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MR. KIM HURTTA

DIGITAL INNOVATION IN PUBLIC SERVICE ECOSYSTEM

Enacting the generative affordance

Directeur de thèse EDBA : **Monsieur Christophe Elie-Dit-Cosaque**
Professeur à Université Paris Dauphine

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ABSTRACT

Information system (IS) literature explains how digital structures provide an affordance for generative change, which is claimed to produce distributed digital innovation in an ecosystem. However, as theory treats technology affordances as non-deterministic and relational vis-à-vis actors, we need to go beyond the structural changes and foreground actors in a deeper exploration of how the generative affordance can be enacted. This direction was indicated by Jonathan Zittrain in his foundational work on digital generativity: *"Participation is the input to generativity and innovation is the outcome*" (Zittrain, 2008: p. 90), but it has not been properly explored despite the organizational relevance of digitalization and innovation.

The IS-literature converge with innovation research in studies on digital innovation, but there is a lack of research on the role of human agency in the enactment of digital generativity to enhance digital innovation. In order to address this gap, this study first explores the agentic orientations of individual ecosystem actors and then, in a second round of analysis, synthetizes the empirical data to the ecosystem level. This multilevel approach is a way to explore how distributed social actors enact the structural potential for generative change.

The findings show how each actor has unique agentic orientations that will determine the response to digital opportunities, as well as a set of differences and alignments areas across actors and actor groups. The ecosystem level analysis further suggests three structural domains; the socio-technical configurations, a dual-mode governance as well as cultural and institutional norms, to be instrumental in enactment of the generative potential. Based on emergent categories, a model is formulated for generativity enactment in the ecosystem. The results are discussed against literature on generativity and digital innovation and five managerial propositions are generated for practitioner guidance.

Increasing our understanding of generative enactment in the case ecosystem, the study primarily contributes to literature on Digital Infrastructure and Generativity, but it also provides empirical support for ongoing conceptualization and theorizing in the area of Digital Innovation.

Keywords: generativity, digital infrastructure, digital innovation, affordance theory, human agency, public administration

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1. INTRODUCTION

The "e-Government Declaration" in Tallinn on October 6 2017, by all European Union members, emphasizes the importance of digital transformation in the public administration for development and growth in Europe (EU, 2017). It reflects EU commitment to higher quality public service, through more efficient governance and greater interactions with citizens. At the same time, pervasive digitization continues to produce a growing and maturing digital infrastructure, which offers new opportunities for individual organizations and the public service ecosystem as a whole. There is a clear political agenda and there seems to be opportunities to draw on new technologies and digital assets. Still, reaching the broader, holistic benefits of digitalization, which often is presented as something of a panacea for contemporary challenges, remains elusive in most administrations and public service ecosystems. This has been the starting point for this research.

Digitalization is defined as "*encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of the product and services*" (Yoo, 2012: p. 137). This definition implies that organizational responses need to take into account both changing structures and the social aspect of organizing in order to make use of new opportunities. In the context of public administration, we have seen digital maturity grow from one-way web presence to effective online service channels and currently taking the step forward towards Digital Government (OECD, 2014a; Janowski, 2015). A shift from individual eGovernment initiatives to a more holistic Digital Government approach has been repeatedly proposed for more than a decade now (Fountain, 2001; Dunleavy et al, 2006; O'Reilly, 2011), but the progress is still slow (Zhang et al., 2014; Meijer, 2015; Di Maio and Howard, 2017). Traditionally, government approach to technology has favored well-defined initiatives within specified organizational boundaries or addressing individual service development needs. A broader scope would increase the number of stakeholders and add complexity, and the dominant implementation models are not well equipped to handle the increased complexity. As a consequence, it has been proposed that new approaches are needed in how public administration responds to digitalization (Dunleavy et al, 2006; Magretts and Dunleavy, 2013; Fishenden and Thomson, 2013; OECD, 2014b). A more holistic approach would align with the definition of digitalization as broader systems provides more opportunities for reconfiguration, but in practice we have seen that broad transformative initiatives and reforms often run into problems due to increased complexity of stakeholders with different interests. We therefore raise the question if it would

be possible to turn the problem around to allow for distributed change that makes use of the growing digital structures without having to include a high number of stakeholders in detailed specification and decision making. A model that would use the growing digital infrastructure as a shared foundation, but allow for distributed actors to take action independently. Research on digital infrastructure suggests that this could be possible if there is a way to find a balance between centralized control and distributed change (Tilson et al., 2010, Ciborra, 2000; Hanseth & Lyytinen, 2010).

The IS literature shows that individual digital artifacts and the broader digital platforms and infrastructure, possess an inherent capacity for generative change (Kallinikos et al. 2013, Yoo, 2012; Yoo et al., 2012; Tilson et al., 2010; Zittrain 2008; 2006). This digital generativity, defined as "*a system's capacity to produce unanticipated change through contributions from broad and varied audiences*" (Zittrain, 2008: p. 70) has been associated with combinatorial growth and innovation (Brynjolfsson & McAfee, 2014; Zittrain, 2008; Yoo et al., 2012). Prior research explains how digital technologies enable distributed change and innovation (Kallinikos et al., 2013; Yoo, 2010, Yoo et al., 2012) and describe how an open system through distributed change can evolve in transformative ways, such as the case of Internet (Hanseth & Lyytinen, 2010). However, we also know that most systems are constrained, that their potential is not always realized (Orlikowski, 2000) and that goal-oriented actors are instrumental in enacting structural affordances (Majchrzak and Markus 2012; Markus and Silver 2008).

While there is a generally accepted agenda for more holistic, customer-driven and reformative digital government (EU, 2017; OECD, 2014), we know very little about how human agency contributes to generative change in a public ecosystem context. Prior research suggests that enactment of technology affordances is strongly linked with agentic orientations (Nevo et al., 2016) and the study follows this path into an exploration of how the generative affordance is enacted in a public service ecosystem.

1.1. THE MANAGERIAL PROBLEM

This research is motivated by the practical importance of understanding the deeper mechanisms of ecosystem digitalization. The definition above states that there is a structural component, i.e. the pervasive shift from analogue to digital, as well as a component of reconfiguring in the way of working, but the mechanisms of this phenomenon are not well understood.

The discussion on digitalization, digital era, digital disruption and many other related terms, shows that there is a big practitioner and media interest in the topic, but also a significant

confusion about the essence of digitalization and how organizations should respond to these internal and external changes (Hess et al., 2016; McGee, 2016; Aron, 2016). Actors see an exponential amount of digital data, technologies and services becoming available and these changing digital structures provide new product and service opportunities, more effective operational processes and changing business models. At the same time, actors struggle with the difference between digitalization and previous phases of ICT-enabled development. The topic has raised questions whether it really is a disruptive change or more of a continuous evolution as well as different opinions related to benefits of centralized versus decentralized governance. Organizations still debate whether it is a technical issue that should be driven by the CIO or CTO, or a business issue led by CEO, head of strategy, or maybe by each business unit individually. Most recognize its potential to disrupt value chains and drive changes in ecosystem roles, but remain ignorant about what they can do and how they should organize to influence the outcome and achieve their own objectives in the ecosystem. More generally, it seems that although most practitioners agree about the importance and potential of digitalization, many, if not most, are still unsecure about how to respond in order to really realise its potential.

There is a feeling that new approaches to digitalization and digital development would be needed (Hess et al., 2016; McGee, 2016; Aron, 2016), but the novelty of the phenomenon, its unfamiliar mechanisms and lack of well-proven response models, makes it difficult to make informed decisions on how to respond. Most organizations have therefore continued to run digital initiatives with similar project- and program-centric models as before. While practitioners recognize a new dynamic in the environment, the academic research literature does not provide models for how to respond.

1.2. DISTRIBUTED DIGITAL CHANGE AND INNOVATION

"*There is a paradigm change in public administration*", was the conclusion of one of the informants of this study when reflecting on the contextual changes and how public organizations will have to find new ways of fulfilling their mission. The argument is that the public mission has not really changed but as the environment, challenges and expectations change there will be a profound shift in roles that will cause change even to the identity of public organizations and civil servants. The public administration of today is built for a "manageable" world. There is an underlying assumption that you can predict, plan and prepare for the future and this is reflected in how most digital initiatives are defined and delivered. Increasingly, however, practitioners realise that the traditional way of specifying a solution,

implementing it in a multi-year program and finally making it operational, is insufficient as response to the challenges and opportunities of today. More agile response models would be needed. Adding more stakeholders to digital initiatives as a response to increased interdependences and complexity, can be counterproductive and freeze the system from any further change. The opposite approach of decentralized development is, while tempting as it could increase agility, likely to reduce synergy and produce fragmented solutions. A rational actor would look for an approach that allows for agility through distributed response to new needs and opportunities, but in a coordinated manner that promotes synergy and enables holistic reform over time.

Information system (IS) literature on how digital artifacts differ from their non-digital counterparts provides a useful foundation for exploration of such an approach. Research on digital materiality and digital ontology (Faulkner and Runde, 2011; Leonardi et al., 2012; Kallinikos et al., 2013) and the characteristics of digital artefacts, platforms and infrastructures (Tilson et al., 2010; Hanseth and Lyytinen, 2010; Henfridsson and Bygstedt, 2013) explain the special properties of these digital structures and how they enable generative change (Zittrain, 2006; 2008; Eck et al., 2015) and create a potential for combinatorial digital innovation (Yoo, 2012; Brynjolfsson and McAfee, 2014). This literature claims that there is an inherent affordance for generative change in digital structures and that this would allow for unforeseen combinatorial innovation. However, it also concludes that the generativity is likely to cause a "*paradox of change and control*" (Ciborra et al., 2000; Tilson et al., 2010) and that human agency will be instrumental in achieving the benefits that any technology affordance would enable (Leonardi, 2011; Majchrzak and Markus, 2012; Boudreau and Robey, 2005). Few studies in the field of IS address these latter aspects and extend the analysis to how organizations respond and organize to achieve a balance between change and control.

Shifting focus from design of digital solutions to known problems towards combinatorial opportunities in a broader digital system (Brynjolfsson and McAfee, 2014; Yoo et al., 2012; Tilson et al., 2010) aligns with a body of innovation literature that promotes open distributed systems (Von Hippel, 2005; 2016; Chesbrough, 2006; Barrett et al, 2015; Lusch and Nambisan, 2015). These contributions support the idea that there would be an alternative approach to the traditional sequential model of specify, design, build and operate, but they do not explicitly link to digital generativity although innovation literature acknowledge the increasing role of digital technologies (Saldanha et al., 2015; OECD, 2015a).

One of the first challenges to overcome in exploring this alternative approach would be to establish clarity in key terms and the difference between holistic but distributed digitalization and the preceding phases of ICT-enabled change, which has brought the opportunity through pervasive digitization. Some practitioners have asked: *"Why is digitalization claimed to be transformative when it really is a continuation of several decades of using ICT in organizations*?" To clarify this issue we follow the definition by Youngjin Yoo, who defines digitalization as "*encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of products and services*" Yoo (2012: p. 5).

This definition is useful for the purpose of the study as it:

a) includes both the continuous trend of digitization and the subsequent potential for reconfiguration of social systems,

b) it acknowledges the combinatorial aspect that goes beyond individual digital technologies and solutions and is a key element of innovation, and

c) it does not limit to organizational boundaries but covers both the production and consumption aspects of a digital ecosystem with the notion of socio-technical context.

The duality and broadness of Yoo's definition for digitalization, i.e. the digital representation of information and the socio-technical reorganizing that follows, might explain why there is so much confusion about what digitalization really is about. It covers almost any development that is done in organizations, as digital data and technologies over the last few decades have been introduced in most functions and aspects of organizational life. Can the change from a paper form to a digital form be considered digitalization? Yes, according to the definition it is part of the digitalization trend even if it is only "digitizing the cowpaths" as it sometime is called (Tilson et al., 2010; Bannister and Connolly, 2012). Are technical Open Data initiatives digitalization or should there be an element of operational / service development in order to account as digitalization? In a similar way, the actions that build the infrastructure for further socio-technical reconfiguration are covered by the first part of the definition and would thereby be called digitalization. Is process automation based on digital data and rules digitalization? Yes, indeed. How about changing consumer behaviour based on location-based services? Yes, that would be a reconfiguration of socio-technical context for service consumptions.

This all-inclusive definition also leads to the question of how digitalization can be managed by individual organizations. In line with the definition above, this study posits that digitalization is a continuous process of sociotechnical reconfigurations, enabled by pervasive digitization and executed through the agency of (at least partly) independent, distributed actors. Most of these changes are outside of organizational control, as seen from the perspective of any single actor, and digitalization cannot therefore be controlled by the actor. Even in a government context, where there are exceptional tools for enforcing control, such as the authority to adjust legal framework or allocate substantial funding, it would be impossible to comprehensively control the course of digitalization. Instead, realizing the potential of digitalization will depend on how well organizations can make use of internal and external digital assets produced by a variety of distributed actors and align its own actions with these opportunities. This change of perspective, accepting that the full potential of digitalization cannot be realized with traditional ICT development models where solutions are designed, implemented and controlled as a single initiative, is a departure point for this study. We therefore focus on the broader structural aspects of digitalization and explore how organizations can make use of the mechanisms and affordances that comes with the phenomenon. With this change of perspective, two concepts in existing Information System literature appear as exceptionally valuable in understanding the sociotechnical reconfiguration: *generativity* and *digital innovation*.

Generativity refers to a system's ability to adapt and extend and is defined by Zittrain (2008: page 70) as *"a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences".* The key words when looking for new approaches are "*unanticipated change*" and "*unfiltered contributions*" and *"broad and varied audiences"*. This is against several traditions in public administration. The dominant development models normally define the scope of the problem (or opportunity), assign responsibilities for defining a solution and then later implement the solution according to plans and specifications produced (minimizing changes to scope). Tapping into the generative affordance of a system would mean opening up for changes rather than trying to maximize control. The advantage of promoting openness that supports generativity is that individual assets can be modified, extended and combined in unexpected ways to produce new value, i.e. it increases the capacity for digital innovation in the system (Yoo, 2012; Brynjolfsson & McAfee, 2014).

While generativity is a theoretical construct that remains unknown to most practitioners, digital innovation is the opposite. It is a term that most practitioners can relate to and recently it has

been attracting increasing academic interest as well. As a response to the many links between innovation and digitalization, Nambisan et al. (2017) have proposed revisiting current understanding of innovation with a set of new theorizing based on *Dynamic problem–solution design pairing, Socio-cognitive sensemaking, Technological affordances and constraints,* and *Orchestration of activities*. These four theorizing logics, which Nambisan et al. (2017) propose to be more relevant than current mainstream innovation theories, resonate well with the *"distributed contribution of broad and varied audiences*" that underpins generativity and the *socio-technical reconfigurations* that creates the value in digitalization. It also seems to be more compatible than current project models with our assumption that individual actors are unable to influence the course of digitalization as a whole, but instead should focus on their readiness to make use of the structural changes around them.

A good understanding of these concepts such as digitalization, digitization, digital structures, generativity, and digital innovation, is important in further exploration of how to respond to digital opportunities in an ecosystems. Key terms are defined and exemplified in Table 1 below.

Table 1 : Definitions of key terms and concepts used in the study

Term	Definition	Source	Example
Digitization	"the process of converting analog signals into a digital form and ultimately into binary digits (bits)"	Tilson et al., 2010, p. 749	E.g. an e-service that replaces a submission by paper form.
Digitalization	"encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of the product and services"	Yoo, 2012, p. 5	E.g. shifting from an application-initiated process for social benefits to proactively granting the benefit based on data accumulated for other purposes.
Digital artifact	"manmade objects and tools that have a digital representation of information or are used to create, store, transmit or consume such digital information"	For the purpose of this study	Any digital tool, infrastructure component or digital dataset.
Digital platform	"Extensible framework that addresses a family of generic functionalities meeting the needs of heterogeneous user communities platform-controlling actor and third-party actors"	Eck et al., 2015, p. 9	E.g. the subsystem around geodata that is coordinated by a platform-controlling actor.
Digital infrastructure	"the shared, unbounded, heterogeneous, open, and evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their user, operations, and design communities"	Hanseth and Lyytinen, 2010, p. 4	All the interconnected digital artifacts and platforms that are being used in the ecosystem.

Digital structures	The recursive infrastructure that is formed by digital artifacts, platforms, and infrastructure.	For the purpose of this study, based on Eck et al., 2015	Any configuration of the three previous terms.
Generativity	"a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences"	Zittrain, 2008, p. 70	E.g. civic activism making use of open resources or a start-up company leveraging public data.
Affordance	"the possibilities for goal-oriented action afforded to specific user groups by technical objects"	Markus and Silver 2008, p 622	E.g. An Open API enables one company to launch a new service but other companies lacking complementing data could not have done it.
Human agency	"Human agency is typically defined as the ability to form and realize one's goals"	Leonardi 2011, p. 147	An entrepreneur or activist that drive their societal vision.
Temporal human agency	"The temporally constructed engagement by actors of different structural environments—the temporal-relational contexts of action—which, through the interplay of habit, imagination, and judgment, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situations".	Emirbayer and Mische, 1999, p. 970	A public servant faced with new digital opportunities is likely to reflect on how it matches his/her objectives, how similar situations have turned out in the past and the specifics of the current situation.
Digital Innovation	"The creation of (and consequent change in) market offerings, business processes or models that result from the use of digital technology".	Nambisan et al., 2017, p. 5	E.g. the new model for social benefits used as example for the definition of digitalization above.
Digital Government	"the use of digital technologies, as an integrated part of governments' modernization strategies, to create public value."	OECD, 2014, p. 6	The national approach to digital opportunities and challenges.
e-Government	"the use by governments of information and communication technologies (ICTs), and particularly the Internet, as a tool to achieve better government"	OECD, 2014, p. 6	Using ICT and digital technologies in either front-end (e-Services) or back-end (process automation) initiatives.

