. Other types of partnerships also exist, and this might make the dynamics of user involvement more complicated. In-depth qualitative case studies or process-tracing might shed more light on the variety and influence of these different circumstances (see Schneider and Rohlfing 2013). Second, due to our sample size, we could only focus on three interrelated conditions of user involvement and their related combinations. However, particularly in public-private collaborations, much is still unknown about the conditions of user involvement that create innovation. Future research should investigate these conditions even further.

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Endnotes

[1] We use these two conditions as a thorough empowerment of the users while still hindering the activities of these users with rules and procedures, might again inhibit their impact on the innovation process.

[2] The selection of the countries in this article represents the typology of Pollitt and Bouckaert (2017), which reflects several types of administrative regimes in Europe, including Nordic (Denmark), Central and Eastern Europe (Estonia), Continental (the Netherlands) and Napoleonic (Spain/Belgium (mixed)).

[3] This was also checked by conducting a factor analysis for these items.

[4] See http://www.socsci.uci.edu/~cragin/fsQCA/software.shtml

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Annex

Table A1: Selected cases

Case ID		Collaboration partners	User involvement	eHealth innovation[2]
Belgium	B1	Multiple national government agencies, ministerial cabinet, multiple hospital networks, regional governments, private health suppliers, and insurance organizations, and user organizations	Presence of patient representatives in 'core team' of project	A portal website which provides patient information for citizens at a national level.
	B2	Private nursing organizations and federation, ministerial cabinets, national government agencies, hospital networks, individual GPs, and several private health organizations	GPs involved throughout the project	A tool which provides access for general practitioners (GPs) to home care organisations' patient information.
	B3	Universities, private health organizations, national and regional government agencies, red cross organizations, knowledge organizations, ICT suppliers, and individual health professionals	GPs and health professionals as initiators of the project and involved throughout the project	A way of creating, validating, and disseminating official evidence-based guidelines for health care providers.
	B4	Public nursing home (local government), private construction companies and contractors, consultant companies, nurses, and patients	Health professionals and patient (representatives) involved in conceptual phase and testing phase	A nursing home which implemented several technologies (wearables, smart cameras, etc.) to support residents and nurses in their daily activities.
	B5	Municipalities, communal network, private hospitals, private ICT companies, consultant companies, citizens, and health professionals	Citizens involved in conceptual phase and testing phase	A platform which brings people with health/social care demands together with volunteers who provide help.
The Netherlands	N1	Municipality, public hospital, and several private health organizations	Patient (representatives) and health professionals involved in pilot testing	An ICT platform which facilitates the exchange of health information between partners and patients.
	N2	Municipality (departments of social affairs, ICT, and service quality), private health care provider, neighbourhood teams, citizens	Family of patients and nurses involved in pilot testing	A digital platform designed to foster neighbourhood collaborations between clients and consultants.
	N3	Semi-private association, software developer, and patient organization	Family of patients and nurses involved in pilot testing	A tracking technology which allows an open floor and the possibility for dementia patients to walk around freely.
	N4	Semi-private association, ICT company, consultant company	Health professionals and patient (representatives) involved in conceptual phase and testing phase	A smart diaper which automatically detects defecation and signals this to the nurses.
Spain	S1	Several public hospitals, private ICT companies, several patient organizations, university	Health professionals involved in conceptual phase and patient associations involved in testing phase	An electronic prescription system, a patient appointment system for the Outpatient Dispensing Unit, a robot for automatic storage and dispensing in assisted and unassisted mode.

[2] The descriptions of the eHealth innovations in the cases are adopted from the European Horizon 2020 research report of Callens et al. (2020, 18-19).

Case ID		Collaboration partners	User involvement	eHealth innovation[2]
	S2	Public hospital/health service, regional government, ICT companies, consultancy companies, several other private companies, universities, health professionals and patients	Patients, health professionals and social workers involved in conceptual phase and testing phase	Advanced ICT systems designed to enable an integrated patient-centred care model to deliver home health care for chronic patients.
	S3	Public hospitals and healthcare services, public research institute, private technology centre, several health professionals (e.g. psychiatrist, psychologists, physicians, etc.)	Health professionals involved in conceptual phase, patients involved in testing phase	Computerised cognitive behaviour therapy (CCBT) through a web application which allows for self-administered treatment regardless of time or place.
	S4	Public hospitals, ICT and telecom companies, physicians	Health professionals involved in conceptual phase, patients involved in testing phase	The application of Artificial Intelligence to diagnose uncooperative patients. It serves to determine whether they have any problems with their eyesight. In some cases, it also enables the diagnosis of the problem.
Estonia	E1	Ministry, government agencies and public authorities, ICT companies, private health care providers, physician associations, hospital associations, individual physicians	Various health care providers (public and private) involved in different phases of the process	A centralised registration system within the national patient portal where patients can book appointments with all health care providers that have partnered with the project.
	E2	Ministries, public health insurance authority, government agencies, physician association, interest groups	Representatives of user organizations and target groups involved in conceptual phase and children and parents involved in testing phase	A redesigned service process that combines three standalone services (application for disability; application for rehabilitation services; application for aids) into one logical service. It is achieved through changes in data processing and analytics.
	E3	Ministry, public health insurance authority, colleges, network of healthcare providers, ICT companies, several health care organizations	Health care providers (public and private) involved in conceptual phase, individual nurses involved in testing phase	An app with a voice command function that supports the health care provider in carrying out procedures through digitalised guidelines.
Denmark	D1	Regional government, municipalities, public hospitals, ICT company, representatives of health professionals	Health care providers involved in conceptual phase, individual nurses and social workers involved in testing phase	An e-learning programme that provides health professionals with knowledge about dysphagia.
	D2	Public hospital, ICT company, health professionals	Nurses involved in the conceptual phase and the testing phase of the project	A smartphone app for patient reported outcomes.
	D3	Public hospital, university, ICT and health service companies, patient associations, health professionals	Clinical staff, GPs and patients involved throughout the project	A smartphone app that helps convey the results of bone scans to patients with osteoporosis.

Table A2: Data collection

Case ID		Surveys (124)			Interviews (132)		
		Coordinator	Public and private partners	Users	Coordinator	Public and private partners	Users
Belgium	B1	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (1)	Representatives of patient organizations (2), physician association (2), and user groups (1)	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (2)	Representatives of patient organizations (2), physician association (2), and user groups (1)
	B2	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)
	B3	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (1), ICT company (1)	GPs (3)	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (2), ICT company (1)	GPs (3)
	B4	Manager nursing home (1)	Municipality (1)	Nurses (3)	Manager nursing home (1)	Municipality (1), external private consultant (1)	Nurses (3)
	B5	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (2)	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (3)
The Netherlands	N1	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)
	N2	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (4)	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (5)
	N3	Manager/project coordinator (1)	Public service provider (2), ICT company (1)	Representative user organization (1), nurse (1), physician (1)	Project coordinator (1)	Public service provider (1), ICT company (1)	Representative user organization (1), nurse (1), physician (1)
	N4	Manager/project coordinator (1)	Public service provider (1)	/	Manager/project coordinator (1)	Public service provider (1)	Nurses (2)
Spain	S1	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)
	S2	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)
	S3	Public hospital (1)	Public hospitals/health care organization (3), ICT company (1)	Physicians (4), nurse (1) and technician (1)	Public hospital (1)	Public hospitals/health care organization (2), ICT company (1)	Physicians (4), nurse (1) and technician (1)

Case ID		Surveys (124)			Interviews (132)		
		Coordinator	Public and private partners	Users	Coordinator	Public and private partners	Users
	S4	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)
Estonia	E1	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)
	E2	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)
	E3	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (1), nurse (1)	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (2), nurse (1)
Denmark	D1	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)
	D2	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)
	D3	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)

Table A3: Operationalization of *innovativeness*

Newness	Adoption
No/A lot of innovative ideas are developed in this project	The frequency of use will typically be very low/high
The innovativeness of the developed innovation is very low/high	The effect on a user's life will be very small/extensive
The innovative character of the project is lower than/exceeds my initial expectations	Only a selective subgroup of users/All users that would benefit from this innovation can use it
The users could do exactly the same thing with other tools/would be unable to do those things without this innovation	The innovative ideas that are developed in the project are not feasible at all/very feasible
It is very easy/difficult (or impossible) to find tools that have the same functionalities as this innovation (at the moment of implementation)	The innovation does not deal with the problems at hand at all/really deals with the problems at hand

Table A4: Calibrated dataset

Case	User empowerment	Rules and procedures that restrict users' activities	Knowledgeable users	Partnership	Perceived innovativeness
N3	0.67	0.33	0.33	0.33	0.33
B5	0.33	0.67	0.33	1	0
E1	0.33	0.33	0.67	1	0
E3	0.67	0.67	0.67	0	0
D1	0.67	0.67	0.67	1	0.67
B3	1	0.33	0.67	0	0.67
N4	0.33	0.67	0.33	0.33	0.33
N2	0.33	0.33	0.67	1	0.67
S3	0.67	0.67	0.67	0.67	0.67
B1	0.33	0.33	0.67	1	0.67
B2	0.67	0.33	0.67	0	0.67
D3	0.67	0.67	0.67	0.67	0.67
S2	0.67	0.33	0.33	0	0.67
E2	0.33	0.67	0.67	1	0.67
D2	0.67	0.33	0.67	0.67	0.33
S1	0.33	0.67	0.67	0.67	1
S4	0.33	0.67	0.67	0.67	1
B4	0.67	0.67	0.33	1	1
N1	0.33	0.33	0.33	0	0

Table A5: Analysis of necessary conditions – absence of highly innovative services

Absence of highly innovative services		
Conditions	**Consistency**	**Coverage**
Government coordinated partnership	0.591314	0.482289
Societally coordinated partnership	0.592428	0.665832
High empowerment of users	0.701559	0.630000
Low empowerment of users	0.702673	0.701111
Presence of rules and procedures that restrict users' activities	0.701559	0.651499
Absence of rules and procedures that restrict users' activities	0.739421	0.711683
Presence of specialized knowledge from the user in the project	0.701559	0.589336
Absence of specialized knowledge from the user in the project	0.739421	0.799037

Table A6: Truth table

	Government coordinated partnership	High empowerment of users	Presence of rules and procedures that restrict users' activities	Presence of specialized knowledge from users	Innovation[1]	#cases	Raw consist.	PRI consist.
1	1	0	1	1	**1**	3	**0.882979**	0.752809
2	1	1	1	1	**1**	3	**0.882979**	0.752809
3	1	1	1	0	**1**	1	**0.866935**	0.668342
4	0	1	0	1	**1**	2	**0.857759**	0.67
5	1	0	0	1	**1**	3	**0.822695**	0.625468
6	1	0	1	0	0	1	0.798387	0.497487
7	1	1	0	1	0	1	0.798387	0.497487
8	0	1	0	0	0	2	0.784483	0.5
9	0	1	1	1	0	1	0.767442	0.39759
10	0	0	0	0	0	1	0.748111	0.39759
11	0	0	1	0	0	1	0.748111	0.39759

[1] The 1 in the columns indicates that rows 1 through 5 consistently lead to the outcome.