The alternative approach to societal challenges and digital opportunities that builds on distributed change and innovation rather than traditional design-driven development, suggests that actors make use of digital contributions by broad and varied audiences in the ecosystem. This way of thinking is illustrated by the following quote from one of the practitioners interviewed during the study; "*think about the start-up scene: some years ago an entrepreneur needed significant time and money to set up a new business, but today you can pick and choose the elements needed, get going very quickly and scale as required".* That mind-set will be a

guideline for the continuation of the research. It often feels that any change in public administration still requires significant investments in time and money and we would like to explore how this responsiveness through "*pick and choose*" could be reached.

1.3. RESEARCH PROBLEM, ASSUMPTIONS AND GOALS

The topic discussed above can be summarized as *how the generative potential of digital structures can be enacted by ecosystem actors to produce new socio-technical configurations*. This high-level formulation of research problem incorporates three assumptions, which are presented below, and will be the basis for the more detailed research questions formulated in the research design section.

The first assumption is that the perspective of generative change and digital innovation would be a fruitful avenue for exploring organizational response to digitalization and ways of realizing its potential. This view is supported not only by the two-way resonance between IS literature and innovation literature (Barrett et al., 2015; Nambisan et al., 2017), but also by engaging with practitioners at the stage of defining the research problem and design. Practitioners tell about the need to think differently and find new ways to operate and make use of digital opportunities. Building on the IS literature on how generativity of digital structures enables distributed change and innovation is an opportunity to break free from the traditional isolated approach to organizational development in public administration.

The second assumption is that the generative potential of digital structures, which has been shown in previous research (Henfridsson and Bygstad, 2013; Hanseth and Lyytinen, 2010, Zittrain, 2006; 2008), holds true, or at least could be true if some constraints were removed. This literature, which will be presented in more detail in the literature review, shows how digital artifacts and structures have different characteristics compared to physical artefacts, and claims that the generativity provided by these characteristics is foundational for the broader socio-technical impact that digitalization might have (Brynjolfson and McAfee, 2014: Yoo, 2012; Tilson et al., 2010). Validating the generativity is therefore not the objective of this research, but it has been accepted as previously established and the research focus is on how goal-oriented distributed actors enact the generativity and respond to make use of it. The findings related to generativity enactment are then at the end of the research discussed against existing literature on digital generativity.

A third assumption is that the actors would be instrumental in achieving the change that is enabled by the generative characteristics. The assumption draws on a large body of work related

to how technology impacts organization and holds that technologies provides affordances and constraints, but do not deterministically change organizations without human agency (Leonardi and Barley, 2010; Robey et al, 2013; Leonardi, 2013). Building on technological affordances as relational to the actor experiences, situation and objectives, has resulted in a research design that foregrounds individuals, their perceptions, their actions and the constraints they experience (Majchrzak and Markus 2012; Markus and Silver 2008).

With these assumptions in mind, the research approach has been to first focus on how the structural opportunities are perceived among actors. Following the assumption that affordances are relational to actors and human agency is instrumental in achieving the potential, it is important to establish how the actors understand the phenomenon. As the outcome is dependent on actor agency and the agency is dependent on the actor perceptions in relation to his / her background, situation and goals, foregrounding the actors over the structures has been the overall approach to this study. Other design choices, such as the value of qualitative research in exploring this emerging phenomenon and the interpretative design follow from the decision to foreground actors and explore the interplay between structure and agency with such a lens. Data is collected about experiences, views and actions, but also about the constraints that actors face in their attempts to drive, support or promote digital change.

The research objective is to increase our understanding of the interplay between structural affordances for generative change and the agency of distributed actors in a public service ecosystem, and use that understanding to drive managerial propositions on how distributed digital innovation could be promoted in the system. Previous literature indicates that the inherent generative capacity of digital structures would enable distributed change and innovation, and the study sets out to explore the dynamics of realizing this potential, which is claimed to be a core source of value in digitalization. The study aims for an academic contribution in the area of generativity enactment and practitioner contributions on how ecosystem governance could be improved to support digital innovation.

The phenomenon under study has a micro-level aspect, with actor perceptions leading to actions that change the system, and a macro-level aspect, with constraints and ecosystem governance, which influence the individual level actions. Explicating the perceptions, actions and constraints related to how individual actors pursue digital opportunities makes it possible to form a consolidated view of ecosystem change dynamics and the influence of governance structures on its ability to evolve and innovate. The duality of structure and action is broadly acknowledged in organization theory and technology (Giddens, 1984 Leonardi & Barley, 2010;

Orlikowski & Scott, 2008, Leonardi, 2013), and visible also in the more specific literature that this study draws on. The claim that innovation does not happen without strong human agency has also been a cornerstone in innovation literature since the launch of the term (Schumpeter, 1934), and foundational works on generativity propose that only through active participation of humans can the generative capacity of technology be realized (Zittrain 2008: p. 90). Understanding the macro-level structures as well as the micro-level actions, and the interplay between them, is thereby necessary in order to make informed decisions about organizational response to new digital opportunities.

1.4. RESEARCH SETTING: A PUBLIC SERVICE ECOSYSTEM

The setting of the study is the domain of *public administration*. In line with recent calls to take a more holistic and reform-driven view in public administration (OECD, 2014b, Dunleavy et al., 2006) the scope is, however, not limited to any individual public institution or digital service, but defined as a *public service ecosystem*.

The context of public administration is well-suited for analysing the distributed response to evolving digital structures, as openness and transparency are valued characteristics and there should be a shared interest among public sector actors to contribute to a common good. Challenges in contemporary public administration are often complex cross-boundary issues, such as e.g. environmental issues, social challenges related to changes in labour market or security concerns, and digitalization has been proposed to enable a more holistic approach in addressing them (OECD, 2014a; 2015a; United Nations, 2014). The challenge with these so called wicked problems (Rittel and Webber, 1973) is that addressing only a part of the problem, be it with digital technologies of traditional means, will change the system and shift the problem to another area instead of solving it entirely. This means that a more holistic approach would be needed and exploring the generative potential of digital structures could provide insight into how this can be achieved.

A holistic approach to public sector digitalization has been increasingly discussed in the literature on e-Government and Digital Government (Fishenden & Thomson, 2013; Margetts and Dunleavy, 2013; OECD, 2014a; Kim and Zhang, 2016), and there seems to be a shift in interest from an e-Government approach, using digital technology to solve individual problems and increase the efficiency of service delivery processes, to Digital Government, described as *the use of digital technologies, as an integrated part of governments' modernization strategies* (OECD, 2014a: p 6).

The ecosystem approach is appropriate for exploring the generative potential, which extends organizational boundaries and individual change initiatives. Following the definition of generativity as *change through unfiltered contributions from broad and varied audiences* (Zittrain, 2008), means that it as a concept holds more potential in an ecosystem context than within a single organization or initiative. This also resonates with the literature on digital innovation as building on combinatorial opportunities (Brynjolfsson and McAfee, 2014; Yoo et al., 2012). Finally, approaching the empirical field as a public service ecosystem aligns with the OECD recommendation on Digital Government to member states, which states that *"the challenge is not to introduce digital technologies into public administration; it is to integrate the use into public sector modernization efforts"* (OECD, 2014a, p.2). The past emphasis on individual e-Government initiatives has reached its limitations compared to the full potential of digital structures and more holistic approaches.

In this study, I will follow the ecosystem definition by Adner (2017, p. 40) as *"The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize."* This has a few important implications. First, it means that all the actors interacting to materialize the value proposition are covered by the definition. Second, the focus on *alignment* is an important aspect of the definition, meaning that there should be a shared understanding of positions and flows in the ecosystem to effectively produce value and that realignment might be needed when environmental changes occur. The third important aspect of the definition is that the interactions are multilateral and not a set of bilateral relations, i.e. there is a network model where anyone can interact with anyone to create value for the ecosystem. Finally, there is the focus on the value proposition that these ecosystem partners through the interactions make happen. The partners are drawn together by a common value proposition rather than by supplier relations or other permanent affiliations. These aspects of the definition make it useful for the study by suggesting that a successful ecosystem is one where there is a common understanding of the value that can be achieved by interactions between distributed but aligned actors (Adner, 2017).

Consequently, the ecosystem of this case study includes actors that contribute to public value by developing or operating public services. It includes central government and ministries, distributed agencies, private companies in all sizes from small startups to multinational corporations, as well as research institutions and third sector organizations. The ecosystem consists of several sub-systems, which overlap. Examples of such sub-systems are the state level system, with ministries and public agencies, the municipalities, which are independent

from state, health service ecosystems with hospital districts, which also are independent but state-funded, etc. The public services ecosystem is a defined *set of multilateral partners*, but it is not static. Actors can join and leave over time (Adner, 2017). Sometimes the changes are formal, such as creation of a new agency or awarding a service contract to a private firm, but often joining or leaving the ecosystem can be based on a unilateral decision, such as when a company decides to launch a new service that complements existing and contributes to the public value proposition.

The study is conducted in the public service ecosystem of Finland, which has reached a high maturity of using ICT in public administration (EU, 2017) and has the ambition to promore holistic, customer-driven and reformative digitalization. The current government program holds digitalization as one of five leading themes, positioning it as a horizontal area that would produce both transformative change, customer-driven value creation and a productivity leap in the administration. These ambitions would be difficult to achieve with a traditional approach of isolated digital initiatives and this makes the ecosystem well-suited for an exploration of how digital generativity could be harnessed to achieve set goals. The empirical field will be presented in more details in Section 3.4.

1.5. STRUCTURE OF THESIS

Following this introduction, the research is presented with the following structure.

The literature review in section two covers four different areas. It presents contributions and gaps related to digital structures and generativity as well as the areas of innovation research that relate to open and distributed participation and digital services. Further, it covers the context-specific literature on digitalization and innovation in public administration and the literature on affordance and human agency theories, which are used as a theoretical framework for the study.

Section three presents the research design and methodology of the research. The design decisions follow from the research problem and framing, which puts the actors in the foreground and takes an interest in the interplay between independent micro-level agency and system level change. Two specific research questions are formulated to guide the execution of the study. The details of the empirical field are provided, along with sampling strategy and the methods for data collection and analysis.

The fourth section presents the findings of the study. In line with the theoretical framing and the two research questions, there are two different levels of analysis and findings are presented in two parts. The first part is concerned with the actor perceptions and agency, i.e. an individual

level analysis that produces findings related to agentic orientations and explicates differences and areas of alignment across actors. The second part takes a more inductive and emergent approach in producing a synthetization at the ecosystem level. The empirical data is analyzed across all actors and the emerging categories are used to form a model for generativity enactment in the ecosystem.

Section five discuss the results against existing literature on generativity and digital innovation. Empirical findings are compared to five factors proposed to increase generativity in a system and put in relation to recent literature on digital innovation, which propose that innovation research needs to give up some outdated premises and use new theorizing logics.

The last section concludes with discussion on contributions and suggestions for future research. Contributions to IS literature as well as Digital Government are presented and the contributions for practitioners in a public service ecosystem are elaborated towards actionable propositions. Finally, the contributions lead to a set of suggestions for continued exploration and further validation of these findings.

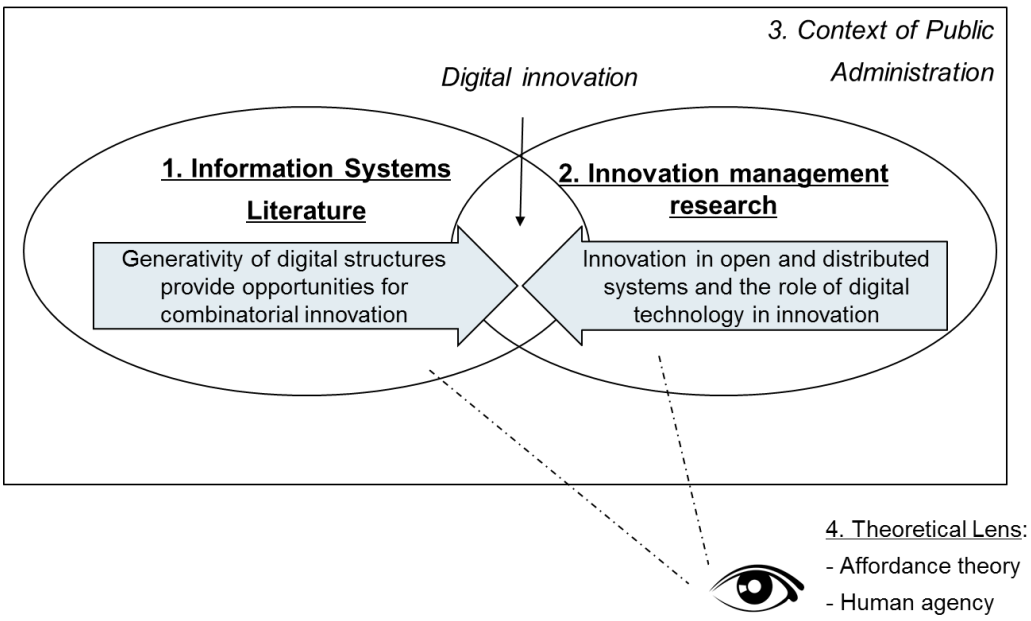
2. THEORETICAL BACKGROUND

To address the research problem, the study draws on following literature domains:

1. Information Systems (IS) literature that explains the specific characteristics of digital structures and the structural generativity that follows,
2. Streams of Innovation Management research, which describe the value of open and distributed innovation systems and other selected areas that relate to digital innovation,
3. Context specific literature on Public Administration, describing a paradigm shift from e-Government to a more holistic Digital Government and the importance of innovation in public administration, and
4. The Theories of Relational Affordance and Temporal Human Agency, which constitute the theoretical lens for the study.

The way these different research areas inform the study and provide the foundation to build on is visualized in Figure 1 below. The first two literature domains of Information System and Innovation Management overlap in the area of Digital Innovation and the third domain provides the contextual setting of digitalization and innovation in public administration. The fourth area provides the theories used to frame the study and address the knowledge gap, i.e. a theoretical perspective for the study.

Figure 1. The literature domains of the study



This section presents the contributions in each of these four domains and the knowledge gap that this study addresses.

2.1. LITERATURE CONTRIBUTIONS AND KNOWLEDGE GAP

The knowledge gap that this research addresses is in the intersection of the first three domains of Figure 1. Research on digital artefacts, platforms and infrastructures has shown how digital structures provide potential for generative change and innovation, but does not explain the enactment of this potential. Research on innovation has contributed to our understanding of open and heterogeneous innovation systems and shown the increasingly important role of digital technologies, but has not addressed the potential for digital generativity. Both of these research streams provide relevant insights for advancing digitalization in the context of public administration, but there is no research on how digital generativity or digital innovation relate to the holistic and reformative change ambitions that are central to ambitious digital government policies.

The digital structures, which are changing at an increasing pace due to pervasive digitization, provide new affordances compared to previous generations of technology. The opportunities are based on the specific characteristics of digital artefacts and create a potential for generative change and combinatorial innovation. The digital characteristics, such as homogenization of data, re-programmability of technology, non-rivalry in use and re-combinability, are well described in IS literature, but the non-deterministic view on technology in organizations and the definition of digitalization as socio-technical reconfigurations, suggests that we need to acknowledge both structure and social action in order to understand the mechanisms of ecosystem change. From the literature on technology in organizations, we conclude that generativity can be seen as a relational affordance, but the aspect of how this generative affordance is enacted in a distributed system is not addressed in existing literature.

As the generativity is proposed to produce innovation (Zittrain, 2008: p.90), the sub-streams of innovation literature that explain the advantage of open and heterogeneous systems over closed systems, innovation in service ecosystems and digital innovation specifically, are reviewed as a potential source of advice on how to enact the generative affordance. In the literature we find classical innovation axioms that resonate well with the literature on generativity, such as the entrepreneurship aspect and the need to "*bring an innovation through*", a range of material on the value of broad exchange of ideas with varied actors contributing, such as distributed innovation, customer innovation, open innovation, disruptive innovation and service innovation, and new contributions claiming that the logic of digital innovation might differ from much of the traditional innovation theory. However, innovation management research has not

addressed the topic of how to enact the digital generativity of a distributed setting to produce innovation as outcome.

The literature on public administration suggests that there is a shift of logic where digital technology is increasingly seen as an opportunity for holistic and reformative response to complex challenges (wicked problems), where it in the past used to be seen as a way to digitize transactions and automate processes. Digitalization and public sector innovation are both acknowledged to be important in the response to contemporary challenges and opportunities, but while there are several studies on open innovation in public administration there is no research that would address the opportunity to employ digital generativity to produce innovation. Bekker (2012) reviews the e-Government literature and suggests that more studies would be needed in the areas of: a) open innovation studies as he argues that ICT is an important source of innovation, b) technology studies, because ICT is the outcome of, as well as input for, the socio-political process and c) literature on steering because of the link between ICT steering and achieving political outcomes. This research touches upon all three of these topics.