Table A7: Parsimonious solution for the presence of highly innovative services

	Consistency	Raw coverage	Unique coverage	Cases in path
Government coordinated partnership * high empowerment of users * absence of rules and procedures that restrict users' activities	0.889632	0.530938	0.135729	D1, S3, D3, B4
Societally coordinated partnership * presence of rules and procedures that restrict users' activities * presence of specialized knowledge from the user	0.857759	0.397206	0.100798	B2, B3
Low empowerment of users * presence of specialized knowledge from the user	0.79198	0.630738	0.169661	E1, N2, B1, E2, S1, S4
Solution consistency	**0.839614**			
Solution coverage	0.867265			

Table A8: Complex solution for the presence of highly innovative services

	Consistency	Raw coverage	Unique coverage	Cases in path
Government coordinated partnership * high empowerment of users * absence of rules and procedures that restrict users' activities	0.889632	0.530938	0.135729	D1, S3, D3, B4
Societally coordinated partnership * high empowerment of users * presence of rules and procedures that restrict users' activities * presence of specialized knowledge from the user	0.857759	0.397206	0.166667	B2, B3
Government coordinated partnership * low empowerment of users * presence of specialized knowledge from the user	0.84985	0.56487	0.169661	E1, N2, B1, E2, S1, S4
Solution consistency	**0.839614**			
Solution coverage	0.867265			

Table A9: Calibration of outcome/conditions

Innovativeness of services (outcome)	User empowerment	Specialized knowledge of users	Rules and procedures that hinder users' activities	Type of partnership
Survey data leading *Questions:* see table A1 *Measurement:* seven-point scale, cross-over point = 5 • All answers of the respondents above the cross-over point → 1 • More than half of the answers above the cross-over point → 0.67 • More than half of the answers below or on the cross-over point → 0.33 • More than half of the answers below the cross-over point → 0 • Equal amount above and below/on the cross-over point → Larger distance to the cross-over point of answer resp. above and below/on cross-over point is indicative for assigning case score above or below cross-over point (i.e. 0/0.33 or 0.67) + qualitative interpretation to assign 0 or 0.33 General qualitative check of the assigned scores using the interview data	***STEP 1: Levels of user empowerment:*** Six levels: 1) listening to partnerships; 2) being consulted by the partnership; 3) advise the partnership; 4) collaborate and co-produce with the partnership; 5) decision making; 6) leading the process • All respondents answer level 4 (collaborate and co-produce with the partnership) or higher → 1 • More than half answer level 4 or higher → 0.67 • More than half answer below level 4 (i.e. level 1, 2 or 3) → 0.33 • All answer below level 4 → 0 ***STEP 2: Specific qualitative check*** Answers of the respondents on the levels of empowerment are checked against the qualitative information provided. Each case receives a score (0; 0.33; 0.67; 1) that matches the qualitative information ***STEP 3: Survey data*** *Question*: The users were given no/extensive freedom to act within the project *Measurement*: seven-point scale, cross-over point = 5 • All respondents above cross-over point → 1 • More than half of the respondents above cross-over point → 0.67 • More than half of respondent below or on cross-over point → 0.33 • All respondents below or on cross-over point → 0 ***STEP 4: Qualitative interpretation of level of empowerment*** Using additional qualitative interview material on the user empowerment, a score of 0; 0.33; 0.67 or 1 was assigned to each case ***STEP 5: Integration of the scores*** • Average of scores calculated in steps 1, 2 and 3 → intermediate score • Intermediate score matches qualitative interpretation → follow intermediate score • Intermediate score does not match qualitative interpretation → round towards qualitative interpretation	***STEP 1: Survey data*** *Question:* The involved users brought no/crucial knowledge in the project *Measurement:* seven-point scale, cross-over = 5 • All respondents above cross-over point → 1 • More than half of the respondents above cross-over point → 0.67 • More than half of respondent below or on cross-over point → 0.33 • All respondents below or on cross-over point → 0 ***STEP 2: Specific qualitative check*** Answers of the respondents in step 1 are checked against the qualitative information provided: Superficial experiences → 0 New perspectives → 0.33 Some technical knowledge → 0.67 A lot of technical knowledge → 1 ***STEP 3: Qualitative interpretation of specialized knowledge of users*** Using additional qualitative interview material, a score of 0; 0.33; 0.67 or 1 was assigned to each case ***STEP 4: Integration of the scores*** • Average of scores calculated in steps 1 and 2 → intermediate score • Intermediate score matches qualitative interpretation → follow intermediate score • Intermediate score does not match qualitative interpretation → round towards qualitative interpretation	***Survey data leading*** *Question*: The users' activities were hindered/ were not hindered at all by the rules and procedures of the actors in the partnership *Measurement*: seven-point scale, cross-over point = 5 • All respondents above cross-over point → 1 • More than half of the respondents above cross-over point → 0.67 • More than half of respondent below or on cross-over point → 0.33 • All respondents below or on cross-over point → 0 General qualitative check of the assigned scores using the interview data	***Interview data leading*** Coordinating actor is: • Government (e.g. local government, a government agency, a ministry, etc.) → 1 • Public hospital or public health care organization → 0.67 • Private health care provider of public interest → 0.33 • Private organization (for-profit/non-profit) → 0

Chapter 6

A configurational approach to collaborative innovation

Chesney Callens

6.1. Introduction

This dissertation addressed how public service innovation arises from processes of collaborative innovation in public sector organizations and public-private collaborations. We were specifically interested in three levels of conditions of collaborative innovation: 1) organizational capacity, 2) partnership processes, and 3) the involvement of users. One of the primary contributions of this dissertation is the use of a *configurational approach* towards studying the conditions on these three levels. This configurational approach allowed us to combine conditions from different theoretical perspectives and explore their combined effect on public service innovation. The configurational approach not only increased the empirical value of the dissertation, but also allowed theoretical contributions, as connections between, and integrations of theoretical frameworks were suggested. The four empirical chapters, each with their own theoretical focus, also allowed us to study in great detail some prevalent gaps in the current literature.

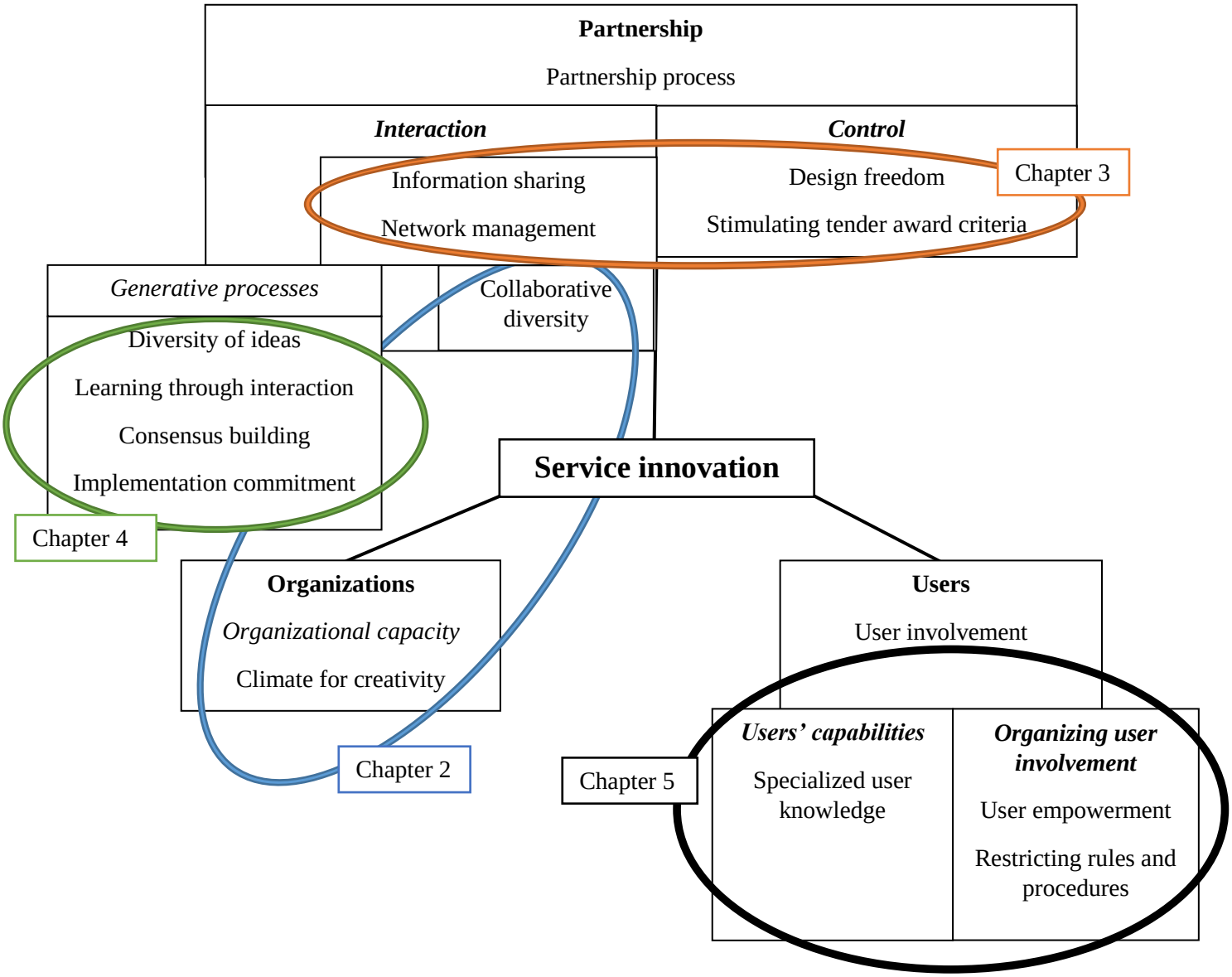
This concluding chapter addresses the primary insights from the four empirical chapters. First, the chapter answers the research questions that were formulated in Chapter 1. The chapter gives an overview of the most important results of each of the empirical chapters, and reflects on the value and contributions of these key findings. Second, the chapter focuses on a theoretical reflection of collaborative innovation. The chapter provides a theoretical reflection that is extracted from the results of the empirical chapters, but also from additional observations which were not part of the empirical chapters. These findings are introduced to broaden the discussion on the antecedents of collaborative innovation, and to learn more from the rich insights the empirical data in this dissertation yielded. Furthermore, the theoretical reflection also critically assesses the value of public service innovation and collaborative innovation, and gives some broader thoughts on new rationales to collaborative innovation. The last sections of the chapter focus on the theoretical and practical relevance of the dissertation, and elaborates on some of the limitations and future research opportunities connected to the dissertation.

6.2. Primary research themes addressed in the dissertation

This section summarizes the most important insights from all four of the empirical chapters in the dissertation. The section addresses the theoretical and practical contributions of every

chapter and reflects on the most important results. Figure 1 illustrates the research focus of the four chapters, and presents for each chapter all of the studied conditions.

Figure 1: Overview of the empirical chapters



6.2.1. Internally and externally oriented conditions for innovation

Chapter 2 of the dissertation considered RQ1: How do conditions related to the internal and external exploration of new ideas, knowledge and perspectives influence public service innovation? Considering individual public service organizations, the chapter looked at how organizational capabilities related to the exploration of new ideas, more specifically the internal

climate for creativity, and the diversity of collaborations with external stakeholders, affect the innovation of public services. Increasing the opportunity to explore new ideas by establishing a climate for creativity is an interesting avenue for innovative public services as it affects the ideation phase of the innovation process (Anderson et al. 2014). Similarly, enabling the opportunity to explore external ideas by collaborating with a diverse set of external stakeholders affects the range of ideas that are explored and stimulate idea generation processes (Sorensen and Torfing 2011). Furthermore, combining internally oriented conditions with externally oriented conditions presents interesting features as it combines both exploration opportunities. For the proposed conditions, this meant that a climate of creativity in the organization could stimulate processes of collaborative innovation as more creative individuals became part of the collaboration. Also, the climate for creativity should make it easier to implement innovations produced in the collaboration as the organization is more sensitive to new ideas because of their climate for creativity. In other words, we expected to observe an interaction effect between a climate for creativity and collaborative diversity.

The chapter addressed this question with survey data from the Australian Public Service (APS). A dataset from 2019 with more than 30 000 observations from the executive level and the senior executive service brand was analysed through a linear probability model. The analysis revealed three findings. First, both a climate for creativity and collaborative diversity had a positive and significant effect on public service innovation. The positive effect of a climate for creativity on innovation confirmed the value of the creative potential of the employees for innovative service delivery. Moreover, the positive effect of collaborative diversity indicated the additional benefits of heterogeneous groups as opposed to homogeneous groups for collaborative innovation. Second, the interaction effect between a climate for creativity and collaborative diversity was non-significant. This was a rather surprising result, as we expected the two independent variables to be complementary conditions. However, this might have something to do with our third result. A negative and significant squared term was found between collaborative diversity and innovation, which produced an inverted u-shaped relationship between the variables. Hence, collaborative diversity was in some instances positive, while in other instances it was negative. Such an effect could have resulted in the non-significant interaction effect. Indeed, the literature on the relationship between collaboration and innovation is not straightforward, especially with regard to the diversity component of collaborative innovation. Collaborations have serious drawbacks for innovation in terms of their reliance on stable interactions and shared understanding (Huxham 2003; Cinar et al. 2019),

whereas innovation relies a lot on dynamic and unpredictable processes (Torfing 2019). In other words, diversity helps innovation but undermines collaboration (Torfing 2019). As a result, collaborative diversity stimulates innovation up to a point at which the negative effects of diversity inhibit the interactions between the stakeholders too much and innovation through collaboration becomes ever more challenging.

The results in Chapter 2 enable us to reflect more on the relationship between internally oriented conditions and externally oriented conditions for innovation. Collaboration is only one stimulating condition for innovation and a combination of internal creativity and external collaboration seemed to be a more effective way to achieve innovation. Our argument was that both conditions stimulate the exploration of new ideas, knowledge, and perspectives, which is critical for innovation. An interaction between both conditions seemed therefore desirable as they can reinforce each other's contributions. However, our findings suggest that there is no significant interaction effect, but that there is a non-linear relationship between collaborative diversity and innovation. The latter result revealed a lot of the paradoxical nature of collaborative diversity, and by extension, collaborative innovation. The result showed that collaborative innovation is highly sensitive to changes in the degree of diversity of the involved stakeholders. If there is too little diversity, the innovation process is insufficiently activated (i.e. we see a positive and significant relationship between collaborative diversity and innovation). However, if there is too much diversity, the collaborative interactions become too complex and difficult to manage, which inhibits the innovation process. This fragile balance between too little and too much diversity could be indicative for the possible complex relationship between internally oriented and externally oriented conditions of innovation, as an overemphasis on internal exploration opportunities might harm processes of collaborative innovation just as much as an improper balance of collaborative diversity impedes the adoption of innovation inside the organization. For instance, an overestimation of an organization's creative abilities in a collaboration might invoke the individuals in the partnership to rely too much on the capacities of the representatives of these organizations and engage too little with the other partners, which undermines the principal mechanism of external exploration and collaborative innovation.

6.2.2. Control structures and collaborative interactions

Chapter 3 of the dissertation addressed the combined effect of control structures and collaborative interactions on collaborative innovation in public-private partnerships (PPPs).

More specifically, RQ2 was examined: How does the combined presence of control structures such as procurement practices, and collaborative interactions such as network management and information sharing, stimulates innovation in collaborative partnerships?

Two considerations were important in this chapter. On the one hand, research into innovation through PPPs generally considers control structures related to the procurement process and the resulting contracts responsible for generating innovation. As we mentioned in Chapter 1, an influential stream of literature on 'public procurement for innovation' (Edquist, Vonortas, and Zabala-Iturriagagoitia 2015) arose from research into 'systems for innovation', in which the government received a key role as an enabler of innovation. Due to their contractual nature, PPPs were ideal to study such 'procurement for innovation logics'. On the other hand, PPPs are also collaborative in nature, as they imply long-term collaboration between the procurer and the contractor (Van Ham and Koppenjan 2001). Collaborative innovation literature suggests the importance of collaborative processes such as network management and information sharing. Managing procurement logics in conjunction with collaboration logics thus creates opportunities to enhance innovation in PPPs.

The chapter studied 24 PPPs in Belgium and the Netherlands that had their contract close between 2007 and 2015. Data from 74 professionals in the PPP projects (both procurers and contractors) was analysed through qualitative comparative analysis. Four conditions were studied: stimulating tender award criteria, design freedom, information sharing and network management, of which the former two conditions relate to procurement logics, while the latter two correspond to collaboration logics. The results showed one clear 'solution path': PPPs that display high levels of information sharing, network management and design freedom, have high levels of innovation. A qualitative examination of the covered cases assisted in the interpretation of this solution path. Three important insights could be extracted from these findings. First, although the PPP literature strongly emphasizes the contribution of structural conditions such as 'procurement for innovation' to the generation of service innovation, the measured procurement-related conditions 'stimulating tender awards criteria' and 'design freedom' were not necessary for the outcome. Second, a combined effect between the procurement logics and the collaboration logics was indeed prominent. The qualitative information of the cases suggested that the procurement logics were particularly important in the early phases of the project, while the collaboration logics were crucial to manage the unpredictable dynamics inherent to the collaborative phases. Procurement logics with

consequences for the collaborative phases after contract close, such as design freedom, seemed to have a stronger effect on innovation than procurement logics that were particularly impactful before contract close (i.e. stimulating tender award criteria). This was reflected in the solution path, as only design freedom, information sharing and network management were present. Third, the three conditions in the solution path seemed to reinforce each other, as design freedom allowed the formulation of a detailed design after contract close, in which network management and information sharing became crucial conditions. This stimulated synergistic interactions between the partners, which led to new ideas and eventually innovation.

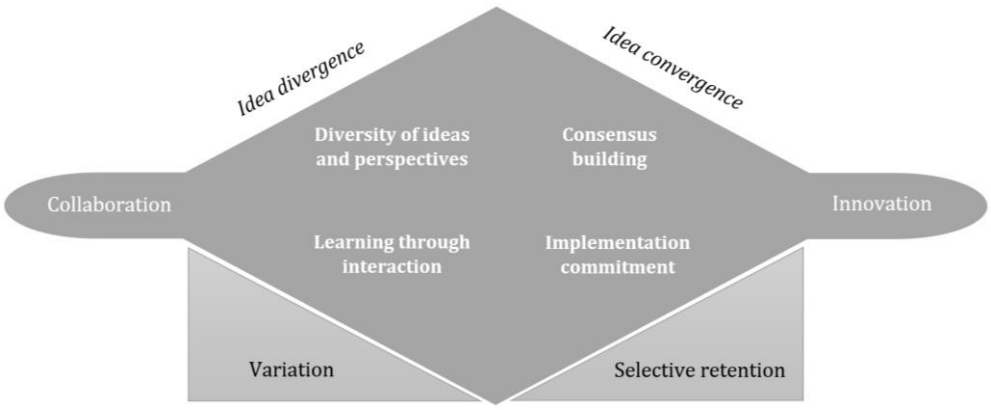
When we reflect on these results, two important insights arise regarding the way in which control structures and collaborative interactions stimulate innovation. First, control structures such as procurement logics provide some level of stability to inherently dynamic and unpredictable collaborative innovation processes. Through bidding procedures, agreements and output specifications, they ensure a clear and stable project orientation towards service innovation, which helps to secure a feasible and desirable outcome. However, only focussing managerial attention on procurement logics stifles the creative capacity of the involved partners. Therefore combining the procurement logics with exploring network management, connecting network management, and information sharing directs the collaboration towards the realization of feasible services, but also helps in harnessing the creative potential of the collaboration, which leads to more novel and original solutions. Second, managing control structures of the partnership in conjunction with collaborative interactions not only leads to a cumulative effect on innovation, the conditions also have a reinforcing effect on the innovation process. Indeed, some of the control structures stimulate interactive dynamics during the collaboration process, which triggers the collaborative interactions to stimulate innovation. This additional stimulation of the collaborative interactions would not have been possible in the absence of the control structures. The synergizing effect of these two management approaches to innovation in PPPs has both theoretical and practical relevance as models that combine these management forms seem to better describe reality, and innovators that combine both management approaches seem to be more successful in creating high levels of innovation in PPPs.

6.2.3. Generative processes of collaborative innovation

Chapter 4 tackled the internal components of the mechanism of collaborative innovation. Instead of looking at the effects of managerial conditions or organizational capabilities on collaborative innovation, the chapter considered the collection of processes that produce

innovation from collaboration. The chapter addressed the following research question: What is the combined effect of the generative processes of collaborative innovation on innovation in collaborative partnerships? In doing so, the chapter looked at four generative processes of collaborative innovation: diversity of ideas and perspectives, learning through interaction, consensus building and implementation commitment. Similar generative processes were first introduced by Sorensen and Torfing (2011) and Ansell and Torfing (2014), and the chapter further developed these processes and tested their combined effect on innovation in collaborative partnerships. Because collaboration thrives in stable situations of shared understanding and connected visions, while innovations flourish in unpredictable circumstance with a lot of diversity and change, the mechanism of collaborative innovation should entail both sides of the coin. On the one hand, creativity and novelty are stimulated through idea divergence, which includes processes of diversity and learning. The goal of these two processes is to increase the variance (in terms of ideas, visions, profiles, knowledge pools, resources, etc.) in the innovation process. On the other hand, collaboration and, hence, the proper implementation of the innovation are fostered through idea convergence, which includes processes of consensus building and implementation commitment. The objective of these processes is to select and retain suitable solutions in an implemented innovation. Figure 2 illustrates the four generative processes of collaborative innovation.

Figure 2: Four processes of collaborative innovation



The chapter considered the combined effect of the four generative processes of collaborative innovation on the innovativeness of created service in 19 public-private collaborations. The collaborative partnerships were selected in five different European countries to allow for (cautious) generalizations to similar partnerships, and were all active in the field of eHealth services. Interview and survey data from a total of 132 respondents (i.e. project coordinators, public partners, private partners and users) was collected. The analyses were performed through

the use of fuzzy-set qualitative comparative analysis (QCA). Additional qualitative analyses of the covered cases provided extra information on the four generative processes.