Together these literature domains have established

- that digital structures provide a potential for generative change that is proposed to produce innovation,
- that open and distributed systems provide better innovation capacity compared to closed systems, and
- that the focus of digitalization in the context of public administration is shifting from individual initiatives towards more holistic digital government.

At the intersection of these contributions is, however, a lack of theorizing on how the generative potential of digital structures could be put to work in a public service ecosystem. More specifically the knowledge gap that this study addresses is:

1) Digital generativity is explained in IS literature in relation to changing and growing digital structures with specific characteristics (Zittrain, 2006; 2008; Tilson et al., 2010; Hanseth and Lyytinen, 2010), but there is little conceptual or empirical studies on how it is enacted.
2) The value of open and distributed systems for increased innovation capacity is explained in innovation management research and the logic of digital innovation is suggested to provide new opportunities for combinatorial innovation (Chesborough, 2006; Von Hippel, 2005; Yoo, 2010; Yoo et al., 2012; Brynjolfsson and McAfee, 2014; Nambisan

and Sawhney 2011; Nambisan et al., 2017), but these opportunities are not linked to generativity or its enactment.

3) The literature on digital government shows a clear direction towards holistic and reformative digital government (OECD, 2014, Dunleavy et al, 2006), but slow progress and little prescriptive advice on how to organize to achieve it.

In order to address this gap, this study uses the theories of relational technology affordances and temporal human agency as a way to foreground actors in an exploration of how the structural potential could be enacted. These theories are presented as a fourth sub-section at the end of the literature review to form a theoretical framework for the study.

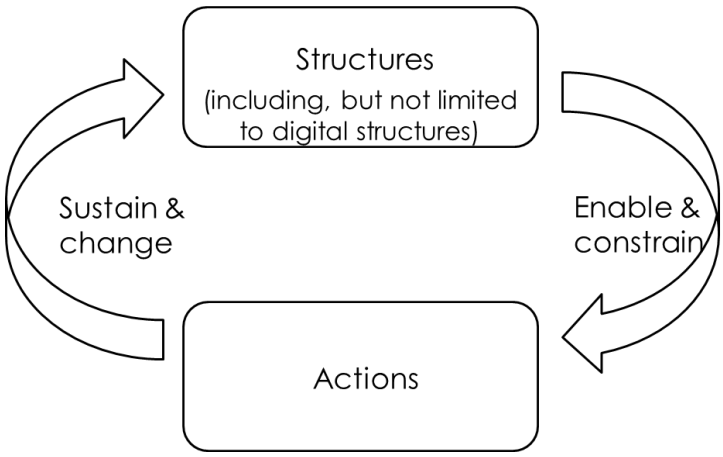
2.2. DIGITAL STRUCTURES AND GENERATIVITY

In order to understand digitalization as a broader phenomenon and the related agency, we need to first understand the nature of digital artifacts and how they as a result of pervasive digitization combine and provide changing and expanding digital structures with specific characteristics and affordances.

The first part of this literature review subsection provides a historical review of how literature on technology in organizations has evolved. This literature leads to the conclusion that we must acknowledge the importance of material structures as well as social action in realizing the potential value. The literature on this duality (e.g. Giddens, 1984; DeSanctis and Poole, 1994; Jones and Karsten, 2008) and the perspective of socio-materiality and imbrications (Leonardi et al., 2012; Leonardi, 2013) explain how digital structures are formed out of pervasive digitization and keep evolving in a way that is not determined by the technological properties, nor by the choices and actions of any single actor, but as an interplay between structures and actions.

Applying a temporal dimension to this duality creates a cycle of structures enabling and constraining actions and actions sustaining or changing structures as illustrated in Figure 2.

Figure 2. The iterative cycle between structure and action (based on Leonardi, 2013)



This view is then taken further to the specific characteristics of digital artifacts and structures in Section 2.1.2 and 2.1.3. Research on immaterial and digital artefacts (which are not the same, nor exclusive) explains how the characteristics of digital artifacts and structures provide potential for generative change (Kallinikos et al., 2013; Yoo, 2012; Faulkner & Runde, 2011; Zittrain, 2006; 2008) and combinatorial innovation opportunities beyond organizational boundaries (Tilson et. al, 2010; Hanseth et Lyytinen, 2010; Yoo, 2012; Brynjolfsson and McAfee, 2014). This literature is the key foundation for the study, explaining the structural potential that suggests a change of logic from individual problems and solutions to broader digital ecosystems and distributed platform-enabled development.

The last part of this literature review subsection presents the concept of affordance and explains how this perspective has been used in analysis of organizational change and use of technology in organizations (Gibson, 1986; Majchrzak and Markus 2012; Markus and Silver 2008; Zammuto et al. 2007).

2.2.1. Perspectives on the role of technology in organizations

Historically, two schools have been particularly influential in the research on IS technology in organizations: technological determinism and social constructivism (Leonardi & Barley, 2010). As the former become increasingly criticized of being too simplified in saying that attributes of technology directly determine its value to an organization, emphasis shifted towards the view that value is instead created in use (Leonardi & Barley, 2010, Robey et al., 2013). The way technology is understood, appropriated and used, is today recognized as a more complex issue of social sciences (Leonardi, 2013). This body of literature explains how organizational change emerges from a broad range of social action in which people respond to a technology's capabilities and constraints. While the debate between determinism and constructivism ended with the defeat of technology determinism, there is still a material significance of technology,

which sometimes was forgotten or neglected in the need to show that value of technology in organizing should be seen as socially constructed (Leonardi & Barley, 2010; Robey et al., 2013; Strong, et al., 2014). E.g. Gidden's broadly used structuration theory puts materiality, such as technology, in the background by stating that structure exists only in the moment of instantiation as traces in the mind (Giddens, 1984). Without an actor, there would be no structure. The socio-material perspective, which acknowledges the equal importance of material structure and social action, has since then emerged as a middle ground providing a more balanced lens for analysing the role of technology in organizations (Orlikowski & Scott, 2008; Leonardi, 2011; 2013; Leonardi & Barley, 2010; Robey et al, 2013).

The sociomaterial view proposed by Orlikowski and Scott (2008), asserts that technology and organizations are entangled and cannot be analysed independently. This perspective proposes that materiality, including the materiality of immaterial digital artifacts (Kallinikos et al., 2013), is so intrinsic to everyday activities and relations that you cannot explain organizations with the traditional view of "technology enabled" or "technology mediated" changes. Instead, the technology and work in organizations are always intertwined and produce a more combined effect (Orlikowski & Scott, 2008). The view on sociomateriality presented by Orlikovski and Scott suggested a fundamental change in ontology from previous research on technology in organization. It proposes a relational ontology, which assumes that "the social and the material are inherently inseparable" (Orlikowski and Scott 2008, p. 456) instead of seeing the social and the material as separate and self-contained entities. This radical change of view has caused criticism and some scholars have taken a different stand especially on this inseparability (Mutch, 2013; Leonardi, 2011; 2013; Kautz & Jenssen, 2013). Alistair Mutch (2013) asks if the sociomateriality took a wrong turn in grounding the work on the philosophy of Karen Barad. Leonardi presents an alternative view, which builds on critical realism. He proposes an analytical dualism which allows for temporal analysis of change, and is thereby claimed to be more suited for empirical studies (Leonardi, 2013). This duality can be seen as an interplay between micro and macro levels, where the macro-level structure provides the context for micro-level actions and individual actions over time sustain or modify the structures in a process named imbrication (Leonardi, 2013).

This analytic duality becomes useful in the exploration of how digitalization impacts organizations and how actors and organizations respond to new opportunities. Digital structures are continuously changing, which provides new opportunities and constraints, but the actors involved in the change are according to the socio-material perspective equally important in

determining the change and influencing the outcomes. The ontology used in this study acknowledges the duality of structure and action in exploring the phenomenon of digitalization and organizational response. It accepts that digital technologies by themselves do not provide beneficial outcomes in a deterministic way, but it is also recognized that the structures, digital as well as others, provide specific opportunities for change as well constraining factors. The actions taken can make use of the structures, either reinforcing them or modifying them (Leonardi, 2013; Desanctis and Poole, 1994; Majchrzak and Markus, 2012; Boudreau and Robey, 2005).

The socio-material perspective holds that the technology is not insignificant in understanding digitalization and organizational response, but also that the actors are instrumental in realizing the potential that is enabled by the changing digital structures. This is a fundamental assumption and departure point for this study and has been used when forming the conceptual framework for the study.

2.2.2. Pervasive digitization and the characteristics of digital artefacts

Digitization, or *"the process of converting analogue signals into a digital form and ultimately into binary digits (bits)"* (Tilson et al., 2010: page 749), is producing an ever-increasing number of digital artefacts. This positions digitization as an element of digitalization, which was already in the introduction defined as "*encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of products and services*" (Yoo, 2012: p. 137). The shift from analogue data processing to digital is enabling the socio-technical reconfigurations that produce value to the actors involved.

The fundamental properties of these digital artefacts, such as homogenization of data, re-programmability, and instant and cheap reproducibility, are therefore at the core of understanding also the potential of *digitalization* (Faulkner and Runde, 2011; Yoo, 2012; Kallinikos et al, 2013). The growing number of artefacts with these special characteristics create new opportunities for combinatorial innovation and the socio-technical reconfigurations that defines digitalization (Yoo, 2012; Brynjolfsson & McAfee 2014). In accordance with the sociomaterial perspective presented above, these structural changes are important in the way they enable and constrain organizational change, but not sufficient to explain the change on their own. This section of the literature review consolidates existing research on digital structures, an important building block of this study.

A start for analysing digitalization with a socio-material mindset would be to establish that "the digital" has materiality at all, since all digital artefacts are not physically in front of the actor to touch upon. The digital ontology and immaterial materiality has been discussed by Kallinikos (2013) and Leonardi (2010) with the view that although digital artefacts do not always fulfil the physical criteria of matters, such as e.g. having a gravitational impact on each other, they should still be seen as part of the material structures in an organization. This is according to a reference to materiality as practical instantiation and significance (Leonardi, 2010), which makes it possible to include different forms of standardized routines, power structures and representations in material structures (Leonardi, 2010; Yoo 2012; Kallinikos, 2013). In line with this definition, I approach the phenomenon of digitalization with a view that digital artefacts and tools, such as data, software, databases, embedded logic, digital content etc., provide significant material structures enabling and constraining social actions.

Yoo et al. (2010; 2012) propose three key characteristics of digital technology to be of importance when considering its role in organizations and its transformative potential:

- The homogenization of data
- The re-programmability of digital technology, and
- The self-referential nature of digital technology

Homogenization of data, i.e. the fact that all information can be structured as binary digits is a profound change. Previously analogue data was tightly coupled to the devices that could interpret the variations in data, whereas any digital information can be stored and transmitted using the same digital medium. Further, the emergence of data and interface standards has enabled digital data of different types to be freely mixed and combined. The re-programmability of digital technology is another crucial aspect of how digital differs from before. Previously there was a tight coupling between logic and the device in use, which has been broken. Today both data and instructions can be stored in the memory instead of being permanently hardwired, which enables flexible reconfiguration and repurposing of equipment. As the homogenization of data and the re-programmability of digital technology lays the foundation, the self-referential nature of digital technology contributes to the diffusion. The pervasive use of digital technology, the ever-decreasing costs of it, and its multipurpose nature, radically lowers the cost of producing and consuming new digital artefacts, which further increases the potential for combinatorial innovation.

These three characteristics have been further complemented with other aspects such as the non-rivalry in use, low marginal cost and re-combinability by Faulkner and Runde (2010), the fluid and editable nature (Kallinikos et al, 2013), decomposability, adaptability, traceability and interoperability (Yoo et al 2010), as well as the cost / performance trend (Moore's law) and miniaturization (Brynjolfson and McAfee, 2014). These can, to some extent, be considered consequences of homogenization and re-programmability or factors contributing to the volume of digital artefacts available. The rapid miniaturization of digital technology, for instance, combined with the increased processing power and cheaper price has made it possible to digitize, in a massive scale, artefacts that previously were only physical. Now we have a lot of digitally created, stored, and consumed contents such as books, music, photos, and maps, but also big data assets such as traffic data, consumption data and different metadata, that only recently would have been considered unfeasible to capture and store. Table 1 summarizes key contributions in literature on how digital artefacts differ from non-digital technology.

Table 2 : Characteristics of digital artefacts in information system literature

Author	**Characteristic**
Yoo et al. (2010)	Three key characteristics of digital artifacts • Re-programmability • Homogenization of data • Self-referential nature of digital technology.
Faulkner and Runde (2011)	Importance of the non-materials objects being binary format of data (bitstrings) and the complementarity with material bearers that add value to non-material objects • Programmability of computers • Infinite expansibility (low marginal cost), • Non-rivalry in use • Re-combinability
Kallinikos et al., (2013)	Four immediate characteristics of immaterial ontology • interactive, • editable, • reprogrammable, • distributed, … and three attributes… • modular, • granular, and • reflexive, … producing the fluid and editable nature of immaterial objects.
Henfridsson et al., 2014	Focus on the two aspects of • re-programmability and • negligent marginal cost of replication
Tilson et al., (2010)	Propose a shift of IS research focus beyond individual systems and tools to digital infrastructures as a separate category of IT artifacts, the relational aspects of digital

	infrastructure, and the paradox of change and control that follows.
Brynjolfson and McAfee (2014)	A higher level view focusing on the impact of these basic characteristics and additional trends such as • magnitude and variation of digital artefacts available, • cost / performance trend (Moore's law), and • miniaturization, which further accelerate the pace and reach of digitization.

These digital characteristics, in combination with a growing amount of compatible digital artefacts, is proposed to produce a generative evolution path that is not controlled by any single actor or organization (Yoo, 2012, Ciborra, 2000).

The next step in the elaboration on how digital materiality enables and constrains organizational change, would be to recognize that digital artefacts are seldom employed alone, but rather in combination with other digital and physical artefacts (Yoo, 2012). The software is providing value together with the servers that they run on, digital data is accessed over physical networks, the physical elements of the network include other embedded software to support routing, social media content is represented on mobile devices, etc. None of the "immaterial" artefacts would be of very high value without their physical counterparts. This linkage is recognized by Faulker and Runde (2010) as they present the physical artefacts as "bearers" that carry immaterial ones. In an analogue world, the physical artefact was normally the dominating one, but two aspects of technology development have changed this situation (Yoo, 2013). The homogeneity of digital data and the re-programmability of digital devices has loosened the connection between information and its storage, transmission and processing technologies and as a result the power balance has shifted towards the digital. The new situation that follows this change is described as modular layered architecture (Yoo et al. 2010) and understanding the new opportunities and challenges that this creates for digital services and business models is a crucial technical foundation for further exploration of response to digitalization (Kallinikos et al., 2013; Yoo et al. 2010; Puhakainen 2001). This is a key change that lies at the core of why digital technology has the potential to cause disruption in products, services, operational processes and customer experience (Brynjolfsson and McAfee, 2014). Seen in a broader societal perspective the effect is that pervasive digitization is loosening the powerful grip of physical materiality on the immaterial. The "digitization of everything" creates conditions for highly combinatorial and generative innovation based on the loose coupling of rapidly growing number of digital artefacts.

Understanding the characteristics which differs from non-digital technology, and the combined effect that these artifacts have when forming loosely coupled structures, enables an informed approach to explore the phenomenon of digitalization. The definition of digitalization provided by Yoo (2012) covers the above aspects when formulated as *"the encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of the product and services."*. This straightforward definition, basically focusing on the change to extremely standardized way of coding information and its sociotechnical consequences is simple and effective. It captures the key aspects in one sentence. The first part builds on the change in structures and the second part of the definition covers the societal changes that follows through reconfiguration of structural elements. With the notion of *possible reconfigurations*, the definition also aligns with the socio-material perspective that change is not a deterministic, but only a potential for change is provided by the structural evolution.

2.2.3. Generativity of digital structures

This section presents in more details the generic potential for change that the digital structures offer to actors as a consequence of the specific characteristics introduced above. Generativity as a concept can be found in many academic fields ranging from organizational routines (Feldman & Pentland, 2003; Pentland et al., 2012), explaining mechanisms of critical realism (Bygstad et al., 2016), to the use in information system research (Zittrain, 2006; 2008; Tilson et al., 2010; Hanseth & Lyytinen, 2010; Henfridsson and Bygstad, 2013). In the context of Information System research, generativity refers to a system's ability to adapt and extend and is defined by Zittrain (2008: page 70) as "*a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences"*.

Zittrain (2008) continues that; *"Generativity pairs an input consisting of unfiltered contributions from diverse people and groups, who may or may not be working in concert, with the output of unanticipated change"*. This means that there is a fine line between "unfiltered contributions" and "working in concert". Clearly, as the contributions are unfiltered and the outcome is unanticipated, there is no single actor designing the detailed outcome or deciding what is allowed in the system, but there can still be coordination and governance mechanisms to facilitate compatibility and to promote a shared vision. This balance between actors' ability to experiment and contribute on their own with the coordination and governance that allows them to work in concert, is expected to be a significant factor in organizational response to digitalization.