The analyses demonstrated three findings. First, as expected, none of the processes were necessary for the outcome, as they each describe specific aspects of the collaborative innovation process and jointly stimulate the innovation process. Second, a single solution path with a combination of learning through interaction, consensus building and implementation commitment was uncovered. As such, diversity of ideas and opinions was both present and absent in cases that showed highly innovative services. The qualitative case information confirmed this, as diversity could lead to tension and conflict, resulting in inferior collaboration and innovation, but could also lead to early discussion and deliberation, which stimulated the innovation process. This result connects to the findings from Chapter 2, where similar ambiguous results were seen for collaborative diversity. The qualitative information of the covered cases indicated that the effect of diversity of ideas and perspectives on innovation depended largely on the origins of this diversity. Diversity that had a cultural or organizational origin (e.g. differences in motives, procedures and routines) was more likely to lead to tension and conflict than substantial diversity (i.e. differences in ideas and opinions).

Third, the qualitative information of the covered cases indicated the interconnected and mutually reinforcing nature of the processes of collaborative innovation. Processes of learning through interaction stimulated idea convergence through consensus building and implementation commitment, while consensus building instances made new ideas and perspectives available, which stimulated diversity and learning. In other words, there is no strict separation between idea divergence and idea convergence in processes of collaborative innovation, and the ideation and implementation phases of the innovation process are full with complex feedback loops, which give it a chaotic and almost cyclical trajectory.

The results of Chapter 4 gave us a better understanding of the inner workings of the mechanism of collaborative innovation. When we reflect on these results, we realize how beneficial collaborations can be to foster innovation, but also how fragile and unpredictable the process is. On the one hand, it allows for enhanced creative ideation and better implementation opportunities, which substantially helps the pursuit for public service innovation. Collaboration increases diversity and learning processes as a variety of actors closely interact with each other, which enhances innovative idea generation. It also helps in selecting and retaining proper ideas as multiple stakeholders are involved in and jointly responsible for the successful

implementation of the innovation. On the other hand, the results also show how fragile some of the components of the mechanism are, with the diversity component as an example of how some generative processes, when improperly activated, might even inhibit the innovation process. Diversity is, however, not the sole process with the potential to hinder the innovation process. On the one hand, an unbalanced reliance on idea divergence might trap the innovation process in a continuous idea generation phase, without ever resorting to a workable innovation. On the other hand, a disproportional reliance on idea convergence might lead to a lack of creativity, originality and novelty of the implemented innovation. Hence, the fragility of the collaborative innovation process not only lies in the ambiguous relationship of some of the components (i.e. diversity) with collaborative innovation, but also with the difficulty to adequately balance the four generative processes. For this reason, appropriate management of the collaborative innovation process, as we saw in Chapter 3, is of crucial importance and more complicated collaborations (e.g. with more actors) require more extensive managerial activities.

6.2.4. Synergizing conditions of user involvement

Chapter 5 examined the way in which conditions of user involvement affect the innovativeness of public services in public-private collaborations. User involvement is generally considered as challenging, as both the users and the innovating actors have to invest a lot in the user involvement without having any certainties that it will be beneficial for the eventual end result. For this reason, we investigated the conditions that positively impact the innovativeness or the created services, and addressed RQ4: How do conditions related to the knowledge and skills of users and conditions related to the empowerment and freedom of users together affect innovation in collaborative partnerships? Two general types of user involvement conditions were considered. On the one hand, individual traits of the users such as their know-how and skills contribute to the knowledge and capabilities already present in the innovation process, and makes knowledge available which was previously inaccessible (Prahalad and Ramaswamy 2000; Lettl, Herstatt and Gemuenden 2006; Greer and Lei 2012). On the other hand, effective engagement of the users in the innovation process by properly empowering the users ensures that the input of the users is actually used in the innovation process (Cinar et al. 2019). This approach led to the selection of three conditions of user involvement: the specialized knowledge of the users, the empowerment of users, and the presence of restricting rules and procedures. As the traits of the users and the empowerment and freedom of the users are essential components of user-centred innovation (see Chapter 1), we examined the combined effects of these conditions on the innovativeness of the created services.

The chapter used similar data as Chapter 4. Interview and survey data were collected from 132 respondents (i.e. project coordinators, public partners, private partners and service users), in 19 European public-private eHealth partnerships. Five European countries from different administrative regimes (Pollitt and Bouckaert 2017) were covered: Belgium, the Netherlands, Denmark, Spain and Estonia. The analyses were conducted with fuzzy-set qualitative comparative analysis (QCA). Additionally, the qualitative interview information of the covered cases was analysed. The results indicated two stable solution paths, each contingent on the type of collaboration. The first solution path consisted of government coordinated partnerships with high user empowerment and an absence of restricting rules and procedures. This result showed that specialized knowledge can be both present and absent when highly innovative services are created. Furthermore, the qualitative information indicated that a lot of the covered cases involved patients or other users in order to observe how the innovation works in reality. Rather than relying on the knowledge of the involved users, some partnerships involved users to witness user experiences directly. The second solution path included societally coordinated partnerships with the presence of specialized knowledge of users, high user empowerment, and a presence of restricting rules and procedures. The qualitative information also indicated that the composition of the covered partnerships was different from the partnerships in the first solution path. Only two partnerships were covered by this solution path, but both of these partnerships had a strong presence of lead users and user-innovators (Baldwin and von Hippel 2011), who had extensive knowledge about the subject of the innovation, but required the capacity of the other partners to realize their ideas. These ideas were, however, sometimes too ambitious for the partnership to realize, and the users were quickly confronted with the limits of the partnership, often in the form of rules, procedures or structures that restricted the ambitious ideas of the users.

Chapter 5 demonstrated the complex relationship between conditions of user involvement and showed how the configuration of these conditions is contingent on the type of partnership. The three conditions were not always present when the partnerships created highly innovative services and their configurations changed dependent on the type of collaboration. Some of the conditions we expected to be present in partnerships that create highly innovative services were not important (e.g. ‘specialized knowledge’ in the first solution path) or were even absent (‘restricting rules and procedures’ in the second solution path). A deeper analysis of the qualitative case material proved to be necessary to understand the reasons for these somewhat counter-intuitive results. These subsequent analyses pointed at the contingent nature of user

involvement, and the special importance of the role of the users in the innovation process. Different configurations of conditions which resulted into the same outcome (i.e. high innovativeness) were therefore needed when different types of users were involved in the innovation process. For instance, restricting rules and procedures were absent in cases in which users were involved as 'co-creators', which gave them more freedom to act in the innovation process, while the exact same condition was present in cases in which 'user-innovators' were involved, which made sure that ideas were not over-ambitious and were actually implementable. Both of these configurations resulted in highly innovative services, but due to the different roles of users, the conditions in these configurations were quite different. We also had tentative suggestions that there might even be a role of 'user-advisor' present in these innovation processes, in which users are involved who possess specialized knowledge, are not highly empowered, but still contribute to the creation of highly innovative services.

The dominant perspective in the literature assumes that user involvement is a management task of the service provider, and the service provider needs to actively engage with the service users to enhance coproduction and innovation. However, this chapter showed that, although managing the process of user involvement is still very important, the user involvement process will also be steered by the profile and role of the users in the innovation process. Project coordinators are unable to control all aspects of the user involvement process and depend to a large extent on the characteristics of the involved users. Particularly the role of users in the innovation process seemed to be crucial (see also Callens et al. 2021). For instance, the user involvement process with citizens who are only slightly invested in the innovation process will be substantially different to user involvement with user-innovators who want to create new solutions for their own use and for which the success of the innovation is paramount. The users in these two scenarios have different expectations of the outcome, will act differently, will provide different value to the innovation process, and will ultimately demand a different approach to ensure a successful user involvement process.

6.3. Theoretical reflections on collaborative innovation

6.3.1. Theoretical reflections related to the empirical chapters

This dissertation was particularly interested in three sets of conditions of collaborative innovation: 1) organizational capacities, such as a climate for creativity, 2) control structures such as procurement-related conditions and collaborative interactions, such as network management, generative processes (i.e. diversity of ideas and perspectives, learning through

interaction, consensus building, and implementation commitment), and collaborative diversity, and 3) conditions of user involvement, such as the empowerment of users, their specialized knowledge, and the degree in which their activities were inhibited by rules and procedures in the partnership. Throughout the dissertation, a couple of theoretical insights were formulated. First, the configurational approach we introduced in Chapter 1 proved to be useful in untangling the effects of the conditions on public service innovation. In most of the chapters, a combined effect between multiple conditions was found, which hinted at the complex relationship between the conditions and innovation. The dissertation showed that inferences about one isolated condition are often tricky and that we need to take configurations of interrelated conditions into account to more fully understand their effect on innovation. These combined effects sometimes transcended the theoretical frameworks of the studied conditions, as was the case in Chapter 3, which showed how conditions such as procurement for innovation (i.e. a demand-side instrument) reinforced the effect of collaboration related conditions such as information sharing and network management.

Second, Chapter 2, which looked more closely at the effects of a climate for creativity and collaborative diversity on public service innovation, showed that, although hypothesized, an interaction effect between these two conditions was not statistically significant. However, perhaps an even more interesting property of collaborative innovation was discovered: collaborative diversity positively affects innovation up to a point at which a further increase of collaborative diversity starts to negatively affect innovation. A similar ambiguity of diversity was discovered in Chapter 4, in which the contributions of all of the generative processes of collaborative innovation led to highly innovative public services, except for the diversity of ideas and perspectives, which could be both present and absent in this particular configuration. Qualitative deepening of the results using the case information unravelled that diversity of ideas and perspectives in some cases stimulated substantive discussions which enhanced creative ideation, while in other cases, diversity in ideas and perspectives was caused by differences in organizational cultures and routines, which led to miscommunication, distrust and conflict between the partners. These results provided evidence for the fragile balance between collaboration and innovation, which has been indicated in the literature (e.g. Torfing 2019).

Third, Chapter 4 also developed and tested a mechanism for public service collaborative innovation. Using recent ideas from collaborative innovation research (i.e. Ansell and Torfing 2014), evolutionary perspectives on innovation, and creative problem solving literature (Zollo

and Winter 2002; Runco and Basadur 1993), we developed a model which was composed of variation/idea divergence, and the related generative processes 'diversity of ideas and perspectives', and 'learning through interaction' and selective retention/idea convergence, and the corresponding generative processes 'consensus building' and 'implementation commitment'. The analyses showed a combined effect of learning through interaction, consensus building, and implementation commitment on the innovativeness of the created public services. These results imply that collaborative innovation is not all about creative ideation, but also about increased convergence towards each other's perspectives and jointly creating shared understanding. Without idea convergence, creative ideas never get realized, and without idea divergence, realized services never obtain proper levels of novelty.

Fourth, collaborative innovation is generally depicted as an innovation process where different stakeholders together work on the innovation process. Service users are a very important stakeholder of public services, and how they are involved in the innovation process is therefore of great importance (Baldwin and von Hippel 2011). Chapter 5 showed that three conditions of user involvement (i.e. user empowerment, specialized knowledge of users, and restricting procedures and rules) work in conjunction with each other. However, it also became clear that configurations of these conditions are not the same for every situation. The analyses from Chapter 5 indicated that partnerships with co-creating users indeed created highly innovative services if these users were highly empowered and were not hindered by rules and procedures in the partnership. However, their specialized knowledge of the services could be both present and absent in these partnerships, because they could provide other valuable information (e.g. user experience during testing phases) that was equally important for the innovators. We saw something different in partnership which involved user-innovators rather than co-creators. These partnerships created highly innovative services if the users were highly empowered, had specialized knowledge about the services, and *were* hindered by rules and procedures in the partnership.

These results illustrate the sensitivity of collaborative innovation to individual differences between involved partners (in this case users), and the way in which the mechanism of collaborative innovation holds these differences in check. Restricting rules and procedures proved to be effective in aligning the often over-ambitious proposals of the user-innovators to the implementation reality of the service providers in the partnership. This insight relates to the conjunction between idea divergence and idea convergence of Chapter 4, where the 'hindering' rules and procedures indirectly led to a convergence between the user-innovators and the

service providers in the partnership. The creativity that was introduced in the innovation process by the user-innovators was held in check by these hindering rules and procedures, in order to ensure that the innovation was feasible and realizable.

6.3.2. Theoretical reflections from additional observations

The core premise of the dissertation centred on three analytical clusters: the internal capacities of organizations, the control structures and collaborative interactions of partnerships, and the involvement of users. These three research levels allowed us to go into great detail on some prevalent gaps in the current literature. However, this detailed focus came also with some downsides. For instance, a lot of important discussions on innovation and collaboration were not addressed by our focus on particular conditions on these research levels. Also, the research we conducted on innovation and collaboration in public service delivery generated a lot more insights than those described in the empirical chapters. For this reason, we dedicate this section to additional discussions and insights that are important to understand the full reach of this dissertation, as we address crucial points concerning user involvement, ICT and trust.

a. User involvement as value creation or normative obligation?

Two interconnected observations from the wider literature demand us to reflect on the motives of user involvement in processes of service innovation. First, the literature on coproduction points to the normative rationale behind user involvement (Kristensson, Magnusson and Matthing 2002). Service providers and other organizations involve users because this is supposed to be the right thing to do. The overly positive connotation of user involvement in policy documents and grey literature shows that policy makers view user involvement almost as a best practice (Osborne, Radnor and Strokosch 2016). However, research has shown that involving users and citizens in service creation processes is challenging and does not always improve the end result. For instance, 1) obtaining access to users and motivating users is challenging, 2) insufficient consensus among users, diverging motives of users and too many different user groups complicates service creation, 3) a lot of energy needs to be invested in providing information to users, educating users and maintaining their attention and interest, and 4) inadequate knowledge of the service creation and delivery procedures and their implementation constraints inhibits the formulation of realistic proposals of the users (Kujala 2003). Second, and related to the first point, user involvement and coproduction can remain ‘tokenistic’ (Arnstein 1969). Due to the normative ‘obligation’ to involve users in service development and the realization that such an involvement requires a substantial investment of

the service provider, organizations may approach user involvement in a minimalistic manner. Users receive insufficient power to affect the service creation and are only consulted on matters that are already quasi-decided (Osborne and Strokosch 2013). This substantially limits the impact of the users on the end result, and it often leaves users disappointed with the process and the outcome.

The data collected in Chapter 5 of this dissertation reflect some of the mentioned issues. First, intensive user involvement was not always an adequate strategy in processes of technological innovation, as users have insufficient knowledge of the technicalities related to, for instance, eHealth innovation. Also, users are sometimes quite conservative in their ideas, which inhibits the creative and inventive approach that is generally associated with innovation processes. In one case, users 'downgraded' the innovation so much that the service provider ended up in discussions with the subsidising government about the innovativeness of the solution, and was in real danger a losing its grants. The sensitivity of service organizations to the pragmatic ideas of the involved users might therefore impede the innovation process. Second, and contrary to the first point, some users behave as innovators who are eager to implement their own ideas by using the capacities of the service providers in the partnership. In these circumstances, user involvement is indeed desirable, but it requires an intensive dialogue and alignment between the users and the service provider. Insufficient investment in the relational interactions between the users and the service provider by, for instance, adopting rigid control structures which impede open dialogue, cuts off the knowledge and information exchange and hinders the realization of the users' innovative ideas. Third, non-participation and tokenism (Arnstein 1969) were actively limited in many of the observed cases in this dissertation. However, although most of the user input in instances of user involvement had a real, functional impact on the innovation process, on some occasions, the service providers exploited the involvement of users to provide legitimacy for their own unilateral decisions. This observation is similar to what Arnstein (1969) calls 'manipulation', as the platform of user involvement is improperly used in order to impose the perspective of the service provider on user groups, without considering the opinions of the users. However, even with these limitations, user involvement was often invaluable to obtain knowledge and experiences related to the user context, to enable the service provider to test the created solutions in a real-life setting, learn from these experiences and improve the performance of the end result, to introduce creative, inventive and necessary alternations to existing solutions, and to increase the support of both users and service providers to the newly created services.

b. ICT as an enabler of collaboration and innovation

Although ICT was not the main focus of the dissertation, it was an important factor in many of the observations. There are three ways in which ICT conditioned the innovation process. First, ICT was an important component of most of the observed innovations. ICT helped to provide novel functionalities and additions to services, such as online access to services, digital visualization through smart camera's, enhanced spatial monitoring through electronic trackers, automated and robotic functions, better connectivity of modules through software advancements, 'internet of things' functionalities, and process enhancements through digitalization of information and content. The advantage of exploiting ICT in innovation processes lies in its ability to provide a wide range of extra functionalities, which would be implausible to achieve when ICT is absent. Of course, not every innovation needs to be 'digital' in nature, and we saw quite a few infrastructural innovations which were not related to ICT in Chapter 3. However, if innovation is something new and not just an optimization of what was previously there (see Chapter 1), ICT easily adds new and far-reaching alternations to services that enable innovation. However, a critical note is also in place, as many researchers and practitioners seem to equate digitalization with innovation and vice versa. Digitalization is an instrument to develop alternations to existing services, and is thus only one component of an innovation. The connection of the digital functionalities of the innovation to the actual service are crucial in understanding digitalization as a means to innovate. A compression robot or online platform indeed have interesting functionalities, but they only become innovative if they are connected to 'real-life' services such as waste reduction or centralised access of information. Therefore, digitalization should never be the starting point of innovation. New knowledge, ideas or concepts are the real backbone of innovation, while ICT is just a potential means to achieve these innovations.

Second, developing technological innovations depends for a large part on the available underlying ICT-infrastructure. As we mentioned in Chapter 1, the concept of 'systems of innovation', described by Freeman (1987), Lundvall (1992), Nelson (1993), and Edquist (1997), challenged the dominant view that innovation was solely about firms that individually pursue innovation to accrue competitive advantages. According to these authors, innovation had to be viewed in a system context, in which various stakeholders were active, some of which were innovators (e.g. knowledge institutions, companies) and others were regulators, diffusers and users (e.g. government, civil society, customers). This system view on innovation is more relevant than ever, as many innovations in public services are achieved due to the underlying

ICT-infrastructure, which connects various stakeholders with each other and allows the connection between information, technologies and services (Kattel, et al. 2019). This digital 'system of innovation' was prevalent in many of the eHealth cases in Chapters 4 and 5 (Callens et al. 2020). National ICT-infrastructure was used to connect services to complementing government services, or to extract digital information for other stakeholders. The service innovations themselves also directly expanded the digital system of innovation, as more data and services became accessible for a wider range of stakeholders, which could subsequently trigger new innovations. ICT is crucial in such an innovation architecture, as many of the innovations rely on digital information and services. The 'system of innovation' therefore becomes more and more digital and accelerates service innovation of states.

Third, besides the macro-level role of ICT-infrastructure in digital systems of innovation, ICT had also a direct, micro-level impact on the collaborative innovation process in most of our cases. On the one hand, ICT was used to increase the communication, interaction and learning between the collaborating actors (Callens et al. 2020). Tools such as online communication and data sharing platforms were used to bridge the physical distance between the involved actors and because it was more convenient to share ideas and documents through a centralised online platform. Also, digital learning and visualization tools were used to broaden perspectives and stimulate knowledge creation. On the other hand, ICT was a crucial feature in the testing and piloting phases of the innovation process (Callens et al. 2020). Digital mock-ups and prototypes were used to test various features of the innovation on the involved users, and physical testing environments were supported by digital tools.

Subsequent analyses also revealed the crucial importance of trust between the collaborating actors in case a lot of ICT tools were used in the collaboration, in order to create highly innovative services (Callens et al. forthcoming). These results reveal that ICT simultaneously stimulates and inhibits innovation processes. ICT pushes the innovation process forward by easing interpersonal communication, enhancing knowledge creation, and increasing prototyping and testing. However, the innovation process is also inhibited by ICT because of the reduction of face-to-face interactions between the collaborating partners, which are essential for trust building, a key driver of successful collaboration. As we have mentioned before and will argue later in more detail, the paradoxical relationship between collaboration and innovation makes collaborative innovation processes highly fragile, which is a serious challenge for collaborative innovation. We see a similar tension arising with ICT in such processes. ICT enhances the innovation process, but eventually lowers favourable relation-

building interactions, which are key for the collaboration process. However, trust between the collaborating partners also reduces the need for face-to-face interactions, as the partners have no need to see each other in person to validate each other's actions. As a result, the presence of trust between the partners enhances the stimulating effect of the use of ICT on the innovation process.

c. Trustful relationships or rigid agreements?

Trust is a key aspect of any collaboration. It relates to the subjective experience that someone acts in the best interest of someone else, and displays desirable behaviour (Bauer 2019). Trust reduces conflict (Entwistle and Martin 2005), facilitates the creation of shared understanding (McNamara 2012), and makes it easier to accept positions and roles of actors in a collaboration (Poocharoen and Ting 2015). As we indicated in Chapter 1, the most recent systematic literature reviews on innovation and collaborative innovation all mention trust as a crucial condition for innovation (see de Vries et al. 2015; Voorberg et al. 2014; Cinar et al. 2019; Lopes and Farias 2020; and Brogaard 2021). The previous section showed that trust is also an essential catalyst for the relationship between the use of ICT and service innovation (see Callens et al. forthcoming). Furthermore, additional analyses of the eHealth cases in Chapters 4 and 5 revealed that trust is a necessary condition for high innovativeness, which implies that high levels of trust were always present in the partnerships when highly innovative services were created by those partnerships (Callens et al. forthcoming). However, trust is not always an available commodity, especially in partnerships with diverse actors, and trust building requires a lot of investment in the interpersonal relations between the partners, for which there often is insufficient time. For these reasons, collaboration partners frequently stipulate their mutual expectations in agreements or contract, which prevent the sole dependence of the actors on believe or trust in the commitment and activities of the other partners (Brogaard 2021). However, the downside of such agreements is their rigid nature and unrealistic assumption that innovation is a predictable and stable process, with clear steps and a quantifiable outcome. In most cases, agreements begin to break down the moment the innovation process starts, as unforeseen circumstances require the partners to redirect activities and adjust projections.

The case data collected in the empirical Chapters 3, 4 and 5 indicate a combination of trust building through various network management activities and adopting agreements through contract management strategies. Not all cases in the dissertation apply the same formal contracts and procurement procedures as the public-private partnerships (PPP) in Chapter 3, but most of

the cases stipulate some conditions in either formal or informal agreements. For some of the cases, this proved to be essential as the visions of the partners started to diverge during the innovation process. The contract conditions and output specifications facilitated fast realignments between the partners and provided an incentive to commit to the partnership. These agreements were particularly useful when the motives and interest of the partners were rather vague at the beginning of the project or began to deviate from those of the project coordinator or other partners. Furthermore, because of the specific consequences of innovation development, partners were eager to protect intellectual property. Intellectual property issues often caused tensions between the collaborating partners in multiple cases and these tensions were almost always solved by adopting rigid contracts. The close collaboration of the actors also often demanded an agreement between the partners on their responsibilities and actions in the partnership, and on how they were tied to the partnership when developing innovations. However, trustful relationships remained the central motor of the collaborative innovation process. Contracts were used to protect important agreements or aspects related to the innovation process, but trust building activities were essential for the collaborative interactions themselves.