The generative potential is inherent in any digital artefact due to its characteristics discussed above, but research on digital platforms and infrastructure shows that this generativity increases with system size, openness and variation (Zittrain, 2008, Henfridsson and Bystad, 2013; Tilson et al, 2010). Expanding the view from single artefacts to a component of system dynamics is important to understand the full potential of digitalization. As suggested by the definition, the potential for reconfiguration becomes more powerful in broader systems where change is introduced by a higher number of distributed actors who contribute to the generativity in different ways; 1) through modification of existing artefacts (based on editability and re-programmability), 2) by adding new components to the system (based on homogeneity and inherent compatibility), or 3) by reconfiguring the components in the system (Kallinikos et al., 2013; Yoo, 2012). The larger number of capabilities and number of actors involved, the better the adaptability of the system as progress can be achieved as step-wise development where successful trials are diffused within the system (Zittrain, 2006). The most common example of how generativity can produce value is the evolution of Internet from a limited-purpose network with a simple centre and no ambition to control all actors or aspects of the network, to its current scope and use (Zittrain, 2006).

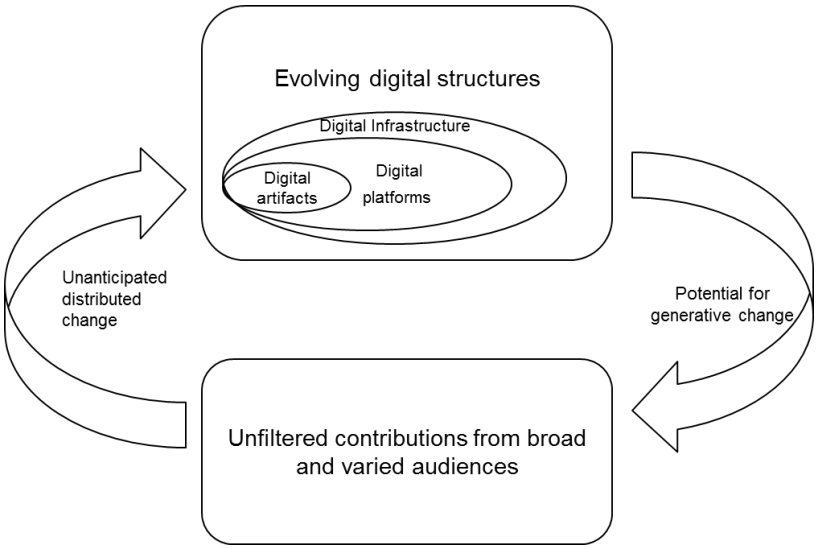
The literature distinguishes between digital infrastructures and digital platforms. Digital infrastructure (also studied under name information infrastructure) is defined by Hanseth and Lyytinen (2010: page 4) as *"the shared, unbounded, heterogeneous, open, and evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their user, operations, and design communities".* It has the characteristic features that it evolves or grows rather than is being designed (Ciborra, 2000; Hanseth & Lyytinen, 2010; Henfridson & Bygstad, 2013). This is really a key element in exploration of distributed responde models as digital infrastructure is "*never fully complete, they have many uses yet to be identified and ordinary organizational actors can be trusted to invent and share good uses*" (Zittrain, 2008: p. 43). A digital infrastructure provides scalability and flexibility (Tilson et al., 2010), which are two much appreciated characteristics among prectitioners, and can be characterized as an open, distributed, recursive system of digital artefacts and actors, with "double generativity" as new artefacts provide additional options for reconfiguration in addition to the generativity of existing components (Henfridson & Bygstad, 2013).

A digital platform, defined as *"Extensible framework that addresses a family of generic functionalities meeting the needs of heterogeneous user communities, platform-controlling actor and third-party actors"* (Eck et al., 2015, p. 9), can be positioned between the individual

digital artefact and the open, freely evolving digital infrastructure. The boundaries between a platform and an infrastructure is infrastructure are fluid, but a key difference would be the role of a platform-controlling actor, who sets the limits to how much and in what ways third party actors can contribute to change (Hanseth & Lyytinen, 2010). Digital service ecosystems often fall in this category, with some actor exercising control e.g. through boundary resources (Ghazawneh & Henfridsson, 2013, Eaton et al, 2015), but the level of openness vs. control can vary considerably and a platform will normally be part of a broader digital infrastructure.

Digital artefacts, platforms and infrastructures, which in this study collectively are called *digital structures*, are overlapping and recursive in providing the affordance for generative change as shown in Figure 3.

Figure 3. A recursive system of Digital Artifacts, Platforms and Infrastructure provide the potential for generative change



In the works on generativity in information systems context, Zittrain (2008) suggests five key characteristics to influence the level of system generativity; leverage, adaptability, ease of mastery, accessibility, and transferability.

- Leverage refers to the value or productivity increase it provides to participating actors compared to the option of not participating,
- Adaptability is a measure of how useful the system can be in different contexts,
- Ease of mastery tells how easily understandable a system is, i.e. how much effort it would take for an actor to adapt it or contribute.

- Accessibility is about the barriers of entry, and
- Transferability refers to how well changes in one part of the system can be beneficial in other parts of the system or alternatively distributed to other systems.

The generativity that extends beyond the structural characteristics is thereby largely determined by the institutional arrangements of a system and the ability to take advantage of the generative potential is dependent on the institutional arrangements (Tilson et al, 2010).

2.2.4. Structural generativity as a relational affordance

The generative potential, which builds up in digital structures as a result of pervasive digitization and the specific digital characteristics, is indeed important to acknowledge for in the organizational response to contextual changes. It is, however, not sufficient according to the perspectives that gives equal importance to structure and action. The role of actors, their understanding, objectives and actions are, as shown in constructivist research on technology in organizations, instrumental in achieving change (Leonardi and Barley, 2010; Boudrey and Robey, 2005). This aspect is not properly accounted for in current literature on digital infrastructure and generativity, but the gap could be addressed by treating digital generativity as a structural affordance that is relational to actors and remains without impact until enacted by them.

Affordance theory originates from studies of ecology (Gibson, 1986), but has been used in information systems research to explain why the use of same technology differs between actors, why sometimes apparent potential to benefit from a technology remains unrealized, and why sometimes technologies are used in unforeseen ways (Majchrzak and Markus 2012; Markus and Silver 2008). In addition, it has been used to explain how technology relates to organizational changes (Zammuto et al. 2007; Leonardi 2013; Volkoff and Strong 2013). In the context of how technology impacts organizations, affordances are normally described as relational between the actor and the technology (Majchrzak and Markus, 2012; Zammuto et al., 2007). This means that technological affordances reflect possible actions enabled to the specific actor by technology, but the outcome is always dependent on the actor's ability to perceive and make use of the possibilities (Volkoff and Strong 2013; Zammuto et al. 2007). As an example, a normal set of stairs does not afford the six month old to climb the stairs, but to the parent it affords not only climbing the stairs but also for instance to sit on the stairs while playing with his or her child. Affordance are often treated together with an opposite concept of constraint. The constraints are potential stumbling blocks that individuals or organizations may encounter when trying to execute the actions that are enabled by technology (Leonardi, 2013, Majchrzak

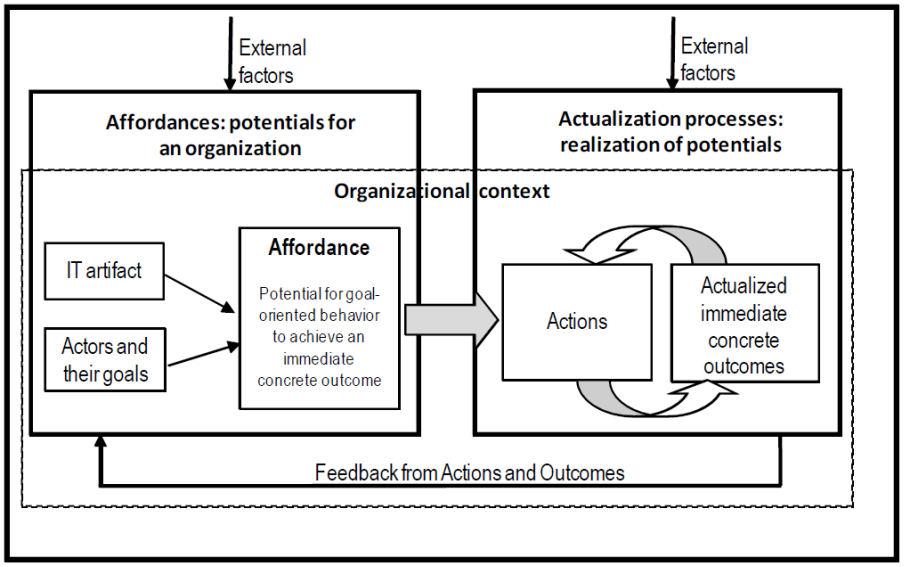
and Markus, 2012). Both affordances and constraints are relational concepts between peoples and organizations and the technologies in use (Majchrzak and Markus, 2012), not properties of either one.

Most of the research that use affordance theory has been to analyse the impact of individual technologies or information systems and less frequently has it been applied to analyse something that could be called a structure affordance. This was discussed by Zittrain who draws parallels between affordance and generativity, but rejects affordance theory at the time as too focused on single technological objects: "*Yet, unlike generativity, affordance theory does not focus much on systemic output. Instead, it takes one object at a time delineates its possible or likely uses."* (Zittrain, 2008, p. 78). This might have been the situation at the time and as some scholars speaking of affordances even suggested that designers should anticipate the uses of an object, Zittrain saw it as far from the objectives of generativity.

However, even though most studies using affordance theory in IS literature normally analyse the use and "misuse" of individual applications, there are no claims that the theory could not be used in a broader context. As it originates from ecology with the meaning that the *environment* affords or provides something to the animal, it can be seen either in the light of an individual object, e.g. a fallen tree, or as an ecological niche (Gibson, 1979). In ecology, the way humans alter their environment affects also other animals in the same environment, sometimes for the worse and sometimes providing new opportunities also for other species. In a similar way, the digital structures in an ecosystem provide affordances to each actor in the ecosystem and changes done by any of actors will change the affordances for all of them.

Strong et al. (2014) suggests a model for actualization of affordances in general, with a duality of affordances building on IT artifacts and is relational to the actors and their goals, and the actualization process that realizes the potential. The model resembles the socio-material perspective with material structures and social actions visualized in Figure 2 before and is one of few conceptualization to date, which would describe how affordances are enacted by actors.

Figure 4 : The model for actualizing affordances by Strong et al., 2014



There is nothing in the model proposed by Strong et al. (2014) that limits the use of affordance theory to individual technologies, even if the case used to build the model has been implementation of an electronic health record (EHR) application. Substituting the box labelled IT artifact with several artifacts or Digital Infrastructures would make the model relevant for enactment of generativity. The model shows the relational aspect of affordances, but as most of the other literature does not provide much details on the actualization (or enactment) process. Following the path of Hutchby (2001), who saw in the term an opportunity to reconcile the opposing poles of constructivism and determinism, this study applies the concept of affordances to explore how structural generativity provides opportunities that have to be enacted by the actors in the system.

2.3. Innovation management in a digital era

The "digital potential" explain above, which enables new products and services, new or updated business models and smarter ways of organizing by using digital assets, leads us into the topic of innovation. Identification, and subsequent development and implementation, of new and better ways of doing things is the essence of innovation (Schumpeter, 1934) and recent literature exhibits a growing connection between these two domains; digital structures provide affordances for generative change and combinatorial innovation (Yoo, 2012; Brynjolfsson and McAfee, 2014) and at the same time an increasing share of innovations build on digital capabilities (Von Hippel, 2005; Lusch & Vargo, 2008). Despite this implicit connection, there is surprisingly little conceptualization and theoretical explanation on how generativity of digital structures can be harnessed to support innovation.

The ambition to find new and better ways of doing things has, of course, been a central element in the history of human evolution, but since 1930s the discourse and theories on how to do this systematically, have been collected under the label innovation (Ahuja et al., 2008; Fagerberg et al., 2006; Schumpeter, 1934). More recent streams of literature on innovation management, such as open and distributed innovation, disruptive innovation and service innovation, has challenged the traditional view that innovation is most effective in large, centrally managed organizations, but since there also are propositions which still hold valid in a digital era, we start this literature review section with a historical overview and a definition of innovation to be used for this study. I then briefly describe those streams most relevant to generativity of digital structures before presenting the literature that today combines the two streams, innovation and information systems, in the sub-section on digital innovation. It should be noted, however, that a comprehensive literature review on innovation management would be beyond the scope of this thesis and the material presented in this section is selective and relates mainly to the changes from a closed system innovation towards a more open and distributed innovation logic.

The section is closed with a review of literature on the need for innovation in public administration, linking the literature to the case context of the study.

2.3.1. Classical innovation theory

Joseph Schumpeter, who is considered to have coined the term innovation even if he never proposed any theory on specifically innovation, emphasize in his Theory of Economic Development that entrepreneurs are innovators (Schumpeter, 1934). The argument is that a new idea (or invention) is not in itself enough to drive implementation, but it must be picked up by someone strong enough to drive it through, i.e. the entrepreneur. He showed that there will be inertia to change at all levels of society, so the entrepreneurial drive needs to be strong to overcome this, and claimed "It is not the power of ideas, but the power to get things done which matters" (Schumpeter, 1934).

This original emphasis on entrepreneurship in relation to innovation is still very relevant in the context of this study, even if we do not always talk about the classical financial risk-taking entrepreneur. The entrepreneur may be inside or outside the organization, he or she can have formal power or not, but when it comes to the motivation and willingness to take some kind of personal risk to try and promote new ways of working, the argument holds. In relation to digital innovation, the claim is supported by Zittrain's arguments that only through active participation of humans can the generative capacity of a technology be realized (Zittrain, 2008: p.90).

The Mark I of Schumpeter, emphasizing the importance of "driving the innovation through", is at the core of most definitions of Innovation. The difference between an invention and innovation is that the latter includes the development and implementation of the idea to something that is used and valued by some group of actors. The dynamics between the creative phase, producing the idea or invention, and the implementation phase is well covered in extant literature (e.g. West and Farr, 1990; Anderson et al., 2014), although no single agreed upon definition has been established. Anderson et al. (2014, p. 1298) explicitly integrates creativity and innovation into one definition stating that "*Creativity and innovation at work are the process, outcomes, and products of attempts to develop and introduce new and improved ways of doing things. The creativity stage of this process refers to idea generation, and innovation refers to the subsequent stage of implementing ideas towards better procedures, practices, or products.".* The short definition by Garud et al. (2013) also explicitly state invention as the first phase of innovation with "*Innovation is the invention, development, and implementation of new ideas",* whereas other definitions more implicitly incorporate the creative phase of coming up with the idea, such as *"the development and intentional introduction of new and useful ideas by individuals, teams, and organizations"* (Bledow, et al., 2009, p. 305). Others still propose that the development of the idea is not only one creative phase at the start of the innovation process, but something that is done iteratively all through the process. In respect to the problem of this study, both aspects are important: the ability to come up with ideas worth promoting in the first place, i.e. to see the opportunity for better ways of doing things, as well as the ability to further develop and implement the idea, i.e. "bringing them through".

A third aspect that often is discussed in relation to innovation is the aspect of creating something new by recombining existing. As the criteria for successful innovation is that it is brought to the market and provide value to some users, it is normally not the outcome of a single invention or scientific research that constitutes innovations, but rather a combination of new and old (or recombination of several old) that fulfil the criteria. This aspect or "recombinant innovation" (Romer, 1994; Weitzman, 1998) is well aligned with the classical Schumpeterian approach to innovation, as Schumpeter throughout his various works defined the essence of enterprise and entrepreneurship to be "the carrying out of new combinations", and argued that "development consists primarily in employing existing resources in a different way, in doing new things with them" (Weitzman, 1998, Schumpeter, 1934)

Extending across both idea generation and implementation, and the notion of recombinant innovation, are two important aspects of innovation for discussing the generative potential for

change and innovation that is associated with digital structures. Consequently, this dissertation will follow a definition of innovation which builds on Garud et al. (2013), adds the notion of useful to indicate that the innovation provides new value (Bledow, et al., 2009), and reincorporates the recombinant logic that has been central from the beginning of innovation studies (Weitzman, 1998):

> "*Innovation is the invention, development, and implementation of new and useful ideas through combination of existing or new practices, resources and assets.*

Apart from emphasizing entrepreneurship and using combinatorial logic to achieve innovation, the traditional Schumpeterian approach also focus on market structures, claiming that market concentration supports innovation, and firm size, with the view that larger corporations have an advantage in relation to innovation capabilities (Schumpeter, 1934). This second contribution, which was in contradiction with contemporary thoughts of large corporation being bad for social development and often called his Mark II, is not uncontested (Ahuja et al., 2008). An extensive review of innovation studies, concludes that market structure in the Schumpeterian sense, i.e. market concentration, cannot be strongly linked to innovative productivity (Ahuja et al., 2008). Other aspects of market structures, such as collaborative networks, supplier contribution, the role of lead users as well as inbound and outbound flow of innovations, have instead been found to be increasingly important for innovation (Ahuja et al., 2008; von Hippel, 2005; Chesbrough, 2003).

This literature that challenges the proposed privilege of concentrated markets and large firms highlights the role of open and distributed innovation.

2.3.2. Open and distributed innovation

An increased mobility and availability of well-educated people outside the traditional research laboratories of large companies and a growing market for valuable ideas and intellectual property, have given reason for organizations to look at innovation in new ways (Chesbrough, 2003; von Hippel, 2005).

Originally conceptualized by Henry Chesbrough, Open Innovation is an academic topic, which has been successful in generating strong interest among practitioners and produced significant impact in the way organizations approach innovation and development. With the refined definition by Chesbrough and Bogers as "*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries*" (Bogers et al., 2017: p. 17), it arguments that not all good ideas are produced within your own organization, but an active

search for new technologies and ideas outside of the firm is needed. Cooperation with suppliers, customers, competitors and other actors can result in better results than closed boundaries, as the broader variation of knowledge and ideas is, due to the combinatorial logic of innovation, is a predictor of innovation success (Chesbrough, 2003; von Hippel, 2005). Another important aspect is the outbound flow of ideas and technologies that do not fit the strategy of the company. With respect to the definition on innovation presented before, this turn adds both to the combinatorial aspect, by adding external alternatives to the previously available internal ones, and to the aspect of "driving the innovation through", by adding alternative paths to market. Contemporary scholars on Open Innovation call to explore it further with multi-level perspectives, such as open innovation at ecosystem level and open governance that would support such objectives, as well as by bridging research domains that traditionally have been studied in isolation (Bogers et al., 2017)

Another influential topic in the literature on innovation, which also relates to the increasingly distributed nature of innovation, has been the role of customers and users (von Hippel, 2005; Bogers et al., 2010; Piller & West 2014), which also challenges the view that innovation is most effective inside the boundaries of large firms. In many settings, the user experience is the most important source of innovation and von Hippel consolidates these arguments into a view that users often are in a better position to innovate than the producer (von Hippel, 2005). In the argumentation, he relies on transaction theory and information asymmetry. The high transaction cost of convincing the producer to modify the product or service to accommodate the needs of marginal groups can make it more economic for the users to innovate themselves. And asymmetry of information can explain why users might be better positioned to innovate than the producer (Von Hippel, 2005), whose innovations will be based on the producer perception of user needs in general, whereas the user innovation will be based on exact and specific user needs. If the efforts needed to make producers aware of the specific needs is high, and the ability for users to innovate is reasonable, the economics might turn in favour of user innovation.

This distributed innovation, with strengthened position of customers, is clearly in conflict with Mark II of Schumpeter, which claims that centralized markets and large firms would have the advantage (Ahuja et al., 2008). The customer is, however, not the only actor that can challenge the large and dominant firms in the game of innovation. Other actors in the ecosystem can see opportunities for innovation, which are neglected by the large market-leading actors, and this

finding is at the core of Disruptive Innovation by Clayton Christensen (Christensen, 1997; Christensen and Raynor, 2003; Christensen et al, 2015).

2.3.3. Disruptive Innovation

Disruptive innovation explains how other actors with limited resources can come to challenge dominant incumbent players by focusing on new segments unaddressed or segments neglected by the market leaders (Christensen, 1997; Christensen & Raynor, 2003; Christensen et al, 2015). According to the theory, incumbents are inclined to focus on improving their products and services for their most demanding and profitable customers, which means that they become too sophisticated and expensive for some segments. Entrants that later might prove disruptive for the industry will find a foothold in those overlooked segments, and can use that foothold to gradually attract more mainstream customers.

In the clarifications on Disruptive Innovation, Christensen et al. (2015) stress that it is a process although the name might lead people to think of a sudden rupture. Just as reform initiatives in public sector are likely to be long processes involving experimentation and development along with the dominant service model to avoid confrontation and dismissal too early in the process. They also emphasize that disruptive innovation is not measured only by level of success and that the dominant players should not necessary fall for the mantra "disrupt of become disrupted". Some disruptive innovations never reach the mainstream market, which is fine and does not take away the value of addressing underserved markets with disruptive innovations, but an important element is the ability to experiment and find new ways of doing things without having the innovations killed by the incumbent players, which most often would be the case if directly targeting the mainstream customers. In the case of incumbents, they reason that there is no reason to dismantle profitable business even if there is risk for disruptive innovators, but instead prepare other ways to benefit from the development, e.g. through separate divisions or partnering arrangements.

This logic of targeted innovation for new or underserved market segments is developed in the context of high-tech industry, largely in the disk drive industry, and often associated with cutting-edge technology (originally even called disruptive technology), but is claimed to be applicable to all industries (Christensen and Raynor, 2003). In the context of a public service ecosystem the complementary aspect and gradual replacement of less effective processes and services is of particular interest. It explains how new digital services can be launched without a one-time replacement of traditional service channels with digital, which is found to be politically hard to accept.

2.3.4. Service Innovation

Another area of innovation, which has received increased attention lately is service innovation. During 20th century most of the innovation literature focused on process or product innovation, but since the beginning of the 21th century the dynamics of service innovation has caught much of the attention (Vargo and Lusch 2008; Barrett et al., 2015; Lusch et Nambisan, 2015; Vargo and Lusch, 2016). With the disconnection of information from physical products, it is claimed that a still increasing share of innovation will be around intangible, digitally enabled or supported services (Barrett et al., 2015).

Many theories have been successfully used in the explaining service innovation, but one which has been bringing IS research closer to service and innovation scholars is the theory on Service Dominant Logic (Barrett et al., 2015). In this perspective service is (re)conceptualized as *"a process of using one's resources (including knowledge) for someone's (self or other) benefit"* and service provisioning is done through the *integration of resources* (Vargo and Lusch, 2008). This resource-integrating view on service provisioning resonates well with literature on generative potential as it describes innovation as a collaborative process between actors, where value of service is the basis of exchange, generativity is achieved through resource liquification, and resource integration is the fundamental way of innovating (Lusch and Nambisan, 2015). By including digital assets as resources among the others, such as knowledge, skills and routines, resources are further liquefied based on the digital characteristics and can be re-integrated in a service ecosystem in ways that provide value to the actors. The resource-integration is according to the theory coordinated by institutional arrangements for mutual value (Lusch and Vargo, 2014), which indicates that the governance model needs to support service exchange and provide enough value to all parties involved.

The reason why digital technology is given a fundamental and transformative role in service dominant logic is that it, together with other resources such as skills and knowledge, enables transport and repackage information for different contexts and thereby creates new opportunities for service exchange and innovation (Lusch and Vargo 2014; Vargo and Lusch 2004; 2008). Barrett et al. (2015) also note that IS research is already providing important contributions for service innovation, such as generativity, work on information infrastructures, and the layered and modular architectures, but suggests that there is potential to go beyond these structural contributions to approaches that would support designing for service innovation in a digital age. They call for more explicit linking of information systems theory with service

innovation, in ways that recognize the role of institutional arrangements, and also proposes service dominant logic as a lens for doing so.

2.3.5. Digital innovation

In addition to the references to digital technologies in innovation literature discussed above, there is an emerging stream of research that focus specifically on digital innovation.

The works by Youngjin Yoo on modular layered architecture (Yoo et al., 2010) and subsequent suggestion for digital innovation building on the fundamental properties of digital technology (Yoo et al., 2010) in a process where limited number of genotypes can be combined to a high number of phenotypes (Yoo, 2013), are fundamental elements in the emergence of this research stream. They contribute to the understanding of digital innovation opportunities, by building on digital characteristics, generativity and socio-materality. They do not, however, provide very much advice on how to organize for it, but the conceptual proposition comparing digital innovation to the evolutionary logic of genotypes and phenotypes is intended more as an opening of a new path and calls for research in this direction to explore these opportunities (Yoo, 2013).

In the following years, studies focusing on digital innovation have been as diverse as including digital innovation in medicine (Topol, 2010), the need to strengthen the digital innovation curriculum (Fishman et al., 2014), contests and hackathon events (Juell-Skielse et al., 2014; Briscoe & Mulligan, 2014), digital innovation strategy (Nylen & Holmström, 2015), customer involvement and crowdsourcing (Saldanha et al., 2017; Boudreau & Jeppesen, 2015), and developer role in innovation (Parker et al., 2017). Clearly these topics can be considered to address digital innovation, but such a fragmented body of work does not advance the theory in the field very much and much remains to be done both in magnitude and quality of theorizing digital innovation.

Digital innovation was defined by Yoo et al. (2010) as "*carrying out of new combinations of digital and physical components to create novel products",* with a clear link to digitization of information as a prerequisite for digital innovation. Another aspect is a specific emphasis on product innovation as contrasted to process innovation. This definition is not quite satisfactory for the purpose of this study, however, as it lacks the explicit inclusion of services and process impact, which both are significant parts of innovation theory in general and most relevant in the context of public service ecosystem. A broader definition is proposed by Nambisan et al. (2017), which includes both these aspects, as "*the creation of (and consequent change in)*

market offerings, business processes or models that result from the use of digital technology" (Nambisan et al., 2017: page 5).

This definition resonates well with the definition of digitalization as it also relies on digitization, but put emphasis on the change in product and service offering as well as the processes and business models. The definition is further elaborated into four new theoretical logics, which each raise a set of new research questions to explore in further research (Nambisan et al., 2017). The proposed dynamic problem – solution design pairing acknowledges fluid boundaries of the innovation space and the potential for innovation agency to be distributed, which is in line with the case context of innovation in a public service ecosystem. The second proposed logic around socio-cognitive sensemaking give reason to explore how do actors make sense and discover new meanings around digital technology and related scenarios and affordances, the reasoning and metaphors used, as well as the effect of distributed agency in influencing socio-cognitive sensemaking around digital innovation. The third theoretical logic highlights the role of affordances and constraints in digital innovation. Considering digital technology as sets of affordances and constraints for innovating actors helps explain how and why the "same" technology can be repurposed by different actors and produce different outcomes in different contexts. Taking this perspective into innovation research could, according to Nambisan et al., answer questions such as how digital tools and infrastructure enable and constrain innovation outcomes. The last proposition in this proposed new direction for research on digital innovation is around the topic of orchestration. The problem–solution matching would be a microfoundation of digital innovation orchestration, but there would be interesting avenues to explore on how digital technologies is enabling or supporting such orchestration and which theories could explain how firms are able to successfully mix, match, and integrate internal and external parties and communities in digital innovation.

The proposed theoretical logics is fully compatible with previous observations of innovations based on pervasive digital technologies, which revealed three traits to be central: the importance of digital technology platforms, the emergence of distributed innovations, and the prevalence of combinatorial innovation (Yoo et al., 2010), but brings more details into how (IS) scholars could continue to contribute to the understanding of innovation in a digital era.

2.4. Context of Public Administration

The societal challenges of today are complex and often interdependent in a way that requires unforeseen degree of shared understanding, collaboration, and commitment across sectors and

organizations (OECD, 2015; UN, 2014). Changing demographics, globalization, climate change, inequality and poverty, risk of potential large-scale disasters are just a few examples of challenges often referred to as "wicked problems", as they are exceedingly difficult to solve due to complex, changing and interdependent characteristics (Rittel & Webber, 1973). Even describing and defining these problems is difficult, as complete descriptions would indicate an understanding of the boundaries and anticipated solutions (Kim & Zhang, 2016). In the discussion and research on how to address these challenges, digitalization is often raised as a "silver bullet" that will change the situation for the better. This expectation might be unwarranted unless major changes can be achieved in how public services are organized and digital technologies are used for organizational and service development (Fishenden and Thompson, 2012; Dunleavy et al., 2006). The dominant governance models with fragmented organizations and an approach where technology is introduced to solve a clearly bounded problem with a defined solution, would thereby be inappropriate for solving these problems.

This has given reason for scholars in public policy science to propose that a paradigm shift from New Public Management (NPM) (Hood, 1991) to a post-NPM society must take place (Greve, 2015; Navarra and Cornford, 2012; Dunleavy et al., 2006, Margetts et Dunleavy, 2013). The proposed models differ from value- and collaboration driven approaches (Osbourne, 2010; Bennington & Moore, Donahue & Zeckhauser, 2011) to models that would build more explicitly on the shift to a digital society (Fountain, 2001; Dunleavy et al., 2006; Margetts & Dunleavy, 2013; Dunleavy & Margetts, 2015). Analyzing the proposed changes in government paradigms would be beyond the scope of this study, but it is important to recognize that there is a push towards re-integration and systemic thinking in government that goes beyond the discussion about digitalization.

This section of the literature review discusses how digital government is being pushed from individual solutions towards a more holistic approach supporting administrative reform, and how this relates to broader perspectives of administrative paradigms and the need for innovation in public administration.

2.4.1. Digitalization in Public Administration

Studies of how ICT could be used to better support public administration has been on the research agenda for decades (Fountain, 2001; Yildiz, 2007; Garson, 2006; Heeks & Bailur, 2007). This research, commonly referred to as e-Government, has become a distinct field of IS research (Heeks & Bailur, 2007; Meijer & Bekkers, 2015), taking into account the specifics of government context. Historically, the use of ICT in government goes back at least 70 years.

First introduced in the 50s and 60s to automate repetitive and intensive tasks, followed by the wide rollout of PC:s in the 80:s, enterprise applications and use of Internet around the millennium, and more recently by phenomena such as social media use in public administration (Garson, 2006; Luna-Reyes and Giles Garcia, 2014).

In the last 10-15 years, much focus has been on digitizing, streamlining and automating internal processes and developing new channels for external information exchange and transactions (Meijer and Bekkers, 2015; Navarra and Cornford, 2012). Meijer describes e-government as *the use of ICT in order to design new or to redesign existing information processing and communication practices in order to achieve a better government, especially in the field of electronic service delivery to companies and citizens but also for managerial effectiveness, and the promotion of democratic values and mechanisms* (Meijer 2015).

Recently there has, however, been calls to shift from an e-Government focus towards a more holistic view on digital opportunities in government context (Dunleavy et al., 2006; Margetts & Dunleavy, 2013; Fishenden & Thompson, 2013; OECD, 2014; Zhang et al., 2014). In the proclamation that NPM is dead, Dunleavy et al. (2006) takes the view that digitalization in public administration is something more profound than just a support tool for NPM and indeed incompatible with the fragmented model that NPM represents. Instead they introduce 3 tenets of a governance for a digital era that builds on re-integration of government, needs based holism, and pervasive digitization of processes (Dunleavy et al., 2006). A similar call for holistic perspective is presented in the OECD recommendation on Digital Government to member states, which arguments that we are entering *"a new stage of maturity in the use of digital technologies by governments and a shift from e-government to digital government with a view to opening, innovating and modernising public sectors*" (OECD, 2014: p. 5). A definition, which separates Digital Government from previous era of e-Government, is provided as *"the use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value"* (OECD, 2014: page 6). This change of focus can be compared to the topics of e-Commerce (front-end) and e-Business (back-end), which have been steps towards fully digital business models of private companies. In a similar manner e-Government has been preparing ground for more comprehensive Digital Government. In a review of e-Government literature Bekker (2012) suggests that the area would need stronger links to: a) open innovation studies as he argues that ICT is an important source of innovation, b) technology studies, because ICT is the outcome of (as well as input for) the socio-political

process and c) literature on steering because of the link between ICT steering and achieving political outcomes.

Fishenden & Thompson takes a more targeted information systems approach in their analysis of how the dominant models of sourcing, introducing and operating solutions is incompatible with both needs and opportunities. Individual monolithic projects automate processes and transactions, but they also "cement" the processes and creates severe lock-in situations, which make future adoption and agile response more difficult (Fishenden & Thompson, 2013; also Orlikowski, 2000).

In summary, the literature on digitalization in public administration context tells us that there is a need to change towards a more integrated and holistic view that is the broader opportunity of digitalization. More holistic views on IT in government have been proposed before (Fountain, 2001; O'Reilly, 2011), but we have seen little results in this direction so far (Zhang, et al., 2014; Luna-Reyes & Mellouli, 2014). There are some developments and trends worth noting, though. Especially, the increased interest in Open Data and Open Government could be a fundamental step towards a layered modular architecture that enables more holistic approach to complex cross-sectoral problems (Yoo, 2012). Some government strategies on Open Data have also been expanded towards Open API and a system of Open Services, which in fact raises new interest in the concept of Government as a Service (GaaP), originally proposed by O'Reilly (2011).

2.4.2. Innovation in Public Administration

Above we discussed the literature showing that approaches to innovation is changing to more open and distributed systems while the ability to "drive through", even by taking personal risks, remains as important as ever. Innovation in public administration differs from private sector in several ways (Bertot et al., 2008; Cunningham & Kempling, 2009; Lee et al., 2012; Uppström et Lönn, 2015) but is no less important (OECD, 2015; Huo, 2015). The contemporary challenges, such as increasingly complex societal problems, rising citizen expectations, new technologies, and tight budgets push administrations to innovate new ways of working. An OECD Observatory of Public Sector Innovation (OPSI) report suggests four ways that this can happen; empowering the public sector workforce, generating and sharing new ideas, working in new ways and innovating within rules, processes and procedures (OECD, 2015b).