6.3.3. Critical reflection on public service innovation

As we mentioned thoroughly in Chapter 1, innovation as a research field was introduced in economics as a mechanism to explain transitions in economies and markets. Although the concept of innovation was never invented for the public sector, the last decades of public sector innovation research have indicated its relevance in the public sector. However, public sector innovation remains a contested research domain, as characteristics of government administrations not always properly connect to innovation related conditions. For instance, the rule-bound, command-and-control, bureaucratic nature of many public administrations generally limit the innovative potential of government organizations (Hartley, Sorensen and Torfing 2013). Furthermore, and in contrast to private sector organizations, government organizations are less affected by competition dynamics. Schumpeter's core principle of creative destruction is, therefore, insufficient to explain public sector innovation, as there are less 'innovate or die' stimuli in the public sector (De Vries et al. 2015). Gullmark (2021) mentions other differences between public and private sector organizations that affect innovation, such as the fact that there is no direct relationship between performance and obtained revenues in government organizations, the large impact of politicians and the media

on the strategy and direction of public sector organizations, and the inertial and risk-aversive nature of governments.

Furthermore, both academics and practitioners in the public sector seem to approach innovation as a normative good instead of a strategic consideration. However, innovation is not always appropriate in every situation. Innovation disturbs processes, structures, and services that each have their role in the organization, and replaces them with new processes, structures and services, which might be inferior and unsustainable. This organizational disruption can do more harm than good in circumstances of uncertainty, where proven methods provide stability and perspective, and where innovation undermines the stable development and growth of an organization (Wynen et al. 2020). As Hartley et al. (2013) note, innovation is difficult in rule bound, inertial and hierarchic bureaucracies such as government organizations. However, these characteristics also offer stability, certainty and reliability, which is incredibly important in organizations that work with public resources and which are responsible for solving societal issues.

The monopolistic position of most government organizations also plays an important role in the pursuit of innovation. When a firm innovates and the innovation fails in the market, competitors will benefit from this and will be able to replace the failed services of that firm, without a large impact for the customers. In monopolistic government services, failed innovations always directly impact the citizens as there are no competitors which can replace the failed services. To use the organizational ecology perspective (Hannan and Freeman 1977) as a metaphor, innovation is more forgiving in a market context than in a government context, as semi-random changes due to innovation will induce growth of the ecology in the former because of the competition between the organizations, while similar changes in the latter will increase the risk of losing parts or functions of the ecology. In this sense, a government ecology is much more fragile than a market ecology and must be protected accordingly. Therefore, public sector innovation needs to be pursued with some caution and more attention should be directed towards the disruptive nature of innovation.

6.3.4. Critical reflection on collaborative innovation

One of the main drawbacks of collaborative innovation relates to the inefficiencies surrounding collaboration. Due to the various opinions and perspectives that have to be aligned, collaboration is a slow, lengthy and sometimes underperforming process (Huxham 2003). Involved actors are faced with various collaborative complexities that have to be properly

managed. For instance, Klijn and Koppenjan (2015) suggest three types of complexities. First, substantive complexities emerge because of the differences in knowledge, backgrounds and perspectives, which causes difficulties in jointly assessing the problem at hand. Second, strategic complexities arise when actors in the collaboration have different motives and interests, and associated agendas and strategies, which might cause erratic interactions between the actors, unpredictable alternations to the direction of the process, miscommunication, and even conflict. Third, institutional complexities occur when the actors work in different institutional realities, with different written and unwritten rules, procedures, routines, etc. This may cause conflicting perspectives on how to proceed in the innovation process, parallel and misaligned processes as different procedures are used, and barriers to the collaborative innovation process due to historical sensitivities. If not properly managed, these complexities have the potential to inhibit and even prematurely terminate the collaborative efforts. Consequentially, collaborative innovation increases the risk of encountering inefficient and failing innovation processes, and aiming to prevent these drawbacks implies investing extensively in network or process management strategies (e.g. Klijn et al. 2010), which makes it costly and time-consuming.

Additionally, collaboration is essentially consensus-oriented, which implies that the actors actively construct shared understanding, sometimes at the expense of radically novel ideas. Indeed, collaboration is fostered by connecting and overcoming differences, consensus-building activities, and convergent thinking, while innovation is stimulated by exploring and exploiting conflicting ideas, creative, out of the box ideation, and divergent thinking. This is translated in the inherent tension between on the one hand collaborating with similar actors, which would strengthen the collaboration, and on the other hand collaborating with a wide diversity of actors, which would strengthen the innovation process (Torfing 2019). Creativity research emphasizes the crucial importance of preventing premature convergence of ideas and believes in order to obtain novel and creative ideas (Anderson et al. 2014). However, in collaborative settings, this would undermine effective collaboration, which is not only necessary to create innovative ideas, but also to implement these ideas. Undermining collaborative efforts by increasing processes of creative and divergent thinking might therefore increase the failing rate of implemented innovations. As we also saw in Chapter 4, effectively balancing convergence and divergence is an important success factor for collaborative innovation, but this might also suggests less radical innovations, as convergence may push radically new ideas back to something that is acceptable for all actors.

Also, collaborations have more serious consequences for the innovation endeavour in case the collaborative advantages are not achieved. As we mentioned, collaborative advantages present win-win benefits to the collaborating actors as all the actors benefit from the shared knowledge, resources and capabilities, and the created innovation is advantageous for all the actors. However, if the collaboration fails, win-win benefits can quickly turn to loose-loose detriments. Because of the very nature of collaboration, failed collaborative innovation endeavours have detrimental effects for a lot more innovators (i.e. organizations and individuals who were involved in the collaboration) in comparison to failed in-house innovation or outsourced innovation. When the collaboration fails, every involved actor loses, which can be far more consequential than when one (outsourced) organization fails to innovate. Precisely because of its focus on complex, interconnected problems, the impact of failed collaborative innovations might cut across multiple policy fields and spheres of society.

6.3.5. Broader reflections on public sector innovation and collaborative innovation using a genealogical perspective

The theoretical insights provided in this dissertation also allow broader reflections on the nature of public sector innovation and collaborative innovation. In this section, we suggest a broader rationale of collaborative innovation, which is built on the genealogical approach of organizational change, which is itself inspired by biological evolution and change. We first give a concise introduction to key concepts of the approach, after which we explain the relevance of the approach for collaborative innovation.

a. Genealogical tradition

Originally proposed by authors such as Baum and Singh (1994) and Zollo and Winter (2002), the genealogical tradition of organization science starts from the premise that organizations are not so different from organisms, in that they are also born and eventually die, and have a way of replicating their own 'institutional memory' (Baum and Singh 1994). The basic components of this institutional memory are generally conceptualized as the 'routines' of an organization (Nelson and Winter 1982). These routines are the equivalent of the genes in organisms (Zollo and Winter 2002). Organizational change occurs when these routines experience small alternations (i.e. mutations) or are combined with other routines (i.e. recombination). Dependent on the breadth of these mutations or recombinations, organizational change can be incremental or radical. A process of evolutionary selection and retention retains some of these routines, while others are abandoned.

b. Evolutionary innovation

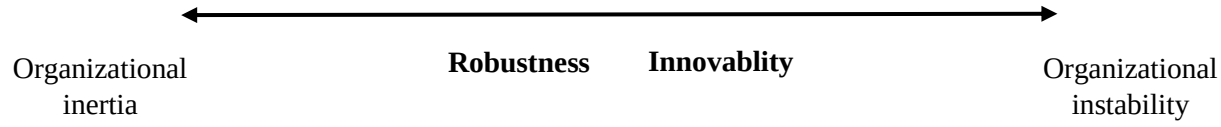
The genealogical tradition is however not an organizational theory of *innovation*. It describes how organizations evolve due to changes of their routines, but a reflection on innovation requires us to understand how evolutionary theories from biology interpret innovation. After all, these theories were the basis for the principal ideas of the genealogical tradition. More recent evolutionary theories in biology propose that innovations are changes in the genotype of an organism which cause substantial alternations to the phenotype of the organism (Wagner 2011). The DNA and RNA sequences that code for the formation of specific proteins are known as the *genotype*, while the visible characteristics or functions of the created proteins (e.g. the metabolic functions of proteins and enzymes) are called the *phenotype* of an organism. As is known from Darwin's work on natural selection, organisms evolve over time due to small changes, caused by mutations or recombinations. These changes occur at the level of the genotype. However, changes in the genotype do not always provoke changes in the phenotype, as a lot of genotypes code for the same phenotype, and the translation from genotype to phenotype can cancel out these changes (Wagner 2011). In other words, not all phenotypic changes can be seen as innovation, just as not all changes to organizational processes or services can be seen as innovation. For instance, muscles adapt to exercise without altering their genotype, just as organizations can optimize their services and processes without altering their routines. Thus, from a (slightly adapted) organizational genealogical perspective, innovations are changes to routines, which cause substantial alternations to the characteristics, structures, policies, processes, or activities (i.e. 'phenotype') of an organization.

c. Robustness vs. innovability

A characteristic of the causal relationship between genotypic changes and phenotypic alternations in the definition of evolutionary innovation is that both types of changes are required for innovation. However, in biology, innovations are quite rare. This is not because of the lack of mutations or recombinations of the genome, but because the phenotype of an organisms does not always (substantially) change when the genotype is changed. A robust phenotype protects the organism from random changes to the genotype. In other words, a phenotype is 'robust' if alternations of the genotype have a minimal effect on the phenotype (Kirschner and Gerhart 1998; Wagner 2005; Tóth-Petróczy and Tawfik 2014). In contrast, phenotypes that change due to minimal alternations of the genotype have a high 'innovability' (Wagner 2011).

Applied to the genealogical tradition of organization science, an organization's phenotype (i.e. structures, processes, policies, activities, etc.) is robust if changes in its routines only minimally affect its phenotype. If small changes to the routines of the organizations changes large aspects of its phenotype, the phenotype can be regarded as innovable. The robustness of the organizational phenotype protects the organization against random changes to its routines. However, a phenotype that is too robust, might become rigid and unchangeable, which might lead to organizational inertia. In contrast, a innovable phenotype has a higher likelihood of retaining changes to routines into innovations. In other words, the higher the innovability of the phenotype, the more likely that an organization innovates. However, being too innovable might lead to unpredictability and organizational instability. Figure 3 illustrates these tensions.