Empowering the public sector workforce emphasizes the cultural and structural aspects related to enabling actors to experiment and "drive through" as discussed in relation to generic innovation theory. This is especially important in the public sector, where motivational factors

are less likely to relate to direct financial gains, and more often to extrinsic rewards such as recognition and seeing the value and impact of one's work. Both the OPSI report and other literature on public sector report that there often is a culture of risk aversion in public administration, which is a barrier to innovation. Generating and sharing new ideas points to the value of opening up and broadening the amount and variation of ideas to draw from, much in line with the perspective of open innovation. This can cover a variety of actions ranging from Open Data initiatives, the crowdsourcing aspect, to the internal use of the data, information and ideas, i.e continuous learning and becoming learning organizations. Working in new ways might sound obvious in the context of innovation, but the mismatch between complex cross-sectoral problems and fragmented silo-based working is a real barrier to innovation, and new perspectives are called for. This would include more collaborative working, flexibility in human resource management, leadership practices that cut across different policy domains, and also the courage to dismantle ineffective services and routines. Finally, the recommendation to increase innovation within rules, processes and procedures, i.e. addressing the legal framework. Many government has taken objective to simplify the administrative procedures for businesses, but might be lagging behind with internal regulations which constrain innovation through a set of complex, overlapping and contradicting rules.

These OECD recommendations are based on evidence collected from member state experiences of public sector innovation and synthetized through discussions and conferences. They are, however, not diverging from the broader literature of innovation in public sector (Osborne & Brown, 2005; Ansell & Torfing, 2011; Szkuta, Pizzicannella, & Osimo, 2014; De Vries et al., 2016), which recently has emphasized topics such as Open Data or Data Driven Innovation (Zuiderwijk et al., 2014; Sucha et al., 2015; OECD, 2015b), citizen engagement in innovation (Thapa et al, 2015) and collaborative innovation (Sørensen, & Torfing, 2012; Szkuta et al., 2014; Torfing, 2016). Some scholars in this stream takes a specific eGovernment perspective on public sector innovation (Meijer, 2015; Misuraca and Viscusi, 2015; Navarra and Cornford, 2012), and Meijer provides a useful classification of innovation constraints according to innovation phase, customer vs. administration related constraints as well as between separating between structural and cultural barriers.

2.5. THEORETICAL FRAMING

The view that digital generativity affords different response alternatives to different actors was already briefly introduced. In this subsection of the literature review, the perspective is

presented in more details and complemented with the human agency theory to form a theoretical framing for data collection and analysis.

2.5.1. Affordance theory

Affordance theory originates from studies of ecology (Gibson, 1986), but has been used in Information System research to explain why the use of technology differs between organizations, why sometimes apparent opportunities to benefit from technology remains unrealized, and why sometimes technology is used in unforeseen ways (Majchrzak and Markus 2012; Markus and Silver 2008). Further, it has been used to explain how technology relates to organizational changes (Zammuto et al. 2007; Leonardi 2013; Volkoff and Strong 2013). In the context of how technology impacts organizations, affordances are normally described as relational between the actor and the technology (Majchrzak and Markus, 2012; Zammuto et al., 2007). This means that the technological affordance reflects possible actions enabled by technology, but the outcome is always dependent on the actor's ability to perceive and make use of the possibilities (Volkoff and Strong 2013; Zammuto et al. 2007).

Zammuto et al. (2007) describes affordances as enablers of goal-oriented action, emerging from the relation between technology and organizational system, and a more complete definition is provided by Markus and Silver as *"the possibilities for goal-oriented action afforded to specified user groups by technical objects"* (Markus and Silver, 2008, p. 622). The fact that affordances are only possibility for action, means that they turn to specific outcomes through a goal-oriented actor that perceives the affordance in relation to his or her objectives and acts upon it, i.e. the process of actualization (Volkoff and Strong, 2013; Strong et al., 2014).

Extending affordance theory from individual technology objects to broader structural affordances is done by Leonardi, describing affordances as *"not exclusively properties of people or of artifacts...[but] constituted in relationships between people and the materiality of the things with which they come in contact"* (Leonardi, 2011: p. 153). This reference to broader structures and their materiality makes affordance theory a well-suited perspective for this study.

In line with this body of literature, this study uses affordances for generative change as a construct that links opportunities of digital structures to organizational change through actor agency. Using this lens suggests that although technology and organizational features may exist independently of each other, their value comes from how they are enacted together. This approach follows works of Zittrain, who claim that it is only through the participation of humans that the generative capacity of a technology can be realized (Zittrain 2008: p.90). This is a

reason why human agency theory often is used in parallel with the lens of technological affordances.

2.5.2. Human agency

Human agency theory complements the affordance view by suggesting that humans enact technologies in ways that support their objectives and by doing so they determine the organizational impact of the technology (Bandura, 2000; Boudreau & Robey, 2005; Leonardi and Barley, 2010). Actors exposed to new technologies can use it to advance their goals either individually or collectively, or they can choose to ignore it or minimize the use if they find it irrelevant or against their objectives. They can also improvise or reinvent usage beyond the original planned purpose of the technology (Boudreau & Robey, 2005; Nevo et al, 2016).

Emirbayer and Mische (1998) argument that human agency involves the capacity both to sustain structures and to transform them, and claim that the agency is best understood when actors are situated not only in social structures but also in a temporal dimension (Emirbayer & Mische, 1998; Nevo et al., 2016). The temporal aspect means that the actors of the study take into account their past, their perception on the current and their view on the future in their response to digitalization in their environment. All three aspects, the iterative one building on the past, the practical evaluation of the present and the projective look towards the future, influence the agency and they will co-exist in actor reasoning, but the focus might be on one of the temporal perspectives. Understanding this tendency to build on the past, evaluate the current or look into the future will improve the understanding of the system dynamics. E.g. an actor with a predominantly projective agency is making sense of the perceived affordance in relation to personal, organizational or ecosystem goals (Boudreau & Robey, 2005; Nevo et al., 2016), whereas an actor building on the past form his or her opinion based on what similar experiences they can relate to and what actions have been successful before.

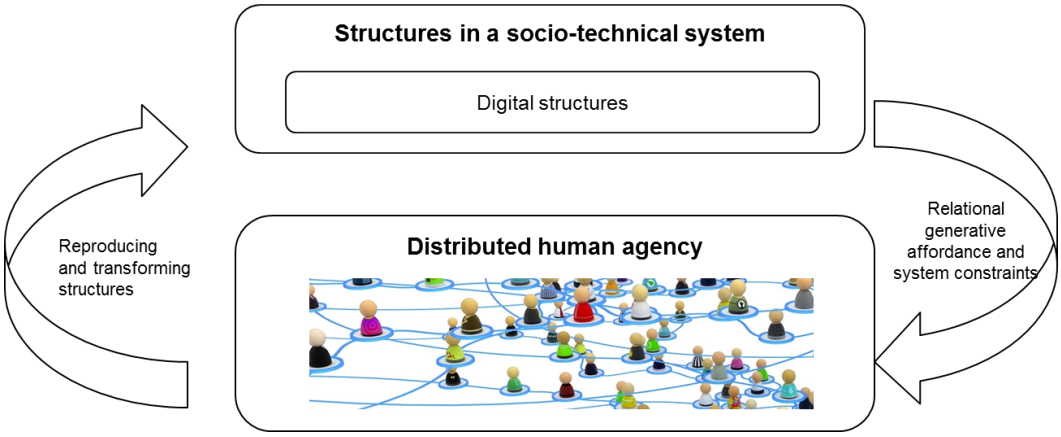
The human agency theory builds strongly on the assumption of self-efficacy, i.e. that sub-units in the system can drive change to advance their own objectives (Bandura, 2000). This assumption may not hold, however, if there are may be too many interdependencies in the system or other structural constraints against desired change (Orlikowski, 2000). The conceptual framing of temporal human agency allows us to capture and categorize the actor reasoning around the structural opportunity that digitization and digitalization presents.

2.5.3. Theoretical framework

The theories of affordance and human agency are often used together to emphasize the relational aspect and the enactment (Leonardi, 2011) or actualization (Volkoff & Strong, 2013)

of the affordance that is needed to realize the potential. Framing the study through the theories of affordance and human agency enables an analysis of digital generativity through the eyes and reasoning of the actors.

Figure 5: Framework for the study



This framing positions technology as one of the structural factors that affords and constrains actors in their action. Both theories, theory of affordance and human agency theory, are widely used in IS research and recommended perspectives in studies where the phenomenon under study has a cooperative and interdependent nature (Eisenhardt, 1989). Together they represent an ontological view on technology in organizations, where technology affordances provide new opportunities and human agency allows each actor to enact them to create a better future for him- or herself, but only to the extent that it fits the understanding, ability and motivation of the actor and assuming a lack of constraints that would limit this actor self-efficacy. By analysing the perceptions (related to relational affordance), the actions (related to self-efficacy and enactment of affordance) and the constraints (the limits of self-efficacy), we should be able to consolidate the actor experiences to an ecosystem level understanding of how the generative affordance of digital structures are enacted in the ecosystem and how ecosystem governance either supports or limits digital innovation.

3. RESEARCH DESIGN AND METHODS

The research is designed to address the research problem and literature gaps through a qualitative case study in the context of public administration. The scope of the case study is a public service ecosystem, which due to its distributed nature should provide affordances for digital generativity but also plenty of social and institutional factors that constrain actors and makes it difficult to realise the potential provided by evolving digital structures. The research is conducted as an emergent and interpretative study that foregrounds ecosystem actors in the exploration of how generativity is enacted.

This section presents the research questions, research design, empirical case with its boundaries and actor sampling strategy as well as methods for data collection and analysis.

3.1. RESEARCH QUESTIONS

To foreground ecosystem actors in exploring the enactment of digital generativity, the research questions have been formulated as

> *Research Question 1: "How are digital opportunities and challenges in a public service ecosystem perceived by the actors and how do the perceptions that underpin their response differ or align across actors and actor groups?"*
>
> *Research Question 2: "How are individual responses to digitalization enabled or constrained in the ecosystem and how can ecosystem governance be organized to support digital generativity?"*

The first research question places the focus on individuals who are in the middle of contextual digital change. Following the assumption that affordances are relational and human agency is instrumental in achieving the potential, it is important to establish how individual persons perceive the phenomenon and new opportunities, based on their experiences, situation and views. This approach is central in the affordance theory, which holds perceived affordances as more important than the "objective" potential when it comes to how actors respond. The outcome is dependent on actor agency and the agency depends on how actors perceive the phenomenon in relation to his / her background, current situation and future goals.

The second question takes analysis to an ecosystem level by synthetizing the experiences of individual actors to informed conclusions at the level of the ecosystem. It builds on the view that technological change is not deterministic but depend on actor agency and systemic constraints (Leonardi and Barley, 2010; Leonardi, 2011). Constraints are opposite to

affordances and theory suggests that technological affordances are provisional and can be enacted by goal-oriented actors who have the motivation and ability to overcome the constraints. The ecosystem constraints that actors face are therefore of interest in drawing conclusions about how the generative affordance can be enacted and identifying constraints can provide insights about governance practices that would support the enactment.

3.2. RESEARCH DESIGN

The approach to answer the research questions is to conduct a qualitative case study in a public service ecosystem. Based on literature showing that generative affordance is inherent in digital structures, affordances being relational to actors and human agency instrumental in enacting this affordance, the study assumes a critical realism worldview (Mingers et al., 2013) and employ interpretative methods to explore the phenomenon of interest (Klein and Myers, 1999; Walsham, 2006).

Qualitative research is chosen to provide new insight on the generativity enactment through in-depth analysis of the phenomenon in its context (Gioia et al., 2012; Langley & Royer, 2006). As the influence of context is not stripped away of the analysis but the data retains its richness, it provides opportunities for exploring underlying and non-obvious issues related to the enactment (Miles et al., 2013). What qualitative research might lack in external generalizability compared to quantitative studies, is compensated with the ability to explore new areas and contribute to conceptualization of how the structural affordance of generativity can become enacted (Eisenhardt and Graebner, 2007). This opportunity to build on the full richness of data and acknowledge the local context, actor experiences and the systemic constraints, is in this specific study considered to be an advantage and has been central in the choice of the qualitative design and the methods for this study.

Empirical case study research is our way of entering the contextual richness that is needed to explore the complex phenomenon of generative change in a distributed system (Denzin & Lincoln, 2011). Case study research is well-suited to study novel phenomena with research questions formulated as "how-questions", by analysing the contemporary in its real-world context (Langley & Abdallah, 2011; Pratt, 2009; Siggelkow, 2007). In the broad range of case study designs, this study is an explorative case study (Stake, 2005).

Critical realism as a worldview holds that there is an objective reality, although it is not always accessible to us (Mingers et al., 2013; Archer, 1998; Bhaskar, 1993). The reality is independent of humans and stratified into the domains of the real, the actual, and the empirical (Archer,

1998), which makes it possible to analyse the reality beyond observable events. Applying this worldview on the research problem means that the digital generativity is inherent in growing digital structures, but can be unobservable or latent due to countervailing powers or lack of triggering action. A key premise of critical realism is a primacy of ontology: the world exists whether or not humans are there to observe it and our knowledge of it can be improved with a number of different research methods (Mingers et al., 2013; Walsham, 2006). In this study interpretative methods have been employed as the experiences and reasoning of actors can provide an entrance into the reality domains that are not empirically observable.

Interpretive research can help us understand human thought and action in social and organizational contexts (Klein and Myers, 1999) and is thereby well-suited design for exploring the enactment of generativity, which according to the theoretical framing is a relational affordance. The interpretivist approach holds informants as "knowledgeable actors" (Gioia et al., 2012), which gives us the tools to explore the reasoning beyond observable reality (Walsham, 2006). In the interpretative approach, the focus is on actor experiences, narratives and interpretations, which leads to a strong reliance on primary data collected mainly through interviews. In applying the interpretivist design, the study follows the seven principles of Klein and Myers (1999).

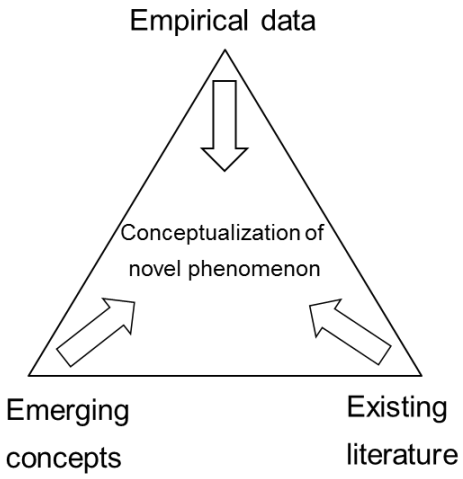
The *emergent approach* complements the other design choices as it allows for the informants to speak up about their experiences, situations and goals without being directed by the researcher towards specific a priori hypothesis (Suddaby, 2006; Gioia et al., 2012; Klein & Myers, 1999). The conceptual framing of relational affordance and human agency emphasises the role of actor perceptions, situations and experiences in the enactment of digital generativity, which means that an inductive analysis can be used to demonstrate patterns in this empirical data, identify emerging concepts and use them to advance the understanding of the phenomenon. Such an inductive approach to data collection and analysis is a way to put the actors in the foreground in the exploration of the overall interplay between structural opportunities and human agency.

A specific characteristic of this study is that the research problem, theoretical framing and research questions call for a *multi-level analysis*. We are interested in how the digital generativity can be enacted to produce digital innovation in the ecosystem, but we also know that enactment of relational affordances depends on actor level agency. Consequently, we need to approach the phenomenon with a multi-level analysis (Bordreau and Robey, 2005; Leonardi, 2011). In the first round of analysis the spotlight is at the individual actors, exploring their

perceptions of ecosystem opportunities and associated challenges based on their specific experiences, situations and goals and from their specific point of view. This first round, where the unit of analysis is the individual, draws on the theory of temporal human agency and is thereby also less inductive. After the individual level analysis, the unit of analysis is shifted to the level of ecosystem. Drawing on the actor experiences, patterns across the ecosystem are identified and emerging concepts are extracted for the empirical data. An advantage of using two different units of analysis in the same case study is that insights about the higher-level context can emerge when the individual experiences are superimposed on each other. The details on how the two rounds of analysis differ are provided in section 3.6. Data analysis.

In conclusion, the selected research design; *a qualitative case study with an interpretative and emergent approach implemented at two levels of analysis,* provides potential for conceptualization and building testable propositions about how the digital generativity is enacted (Gioia et al,. 2012; Eisenhart and Graebner, 2007). The way it is done by iterating between existing literature, empirical case data and emerging theoretical concepts is illustrated in Figure 6 below.

Figure 6: Theory informed emergent case study (based on Eisenhardt &Graebner, 2007)



The research is conducted in the spirit of *engaged scholarship* (Van de Ven, 2007), which stress the importance of grounding academic research in practice throughout every step of the research process. This is a participative form of research that is proposed to provide more relevant insight in complex social settings as the researcher can benefit from the guidance from practitioners in problem formulation, research design, problem solving and theory building.

3.3. SCOPE AND SAMPLING STRATEGY

The scope of the case study is the public service ecosystem in Finland and the actors invited to participate are individuals in positions where they have first-hand experience of digital changes, opportunities and constraints, as well as decision power or influence over the response taken.

Relying on the Adner's (2017, p. 42) definition of ecosystem, "*The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize*", we include in the ecosystem term both government and non-government actors who interact to produce value, but not the consumers of public services, who could be considered part of an ecosystem based on other definitions (e.g. Autio & Thomas, 2014) or based on service-dominant view on value creation (Vargo and Lusch, 2016). The alignment of partners is a key element of the definition, meaning that there is an understanding of positions and flows in the ecosystem and a dynamic where environmental changes might trigger either designed or spontaneous re-alignment. Another important aspect of the definition is the notion of a focal value proposition, which helps to keep independent actions aligned towards common goals and values. These aspects of the definition makes an ecosystem approach well-suited to explore the enactment of digital generativity through human agency in a public service ecosystem. Actors are independent but there is a focal value proposition that guides them alignment. It also resonates with the "broad and varied audiences" that is part of the generativity definition and explains how actions and interactions between partners produce value to the whole ecosystem.

A public service ecosystem can be characterized as a system of independent or semi-independent actors interacting with each other and a variety of digital structures. Actors have both individual goals and the shared interest to promote the success of the ecosystem as a whole. The shared interest, i.e. *focal value proposition*, has to be strong enough to align actions and the structures shall support rather than constrain the *value creating interactions* in the ecosystem. If the shared interest is too weak or the constraints are too high, there will not be the ability or motivation that according to affordance theory are required for actors to enact the affordances.

Selecting the public service ecosystem in Finland as the empirical case for the study is based on its relevance and potential for new insight about a holistic, customer-centric and reformative approach to digitalization across organizational and sectorial boundaries. Finland is already one of the leading countries in public electronic services (European Commission, 2017), but the government program from 2015 raised the bar to a new level with digitalization as one of five

strategic priorities (Valtioneuoston kanslia, 2015). The digital maturity in the Finnish public administration is ranked third among EU member states and the digital inclusion rate and skills related to digitalization among citizens is the highest in Europe (European Commission, 2017). These two macro-economic factors should provide favourable conditions for broad digitalization in the public service ecosystem as some of the potential barriers that can could rise from lack of infrastructure or lack of skills are less likely to influence progress.

Within the ecosystem, individual actors are invited to the study based on theoretical sampling (Pratt, 2009; Eisenhardt and Graebner, 2007). Specifically, for this study it means that the actors included are in positions where they have the opportunity to influence the response to digitalization, they can propose or decide about actions to take advantage of digitalization, and they have personally faced the constraints and challenges related to promoting digital change. The criteria used for sampling actors are shown in Table 3 below.

Table 3 : Sampling criteria used for identification of informants

Criteria	Description
1. First-hand experience of changing context in public administration due to evolving digital structures	Substantial experience of how ICT has been used to support organizational change and service delivery in public administration.
2. In a position to decide or influence the response that is taken to structural digital opportunities	Decide: Formal position that authorizes the actor to participate in decision making on how his / her organization responds (C-level executives, general directors, etc.)
	Influence: recognized expertise and experiences that makes the actor an advisor to decision makers in matters related to digitalization.
3. Position in one of the four categories used to balance the views in the ecosystem	Central Government: Actors in government, ministries central to digitalization and cross-sectoral governance bodies of Digital Government.
	Distributed Government: Actors in public agencies, municipalities, health care institutions, etc.
	Non-government: Actors in private companies or independent expert organizations that are involved in public sector digitalization.
	International: Public officials that work with public sector digitalization across national governments, but also have a basic familiarity with the situation in the case ecosystem of Finland.

In the sampling it has been required that all actors fulfil the first criteria and one of the alternatives of the second criteria. The categorization into one of the four groups has been more

challenging as individuals change positions in the ecosystem. Some of the actors provided insight from several perspectives that they had held in recent years. At least 4 such actors are identified; one actor had moved from non-government to decentralized government, two from decentralized government to central, and one from central government to the international group. The solution was to categorize these actors according to current position, although previous roles could have influences the perceptions and views.

As a consequence of the sampling criteria, the informants involved in the study are individuals in higher management positions or have recognized expertise in the area. Following these sampling criteria, private sector actors involved in digital change initiatives of public services have been included, but end users of public digital services are not included in the study, although acknowledging that they might have an important role in digital innovation and development of public services (von Hippel, 2005; Thapa et al., 2015). Sampling individuals has been based on sequential purposive sampling, with a reputational first set of selections (Miles et al., 2013). All interviewees, both the initial set and informants added along the data collection, are selected based on their relevance and potential to reveal relevant experiences and views without any objective to establish a sample that would be representative for the population of the ecosystem (Eisenhardt and Graebner, 2007).

3.4. EMPIRICAL FIELD SETTING

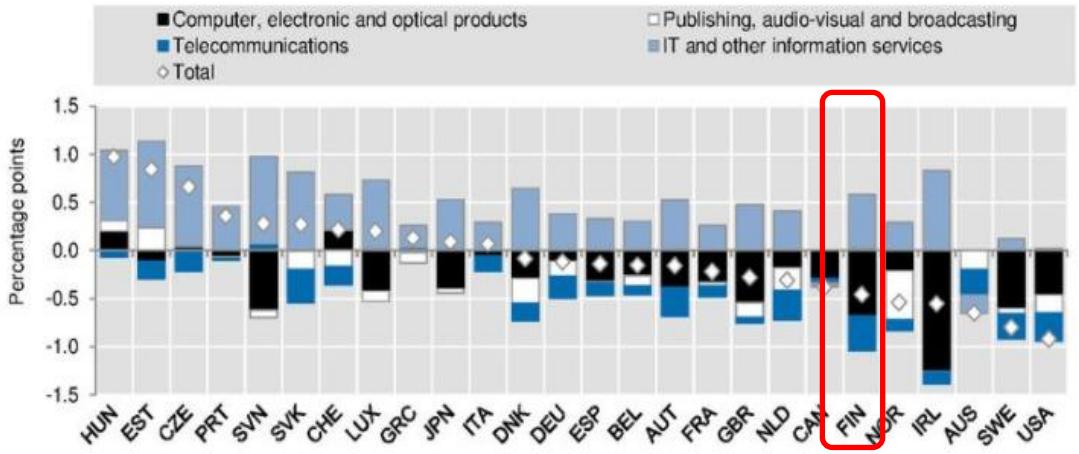
The empirical setting for this research is the public service ecosystem in Finland. Finland, with its 5.5 million inhabitants, is a country that is influenced by its membership in the European Union and Euro group. It is also part of the Nordic reference group of countries, which are considered to be open and liberal societies with strong emphasis on social welfare, equality and a high level of trust in public institutions (OECD, 2015d). Within this context there are a number of socio-economic factors that are relevant in understanding the local context of the study and the role it plays, such as structure of economy, its recent changes, skills and resource availability, evolution of IT in public administration and current policy ambitions for digitalization, as well as the history and current thinking about public governance in general.

In the most recent growth period of Finnish economy the high-tech and ICT industry played a major role. The ICT sector contribution to national economy grew in the 1990s and 2000s to more than 10 % of GDP, with successful outcomes such as Nokia becoming world leader in the mobile phone industry, the movement around Linux OS producing an alternative to global proprietary platforms and other open source success stories such as MySQL following.

Although the high-tech industry still continues to produce success, such as the more recent growth in mobile gaming industry and a very vibrant start-up community with leading events such as Slush, the Start-up Sauna and hackathons, the share of economic activity that comes from ICT industry has fallen to 5-6 % (Statistics Finland, 2017).

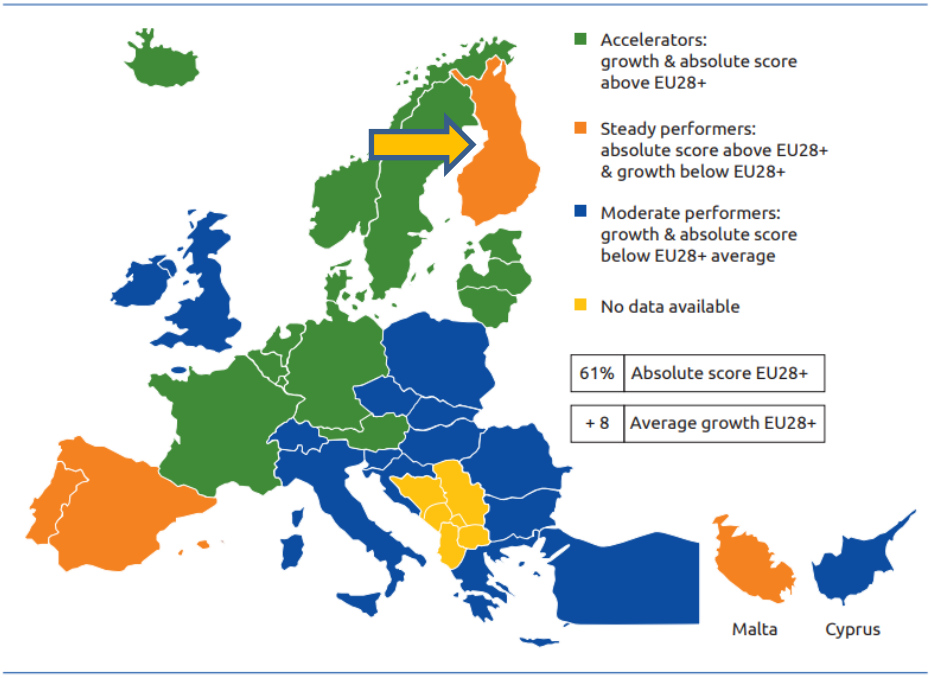
This structural change came with a negative impact on employment and economic growth, which had an impact on public sector funding, but it has also enabled new sub-sectors within ICT industry to grow. A high number of experienced and competent people have shifted from the dominant mobile telecom and ICT manufacturing industry towards a more generic ICT service industry as shown in Figure 7 below. The downsizing of Nokia and the mobile technology cluster has freed up competence and resources for new initiatives and enterprises, including digital government and work on societal issues.

Figure 7: Change in ICT industry employment between 2000 and 2012 (OECD, 2014)



In the context of public administration, the maturity of e-Governance and online public services is high compared to any international reference group (EU, 2017; UN, 2014; OECD, 2015). Finland is one of the leading countries in the world in public electronic services and studies show that the digital skills of Finns are the best in the EU. This indicates that the prerequisites for further digitalisation would be excellent, although the growth has slowed down in recent years as shown in Figure 8.

Figure 8 : Maturity and growth of e-Government (EU, 2017)



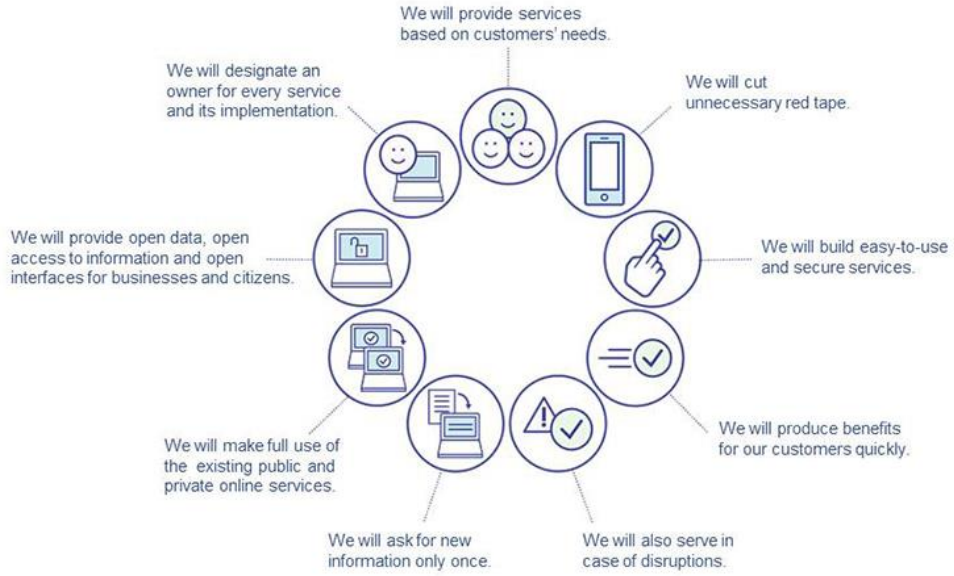
There is a sentiment that although the nation is still doing rather well in international comparison, the responsiveness and renewal rate is too low (Doz and Kosonen, 2014, OECD, 2015b). This gives rise to frequent comparisons to the neighbour country Estonia, which has been able to rise from laggard to world-leading in the way technology is used in public administration (OECD, 2015). A major difference between the two countries is that the development of public ICT infrastructure in Finland has evolved gradually without any major disruptions or renewals and this might have negative consequences on future responsiveness when the context is changing rapidly. The public governance that raised the Finnish economy from post WWII laggard to one of the wealthiest and most innovative countries, has been an example of international best practice for decades, but the concerns are rising about its fit for purpose in a digital area. In particular, the challenges related to cross-sectoral development and reform pose significant barriers to integrated policies that make use of digital opportunities. The stove-pipe autonomy of ministries and their sectors is deeply rooted in the governance, legislation and culture. In this way the case ecosystem seems to match the academic debate on how new approaches would be needed (Dunleavy et al., 2006; Margetts & Dunleavy, 2013; Fishenden & Thompson, 2013; OECD, 2014).

The current government program addresses this challenge at the highest level. Digitalisation in public administration is promoted as one of five key focus areas in the government program of 2015 (Valtiokonttori, 2015). The implementation of the program was launch with a strategy of

broad and open participation. In June 2015 the new Prime Minister Juha Sipilä and Minister of Local Government and Reform, Anu Vehviläinen, challenged ministries, agencies, municipalities and any other actors to make proposals on how to promote digitalisation in public administration. By the deadline a total of 263 proposals from 115 different actors were received. A special funding was established to promote and fund digitalization initiatives that show potential for substantial cross-sectoral impact. Fifteen of the proposed initiatives are now being funded and implementation is ongoing, but is funding for a limited number of initiatives going to solve the challenges above?

Other actions taken include an open and collaborative process of defining principles to guide the digitalization efforts and a new organization to digital service design. The principles of digitalisation were published in February 2016 and cover nine principles, which now are the commonly agreed rules for digitalisation in all public administration. These confirmed principles are presented in Figure 9.

Figure 9 : Digitalization principles of 2016



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The principles show an ambition to move towards integrated and customer-driven approach that follow the "digital first" and "once only" principles and resonate with the OECD recommendations for Digital Government (OECD, 2014).

3.5. DATA COLLECTION

The conceptual framework and research design foreground the actors and their experiences in relation to ecosystem digitalization. Actors are the natural focal point of the first round of analysis but also in the second analysis, which inductively produces a synthetized view at the ecosystem level, the unit of observation remains at the level of individual actors. This interest in individual actors has been the starting point for data collection.

The research design as an interpretative case study calls for a broad and deep understanding of how informants perceive the situation, its potential and its challenges in relation to their specific situations and goals (Gioia et al., 2014). Semi-structured interviews match these needs and have proven useful in such studies (Gioia et al., 2014; Myers & Newman, 2007; Klein and Myers, 1999). Collecting rich primary data directly from the actors is a way to form an understanding of how distributed digital opportunities are perceived and acted upon and provides insight on the unobservable reality domains (Mingers et al., 2013). It is in line with the assumption that affordances are relational and dependent on actor situation, understanding and goals as well as his or her ability and motivation to act upon it (Zammuto et al., 2007). Using semi-structured interviews has been a way to capture data on how actors respond to changing digital structures, but also to capture the more subtle and nuanced data related to their thoughts, ideas and values.

As recommended for semi-structured interviews in interpretative research (Myers & Newman, 2007) all interviews were conducted by me personally, which reduced the risk for misinterpretations within a research team. Whenever permitted by the informant the discussions were recorded and transcribed. At the time of asking permission for recording, it was stressed that anonymity is guaranteed and the reason for recording is only to enable proper analysis of the data collected. More specifically, to promote an atmosphere of open and truthful discussion informants where promised that I will not identify them by name, position or identifiable quotes in the thesis or research articles. This means that some organizational names and references to initiatives or events are removed from the material used in this document, but it does not reduce the value of the material in the inductive reasoning. Some of the informants were familiar to me from projects, events and other activities in the case ecosystem, which might have influenced the nature of the discussion at the start of the interview, but as we got into the content and interview topics, I do not see a difference in how openly the actors were willing to discuss their experiences.

The nature of data collection has been iterative with some fine-tuning of focus along the way. Data collection started with a first round of 12 interviews based on a set of four broad discussion

themes, which were derived from the conceptual framing and research questions. The themes covered:

- Perception and goals related to digitalization across the ecosystem,
- Actions taken (or desired) to reach the individual and ecosystem goals,
- Constraints that has made it difficult to act as desired and make use of opportunities,
- Governance that would make it easier to act upon the opportunities.