Figure 3: Continuum of robustness and innovability



d. Collaborative innovation from a genealogical perspective

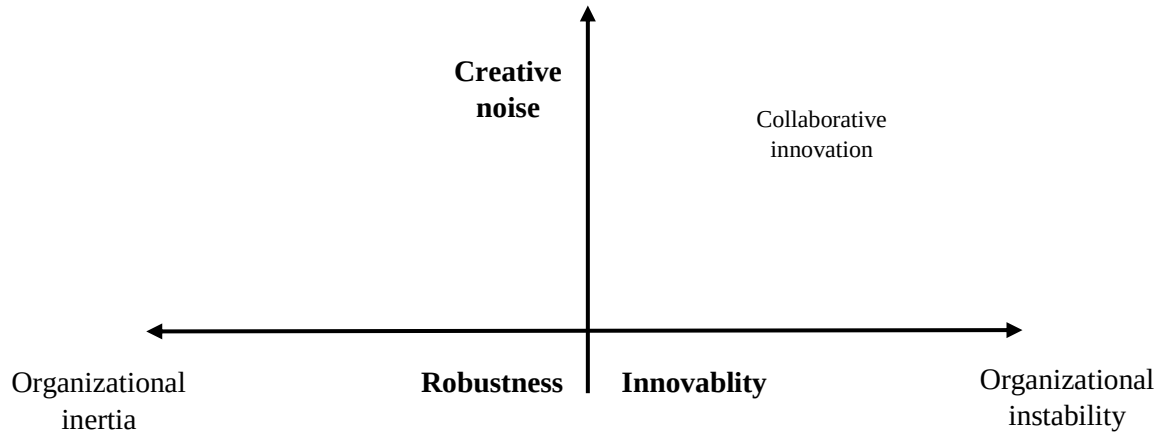
Innovation has a large chance of failure (van der Panne et al. 2003), which might have detrimental consequences for organizations with very innovable phenotypes. A shift from robust phenotypes to innovable phenotypes to enhance organizational innovation is therefore not always the best option. Collaboration might provide an intermediate solution, with lower risks for the organizational stability, but still with the benefits from increasing phenotypic innovability.

Two reasons can be given. First, establishing a partnership creates a new organizational entity outside the own organization. While not all partnerships can be regarded as separate organizations, most of them have formal or informal meeting arrangements in which the partners interact with each other. While the organizational phenotypes might still play important roles in the partnership, the partnership itself will most likely establish its own phenotype (e.g. objectives, activities, processes). Because the partnership is newly established, its phenotype would be more innovable than that of the involved organizations, which creates a context in which innovating becomes easier.

Second, the partnership, and particularly the interaction arenas in the partnership, bring routines from different organizations together. In other words, the gene pool diversifies, which allows

for more recombination opportunities. Knowledge, perspectives and ideas from various actors are united in one interaction arena, which potentially stimulates creative ideation. This 'creative noise' might enable alternations of thinking patterns and routines, and without a robust phenotype to resist genotypic changes, innovation can occur uninhibited. Figure 4 illustrates this process.

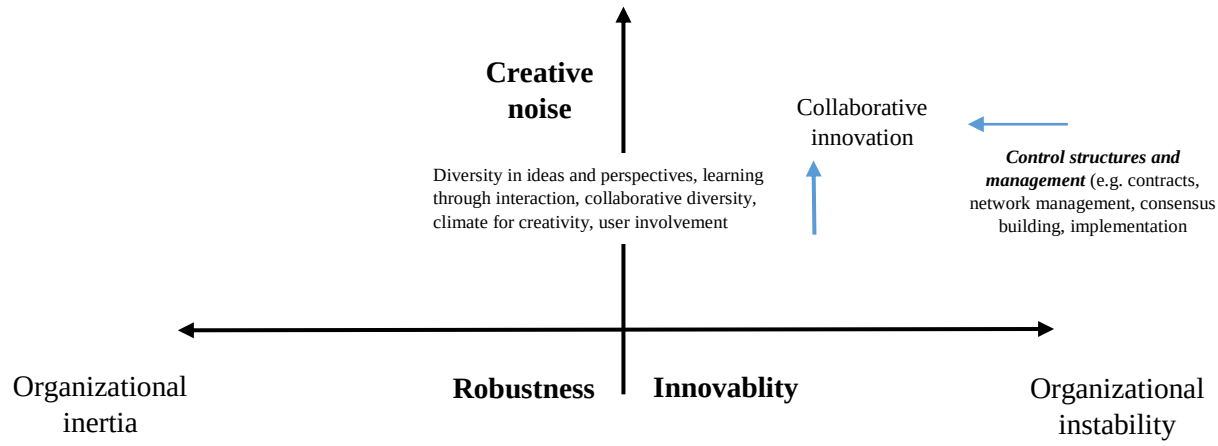
Figure 4: Robustness/innovability and creative noise



e. Configurational approach on conditions of collaborative innovation

When we turn to the main results of this dissertation, we see that multiple conditions can affect collaborative innovation. Configurations of different clusters of conditions, at the level of the organization, partnership, and users, create a favourable setting for collaborative innovation. Applied to the genealogical perspective on collaborative innovation, these conditions have two functions. First, conditions such as control structures (e.g. contracts, rules and procedures) and management activities (e.g. network management, consensus building, implementation commitment) might prevent the phenotype of the partnership from becoming too innovable, which can lead to organizational instability and a premature termination of the collaborative innovation process. Second, conditions such as diversity in ideas and perspectives, learning through interaction and user involvement may contribute to the creative noise that is present in the partnership, and from where innovation can emerge. Figure 5 illustrates these conclusions.

Figure 5: Conditions that stimulate collaborative innovation



f. Conclusions: towards a meta-theory of collaborative innovation

The genealogical perspective on innovation helps us to understand the place of collaboration in innovation research. It provides a nuanced depiction of innovation and collaborative innovation. The model allows us to consider the advantages and drawbacks of innovation and collaborative innovation, which are concepts that in the current literature sometimes lack critical reflection. Furthermore, in this model, innovation becomes a natural part of an organization's evolution. In other words, the model depicts innovation as an inherent part of organizational change, and collaboration as a catalyst for innovation. Collaboration helps to stimulate the underlying processes of innovation through positive feedback loops such as the establishment of an innovable organizational setting and the stimulation of 'creative noise'. However, negative feedback loops are also necessary to ensure that the innovation process does not spiral out of control (e.g. increasing organizational robustness through structuring and managing the collaboration). Configurations of conditions should consider both of these aspects of effective collaborative innovation. We believe that the combination of the genealogical perspective on collaborative innovation, which depicts a balancing act between robustness and innovability, and the configurational approach on conditions of collaborative innovation, which describes that configurations of conditions and not isolated conditions have an impact on innovation, has the potential to become an important component of meta-theoretical notions of collaborative innovation.

6.4. Theoretical relevance of the dissertation

This dissertation advanced our understanding of how processes of collaborative innovation enhance public service innovation on three aspects. First, the dissertation contributed to the configurational approach on the conditions of collaborative innovation, which has only very recently attracted attention of public administration scholar (e.g. Torfing et al. 2020). As was mentioned in Chapter 1, service innovation and collaborative innovation are relatively new research areas in the public sector. By complementing theories from outside the fields of public administration, in which innovation is already thoroughly established (e.g. procurement for innovation, creativity research, evolutionary thinking, service management, and private sector collaborative innovation research), with public service innovation theories, we were able to extent existing theories and build new ones. The configurational approach adopted throughout the dissertation helped us in advancing existing theories and in shaping our understanding about the complex nature of collaborative innovation. Hence, we discovered that theoretical models which combine procurement-related conditions with collaboration-related conditions enable a better explanation of how public-private partnerships (PPPs) generate service innovation than either of those theories were able to do in isolation. The same is true for theories on learning through interaction, consensus building and implementation commitment. Furthermore, the dissertation brought theories of intra-organizational conditions of innovation (i.e. climate for creativity) together with theories of collaborative innovation (i.e. collaborative diversity), and it build a model for the desired configuration of distinct conditions of user involvement for innovation (i.e. user empowerment, specialized knowledge, and restricting rules and procedures).

Second, the dissertation provided empirical evidence for important aspects of the collaborative innovation process, which have long remained purely conceptual in nature. For instance, conceptual contributions of Sorensen and Torfing (2011) and Ansell and Torfing (2014), which have become hugely influential in the last decade, were refined and empirically tested in this dissertation. Many of these empirical findings entail new discoveries which contribute to our understanding of the conditions and mechanisms of public service collaborative innovation. For instance, the discovery that mixed strategies of procurement and collaboration seem to be superior in order to stimulate innovation in PPPs, brings more nuance into the discussion of the enabling conditions of collaborative innovation. Whereas PPP research is currently dominated by the stimulating effect of ‘hard’, procurement-related conditions, collaborative innovation

research is presently dominated by the stimulating effect 'soft', collaboration-related conditions. Empirical findings from Chapter 3 give a more balanced view of these two perspectives, from which both sides of the argument can learn. The empirical analyses conducted in the dissertation also indicated some drawbacks of collaborative innovation, such as the inverted u-shape of collaborative diversity, which was discovered in Chapter 2. The fact that we found a similar ambiguous result for the diversity of ideas and opinions in Chapter 4, confirms that some aspects of collaborative innovation can, in some cases, do more harm than good. Furthermore, learning through interaction, consensus building, and implementation commitment were shown to be strongly interconnected and mutually reinforcing in Chapter 4, which indicates how complex and intricate processes of collaborative innovation are. The findings in the dissertation also present some of the first empirical evidence for the stimulating effect of user involvement on collaborative innovation, and show how the configuration of conditions of user involvement is contingent on the type of partnership.

Third, the dissertation contributed methodologically to current research in public service innovation and collaborative innovation, and therefore invested in the application of methodologies that enable more robust results than is possible with qualitative case study research. In order to heed to calls in the literature on the need of quantitative analyses and multi-method approaches in public service innovation research (De Vries et al. 2015), we applied sophisticated qualitative methods such as fuzzy-set qualitative comparative analysis (fsQCA) and quantitative techniques such as regression analysis. fsQCA allows a qualitative comparative analysis between a large number of cases, which enables (cautious) generalizations to similar cases, and which is impossible with case study research. Moreover, QCA findings were tested against in-depth qualitative information collected through semi-structured interviews, which shows how multi-method research designs can be applied to qualitative comparative research. The quantitative analyses conducted in Chapter 3 add findings from a large dataset to a research field which is dominated by qualitative case studies.

6.5. Practical relevance of the dissertation

The results of the dissertation have some practical implications for project coordinators, public managers and policy makers. A first implication relates to the urge of many public managers and policy makers to overdesign or over-structure service creation processes in order to reduce the risks associated with an unpredictable innovation process. The same goes for partnerships, such as large PPP infrastructure projects, which spend a lot of public resources to design new

services, and have often strict contract conditions that need to be fulfilled. However, collaborative innovation is fuelled by the interactions between diverse actors, and the learning and consensus building processes that result from these interactions. Stipulating the constraints of the service design too much by applying rigid contract specifications or hierarchical decision-making procedures, might eliminate creative ideation and the commitment to innovate, as the partners will be incentivized to proceed as the contract stipulates, without taking additional risk for, and investing time and money into the creation of something innovative. Policy makers should be aware that establishing an innovation partnership is different from creating a service partnership, and that time and money should be invested in the creative interaction processes, even without the certainty that these processes will actually deliver desirable results. Indeed, such risks are inherent to every innovation process. This does, however, not mean that coordinators and managers should not intervene at all in processes of collaborative innovation. On the contrary, intervention is crucial to ensure a robust innovation process and prevent that the collaboration becomes instable. Managers should achieve this by combining contract or procurement-related conditions such as design freedom with collaboration-related conditions such as information sharing, network management, consensus building, and commitment building. In partnerships that are traditionally very contract-driven (e.g. PPPs), investing in these collaboration-related conditions is of particular importance to achieve innovation. Contract conditions, such as stimulating tender award criteria, might incentivize an innovative outcome, but the service innovation itself is created through the interactions between the public and private partners, which occurs after contract close.

The second implication relates to the observation that diversity in the innovation process is actually a double-edged sword. Systems with actor diversity and the corresponding variance in ideas, perspectives, skills, knowledge, etc. are great incubators of creative ideation and divergent thinking, which increases the likelihood that innovation will emerge. However, diversity also undermines relational stability, which is a crucial aspect of effective collaborations. Diversity might invoke tension and conflict between the partners, as opinions and perspectives can differ, interest and goals will not always be aligned, and ways of working might vary. These drawbacks of diversity may cause the collapse of the collaboration long before creative ideation is ever initiated. Operating in a highly innovable system, where robust structures and practices are not yet established and creative noise has a firm hold on the activities in the system, increases the risk of a premature collapse of the system. By establishing a collaboration with a variety of actors, policy makers already create an innovable environment

in which new ideas have a higher survival rate than in their own organization. Governance structures and managerial practices should prevent that the collaborative innovation process becomes uncontrollable and the partnership break-ups before it can create an innovation. Increasing creative noise by involving a diverse set of actors in the collaboration implies that the collaboration is robust enough to cope with this variance, and means that the coordinators should structure and control the process more than would be necessary without this diversity. Clear governance structures, for instance with project teams and steering committees, and network management strategies directed towards the exploration and connection of ideas and interest are great examples of practices that help secure the stability of the partnership.

A third implication relates to our observation that the generative process of collaborative innovation are closely interconnected and mutually reinforcing. The generative processes are central in generating innovation from collaboration, and our finding that these processes are interconnected and mutually reinforcing can be exploited by coordinators and managers. We observed that open ideation and exploration of ideas cause learning dynamics, but also trigger consensus building and implementation commitment, as the partners work together to realize a shared idea. As such, coordinators can initiate ideation phases for the purpose of generating new ideas, but can at the same time stimulate the creation of shared understanding and implementation commitment in these ideation phases, and increase the likelihood that creative ideas are actually implemented. The reinforcing nature of the generative processes also cause relational stability, as the actors learn from others' ideas and perspectives and try to align their own ideas with those of the other partners. Hence, generative processes directed towards idea divergence (e.g. learning through interaction) should be able to interact with generative processes directed towards idea convergence (e.g. consensus building and implementation commitment) and coordinators should refrain from any attempts to separate these two types of generative processes from each other, both in space (e.g. different project teams for idea divergence and idea convergence) and time (e.g. idea divergence in the first phase of the innovation process, idea convergence in the second phase). Policy makers might make use of these dynamics by creating partnerships in which the frequently used project management approach, with strict timings and deliverables, is abandoned, and replaced by iterative approaches, in which each stage builds on the previous results, without placing large restrictions on what has to be achieved in each stage. This would prevent that idea divergence is completely separated from idea convergence.

The fourth implication relates to the involvement of users in processes of collaborative innovation. The results show that users are not a homogeneous group of stakeholders, and differences between users have consequences for collaborative innovation when they are involved in the innovation process. User-innovators have different expectations from the collaborative innovation process than co-creators, and coordinators and managers should be aware of the profiles of the users and take advantage of this in the innovation process. User-innovators are able to handle extensive responsibilities and activities in the innovation process, and also expect a lot of power to translate their own ideas into workable solutions. Co-creators, however, need to be guided by the coordinators and managers in the innovation process, and expect to be engaged in activities directed towards coproduction, rather than being responsible for solely developing innovations. Coordinators should correctly respond to the expectations and capabilities of these two types of users in order to maximally exploit the time-intensive process of user involvement. Also, user-innovators should be aware that collaboration means compromise, and a perfect translation of their ideas is often not possible, and should be informed by the coordinators and managers about this. Furthermore, policy makers should move beyond perceiving user involvement as a normative good, and instead focus on which innovation processes require user involvement and which types of users should then be involved.

6.6. Limitations and future research

The dissertation has also some limitations, both at the level of the research design and the methodologies that were used. The specificity of the employed research designs in the various chapters of the dissertation restricts the scope of the conducted studies. Due to our research methodologies, we were able to include a large variety of collaborations. However, the collaborations always needed to comply with strict case selection criteria in order to properly compare the cases with each other. As such, results always need to be evaluated in relation to the types of partnerships that were selected. Throughout the dissertation, we considered public-private partnerships and public-private eHealth collaborations. The theories applied in these chapters should, however, be applicable to other types of partnerships in other sectors as well. For instance, intra-organizational collaboration, interagency collaboration (i.e. horizontal collaboration), and inter-governmental collaboration (i.e. vertical collaboration), are relevant modes of collaboration, which help governments to realize wicked issues. Furthermore, such wicked issues are not limited to infrastructure or health care, the two main policy fields that were studied in this dissertation. Wicked issues such as global warming, poverty, and

worldwide health crises (e.g. COVID-19 pandemic) even transcend single policy fields, which affects the way in which collaborative innovation is studied. Future research should investigate if the conditions of collaborative innovation that are observed in the public-private collaborations of this dissertation, also apply to other types of partnerships and policy sectors.

A second limitation at the level of the research design relates to the specificity of cases that were selected. Because of our research interest in examining the collaborative processes in public sector organizations and collaborative partnerships, and understanding the conditions that lead to innovation in these entities, we were never able to compare the level of service innovation generated by individual organizations with that of collaborative partnerships. The dissertation addressed the way in which innovation can be produced in public sector organizations from collaborations (Chapter 2) and the way in which collaborative partnerships exploit collaborative processes to generate service innovation (Chapters 3, 4 and 5). However, a direct comparison between innovation generating organizations and collaborations was not possible with this research design. Such a direct comparison is relevant, as it would provide direct evidence of the differences and possible advantages of collaborative innovation as opposed to in-house innovation. Also, a direct comparison between the collaborative innovation processes of individual organizations (i.e. Chapter 2) and collaborative partnerships (i.e. Chapter 3, 4 and 5) was also not possible within the scope of this dissertation. Future research should tackle these open questions.

A third limitation concerns the specific selection of conditions in the research design. As Chapter 1 illustrates, a lot of conditions at the level of the organizational capacities, the partnership process, and the process of user involvement and coproduction are related to innovation. We focused our research on conditions within these three clusters, which were, based on the literature, the most promising to explain collaborative innovation. This does not entail that other conditions should not be investigated in future studies. In fact, we reflected on a couple of these additional conditions in this chapter. Particularly with regard to the configurational approach that we used to connect conditions and study the combined effects of these conditions, slightly altered combinations of conditions (e.g. by adding another condition to the configuration), might result in interesting new insights. For instance, conditions of user involvement were now studied within an individual cluster. Combining these conditions, for instance, with conditions related to the collaboration process (e.g. network management), might be interesting for future studies, as potential synergies between, for instance, user empowerment

and network management can be assumed (i.e. using network management strategies to enhance the effect of user involvement on innovation).

A fourth limitation is situated on the methodological level. The multi-method approach employed in this dissertation was valuable because of its combination of generalizable, statistical results, and in-depth, qualitative results. By utilizing both quantitative and qualitative data collection instruments (i.e. resp. surveys and interviews) and data analysis tools (i.e. resp. regression analysis and qualitative comparative analysis), we were able to generalize results without losing the in-depth information regarding the specific processes of collaborative innovation. Because of the systematic nature of QCA, the results in Chapters 3, 4 and 5 were based on a relatively large set of cases (at least for qualitative research standards), which increases the reliability of the results when applied to other, similar cases. However, QCA also comes with some disadvantages, as causal relationships are more difficult to trace down and qualitative details can be overlooked because of the systematic calibration process. Although we incorporated a deepening of the QCA results in Chapters 3, 4 and 5 by using the qualitative interview information, additional in-depth qualitative analyses such as process tracing are desired to unravel the causal relationships. In other words, the QCA analyses in this dissertation give strong indications of causal relationships between conditions and outcomes, which are supported and deepened by the insights from the interviews, but thorough qualitative analysis such as process tracing is still needed to acquire a deeper and more complete understanding of the causal processes of collaborative innovation.

6.7. Final words: coevolving towards innovation

This dissertation tackled various topics related to collaborative innovation. We considered how organizational features, partnership features, and features of user involvement affected public service innovation, and we found that configurations of different types of conditions have an impact on innovation through collaboration. The impact of these configurations of conditions on innovation also unravelled the inherent complexity of innovation processes. Innovation processes are not linear in that the problem definition phase is followed by an idea generation phase and then a phase of idea implementation. Actually, we found that innovation processes are quite chaotic. For instance, problem definitions are rarely fixed throughout the whole innovation process, as new issues are introduced, new people with diverging perspectives on the problem are brought into the innovation process, or unpredictable events cause new problems which make some potential solutions obsolete. While innovation is generally related

to words such as ‘design’ and ‘creation’, which assume a predictable, well-defined, easy to control process, we thus found that the innovation process is actually the opposite. Particularly in collaborative innovation processes, collaborating individuals and their ideas seem to coevolve at their own pace towards innovation, without the presence of someone who intentionally designs the steps of this trajectory. Manipulating configurations of conditions instead of isolated conditions helps to control more ‘degrees of freedom’ of the innovation process. This is particularly beneficial in chaotic processes, as multiple dynamics are simultaneously responsible for the outcome of such processes. Affecting one of these dynamics might therefore not generate the desired outcome. Instead of trying to control each aspect of the innovation process, attempts to direct the collaborative innovation process should thus target the configurations of conditions which enable the coevolution towards innovation.

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Annex

Author contributions

Chapters	Title	Authors
Chapter 1	Collaboration as a driver for innovation	**Single authored**: Chesney Callens
Chapter 2	Internal and external exploration for public service innovation – Measuring the impact of a climate for creativity and collaborative diversity on innovation	**Co-authored**: Chesney Callens (introduction, theoretical section, conceptual framework, operationalization, discussion/conclusion), Jan Wynen (methodological section, analysis and results), Jan Boon (introduction, discussion/conclusion, reformulations, feedback) and Koen Verhoest (feedback, review)
Chapter 3	Combined effects of procurement and collaboration on innovation in public-private-partnerships: a Qualitative Comparative Analysis of 24 infrastructure projects	**Co-authored**: Chesney Callens (introduction, theoretical section, conceptual framework, operationalization, analysis, result section, discussion/conclusion), Koen Verhoest (involved in data collection, feedback, review) and Jan Boon (involved in methodological section, analysis, and review)
Chapter 4	Unpacking generative processes of collaborative innovation in public-private collaborations	**Co-authored**: Chesney Callens (wrote all sections of the paper, and conducted data collection, data analysis, calibration, etc.) and Koen Verhoest (review and feedback) Five international research teams were involved in the data collection, but coordinated by the Belgian team.
Chapter 5	User involvement as a catalyst for collaborative public service innovation	**Single authored**: Chesney Callens Five international research teams were involved in the data collection, but coordinated by the Belgian team.
Chapter 6	A configurational approach to collaborative innovation	**Single authored**: Chesney Callens