The first theme is motivated by the theoretical framing, which claims that affordances are relational and reflects perceived rather than objective opportunities and become enacted by goal-oriented actors (Majchrzak and Markus, 2012; Zammuto et al., 2007; Volkoff and Strong, 2013). This theme also provided cues for temporal reflection into past experiences and future ambitions, which according to Emirbayer and Mische (1998) are crucial in understanding agency. The interviews normally started with a question on how the informant perceives the difference between hype about digitalization today and the long history of "ICT enabled development" that we have seen for decades. The second and third themes are motivated by the interest in the interplay between structural opportunities and human action (Leonardi 2011; 2013; Emirbayer and Mische, 1998). Discussion on actions taken, as well as actions planned and actions that would have been desired but constrained by other factors, provides insight into the ability to make use of relational affordances provided to the actor. The fourth and last theme, which normally was introduced by researcher later in the interview situation, is motivated by several aspects of the research design. It is suggested in the literature on generativity that the distributed contributions may or may not be working in concert (Zittrain, 2008), the literature on digital infrastructure describe a paradox of change and control (Tilson et al., 2010), the proposed theorizing logics of digital innovation suggests that there need to be an element of orchestration (Nambisan et al., 2017), and the definition of ecosystem requires an alignment of flows in the ecosystem (Adner, 2017). The interview guide, which was used to introduce the topic and the four themes, is presented in Appendix C.

The loose data collection process is a response to the exploratory, emergent research design and the objective to "let the data speak". It is a way to allow for insight to emerge from the empirical data, while the interview themes that are derived from the theoretical framing still ensure the relevance and focus of data collected. A tight format in the beginning could have blinded from important aspects and reduce the role of context in exploring the phenomenon (Miles et al., 2013).

Contextual grounding is achieved both as part of the interviews and from the complementing secondary sources. A certain understanding about background, current situation and goals in the ecosystem was established already prior to the start of data collection through discussions with both central government actors, who had been charged with the implementation of digitalization aspect of the government program, and representatives from distributed government and non-government actors. The background of evolving digital structures and new related opportunities was also familiar from previous work within the ecosystem and other activities related to use of ICT technology in public sector organizations.

As part of an iterative data collection strategy, pilot interviews were conducted with stakeholders having a broad view on digitalization in public administration and the society in general. The three pilot interviews presented in Table 4 were conducted very early in the research process while still working on the research problem and served primarily for the scoping and formulation of research questions, rather than answering them.

Table 4 : Pilot interviews and outcomes related to research design

Informant	Time	Key insights	Other suggestions
Researcher in national research institute (part of case ecosystem)	October 2016	• Digitalization is bringing significant change in many aspects; including the future of work and ecosystem roles and dynamic. • The governance aspect is a major obstacle in benefiting from digitalization; motivators and incentives of different actors should be understood.	Mixed methods approach to complement the qualitative analysis.
Public official in ministry (part of case ecosystem)	October 2016	• Lots of confusion around the topic as everyone talks about it, but no-one cares to define what they talk about. • Need to be clear on definitions and focused in the study. • Very complex topic; might be better to limit to one sector, e.g. health care reform	Focus on the sectoral reform in the social- and health care area
Research manager in international research organization (external to case ecosystem)	October 2016	• Industry boundaries are blurring. • Openness and standardization are important enablers, but problem is that incumbents dominate the standardization process. • Data management will be in a crucial role • An interesting question is whether digital innovation will be bottom-up or top-down?	Comparative study on international similarities and differences would be very interesting. More quantitative studies will be needed to drive policy recommendations.

The pilot interviews were not recorded, but the key contributions in relation to research problem, scoping and research questions were documented in field notes and extended write-ups were produced soon after the interviews.

The pilot interviews helped to realize the complexity of the topic and the need to better define and focus the study. They also showed opportunities for both quantitative and qualitative research and confirmed the value of taking a broader ecosystem approach as compared to limiting the case to a single organization or a single problem. The pilot interviews produced some additional proposals for the research design, which could not be incorporated to the study, but might be interesting as future research. The proposed focus on digitalization in social- and health reform would indeed be interesting, but as it is a very complex special case with specific organizational, financial and decision-making structures, it would consume all resources on one sub-sector and reduce the potential for understanding the more generic dynamics around

enactment of the generative affordance. Adding quantitative methods in addition to the qualitative approach is also interesting, and a mixed method study would increase the validity of findings, but is not possible in the scope of this study. It might, however, be a logical continuation to validate the findings and propositions quantitatively. This will be discussed in more details as part of proposed further research at the end of the report. Finally, including a comparative study across countries is a very logical suggestion from a research manager in an international research organization, but unrealistic to include in an explorative case study where much of the value lies in the deep exploration of the case and building on the contextual understanding.

Data collection was designed to be iterative with the flexibility to update interview themes as the study proceeds, but as it turned out only fine-tuning of the interview guide was needed and the broader themes remained the same. Based on the finalized research design after pilot interviews, a first round of interviews was conducted between November 2016 and March 2017. All interviews except one were recorded and transcribed by me personally. The reason for one interview not being recorded and transcribed, was a previous experience where the informant felt that the recorded material had been misused. In this case, the field notes of this interview were expanded to a write-up soon after the interview to capture the most important content fresh out of memory.

After the first iteration there was a short break in data collection. Preliminary findings were documented and communicated both within the research community and in the case ecosystem and the relevance of research questions and interview themes were fine-tuned. As the data collected seemed to serve the purpose of the study and the research questions remained valid, only minor adjustments were done. After this chance to revisit the direction of the study, data collection was resumed with further actors that where selected and invited to interviews based on the findings so far. Nine of those responded positively to the invite and the total set of actors included in the study is thereby 21 (excluding the pilot interviews). The informants are distributed across the four groups as shown in Table 5 below. The roles of actors are included in the table to illustrate their position in the ecosystem.

Table 5 : Empirical data corpus used in the study

Empirical data	Description	Organizational roles of actors	Use of data
Interviews in Central Government (4 actors)	Actors working with digitalization policies and strategies in ministries or central governance body for public sector digitalization	Director General, CxO, Member of Public Sector Digitalization Board (DigiNYT), Head of Department (ministry)	Used for preparing actor specific profile of agentic orientations Used in the cross-actor analysis of agentic orientations Used in the cross-group analysis of agentic orientations Used for inductive ecosystem level synthetization.
Interviews in Distributed Government (7 actors)	Actors working with digitalization strategies in government agencies or other distributed public organizations and involved in decision and governance of implementation projects.	CIO, CIO, Head of Integrations, acting CIO, Head of Digital Innovations, Service manager, CIO	
Interviews of Non-Government actors (6 actors)	Actors in companies or academics that influence digitalization in the ecosystem either as in an advisory role or in implementation projects.	Director, Managing Partner, Executive Partner, Head of Education, VP of Sales, President	
Interviews of International actors (4 actors)	Actors in international organizations with some insight and influence in the case ecosystem, but also comparable insight from other constitutions.	Research Director, Policy Analyst, Deputy Director General, Director	
Secondary material	Documentation related to digitalization in the case ecosystem that has been referred to by interviewees.	Government program 2015, Implementation plan for Government program, Digikiri-analysis 2015, Digistartti-review of proposed digital initiatives, OECD recommendation to member states on Digital Government, EU DESI Index, OECD review of Digital Government in Chile (Section 1), OECD Review of Estonia and Finland	Providing contextual grounding Used in the inductive ecosystem level synthetization Used to triangulate the experiences expressed by interviewees

This primary source of empirical field data, i.e. the semi-structured interviews with actors in key roles related to how digital opportunities are acted upon, is supported with a set of secondary data related to the strategic ambitions, policy guidelines and initiatives. These are shown in the last row of Table 5. The strategy for determining which secondary material to include, as there is abundant documentation relating to digitalization in the case ecosystem, has been to include only the materials that were referred to in the interviews. The reasoning has

been that the documentation, which has been referred to by actors during interviews, can be considered relevant for them in their context and consequently also for the analysis as the study is designed to foreground the views of ecosystem actors.

The process of data collection and analysis has been documented for potential future analysis and validation of the study (Miles et al., 2013). Each actor is assigned a code based on actor group and running number (e.g. CG1 for the first interview in central government, NG3 for the third interview of non-government actors, etc) to link views, quotes and references in the analysis to the actor while keeping the anonymity of each individual. Original interviews scripts, field notes, recordings, data transcripts (or extended write-ups if recording and transcribing was not possible), email communication, secondary materials as well as codings, memos, data analysis results, previous versions on reports are saved and can be made available for further analysis if needed.

3.6. DATA ANALYSIS

Data analysis has been conducted in two consecutive rounds with different level of analysis; the individual and the ecosystem. This multi-level approach is needed to explore the interplay between actors and their surrounding and contribute to the understanding of how generative affordance is enacted in the ecosystem. Different methods of analysis have been employed for the two rounds and the reasoning for these choices are described below.

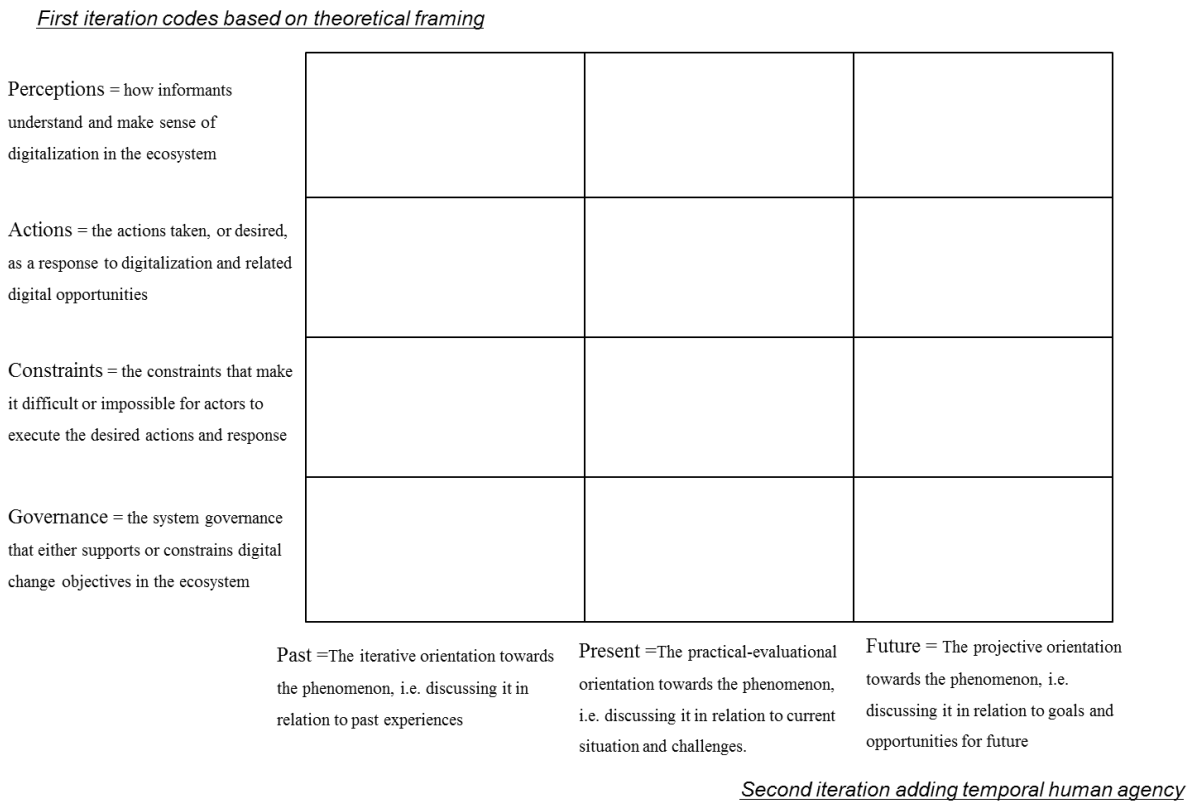
3.6.1. Actor level analysis

The objective of the actor level analysis has been to explore the perceptions and agentic orientations among ecosystem actors, as they will influence their responses to structural opportunities. As the generativity is assumed to be relational to actors and enacted only through the human agency of these goal-oriented actors, it is relevant to understand their reasoning vis-à-vis the phenomenon.

The actor level analysis is based on the interview transcripts and launched with a start list of provisional codes shown (shown in the y-axis in Figure 10), which were selected based on the research questions and theoretical framing. During analysis additional codes that reflect the temporal agentic orientations (the x-axis in Figure 10) were added as this specific perspective of human agency by Emirbayer and Mische (1999) was found to provide a relevant lens for the analysis. This coding was thus done in two iterations. A first coding cycle was done with the provisional code set derived from the conceptual framing and research questions. The same dataset was then analysed in a second cycle that provided a temporal label for each of the

initially coded elements and together these two rounds of coding created the two-dimensional profile for each of the informants.

Figure 10 : Two iterations of coding establishing an actor profile



The profile describes actor orientations based on the aspect of the phenomenon they emphasize in their narratives (perception, actions, constraints or governance) and how they draw on different temporalities (past, present and future) in their relation to the phenomenon.

Establishing a content dimension for each actor is based on the semi-structured but loose interview script, which allows for considerable deviation in the discussion based on the interests of the informant. The interview guide (Appendix D) included prompts about the following four categories:

- how the informants perceives digitalization in the context of public services,
- the actions taken (or desired) as a response to digitalization,
- the constraints that make desired response difficult or impossible to execute, and
- the governance model that would support digitalization objectives.

The time used for each of these topics was, however, determined by the informant based on what he or she felt to be most important. This means that we can categorize the actor's

orientation based on the relative emphasis they gave these topics. The measure for content orientation is the share of the total transcript length that was coded to each of the categories above. The share of the transcript is selected as an indicator because it shows relative focus better than number of coded elements, which could be distorted by variation in coding granularity.

The second dimension of actor profile is the temporal orientations that actors primarily draw on in explaining his or her experiences and views. In the literature review section, we saw how human agency is instrumental in achieving the change that technological structures afford and how the actors draw on three temporal perspectives when making sense of a situation, relating it to his or her objectives and making decisions about appropriate response (Emirbayer and Mische, 1998). This temporal view on human agency suggests that actors take into account their experiences of the past, their perception on the current and their view on the future in their response to contextual digitalization and new opportunities. The measure for temporal orientation is also the share of total transcript length that is coded to each temporal category.

Based on the individual actor profiles, further comparative analysis was conducted to explore differences and areas of alignment across ecosystem actors and between the four actor categories (central government, distribute government, non-government and international).

3.6.2. Ecosystem level analysis

The second round of analysis takes a different approach. As the objective of the ecosystem level analysis has been to increase our understanding of how generative change is enacted in the ecosystem, the methods employed are more inductive and grounded.

The ecosystem level unit of analysis is done with an actor level unit of observation, through capturing of experiences and "self-stories" related to the phenomenon and adding interpretation to the empirical material through decomposition, bracketing, and re-assembling into ecosystem level (Denzin, 2001). The analysis has followed procedures proposed by Gioia et al. (2012) with 1st- and 2nd-order labelling to produce a data structure that captures the informant voices and translates them to emerging theoretical concepts.

Interviews have been the primary data source also in the second also in the second round of analysis, but selective secondary data, shown in Table 6, has complemented the actor narratives in building the synthesized view of how generativity enactment happens in the case ecosystem. Two categories of secondary data has been used: 1) A basic set of documentation on the case context, such as strategy and policy documentation on public sector digitalization, the 2015

government program and related implementation plan, and studies on implementation status and 2) additional documentation relating to experiences and actions that have been discussed during the interviews.

Table 6 : Secondary data sources complement, contextualize and triangulate

Data source	Data content	Use in the data analysis
Contextual materials on case structure (government program, implementation plans and similar public materials).	Digitalization objectives and priorities as well as projected means to achieve the desired outcomes.	Case setting, contextual factors and the backgrounded structures including political agenda, governance models and ongoing public discourse about digitalization opportunities
Other documentation referred to by informants	Complementing details on issues raised or identified during interviews.	Details on actions, constraints or initiatives discussed during the interviews.

Secondary data has been considered complementary to the interview data, which means that the focus of analysis has been placed on the sections that already had emerged as conceptually interesting based on primary data.

The analysis started with inductive descriptive coding (Miles et al., 2014), in which the empirical data was systematically reviewed and labelled. The incoming data was captured, compared and classified through continuous comparison to previously collected and coded data to form increasingly conceptual codes. The outcome of this open coding process is presented in Appendix F.

In the next phase, the data was restructured by grouping open codes that were conceptually similar, linking sub-categories to broader ones, and continuously testing the data against the new structure to ensure coherence. The outcome of open coding was iteratively fine-tuned and each code was defined individually until the content was found conceptually coherent. As an outcome of this axial coding (Corbin and Strauss, 1990) five categories emerged. Based on the open codes and empirical data that form these categories and contribute to their distinct role in understanding the phenomena, they were described, defined and finally named. The axial categories along with some examples of open codes for each, are presented in Table 10.

Table 7 : Axial categories and Open code samples

Axial Category	***Open Code samples***

Contextual change and roles of public administration	• Industries are changing • Increase in complexity • Roles and responsibilities • Need for new approaches
Managing the fundamentals	• The foundation for digital innovation • Data as key asset • Service layer • Digital asset portfolio
Evolutionary customer centric development	• Implementation challenges • Holistic approach • Gradual change in initiatives • Digital evolution • Innovation logic
Governance and institutional arrangements	• Hard structures (legal, budgetary and sourcing structures) • Resource management • Centralization vs. decentralization • Attracting innovators
Culture and attitude	• Risk taking • Leadership • Increased mental readiness • Isolation and Not Invented Here

The emerging categories were considered provisional during continued data collection and analysis, to make sure that they can be verified repeatedly against incoming data. The codes that did not hold when compared to additional empirical data have been revised. The changes made to the initial set of open codes are presented in Table 11.

Table 8 : Fine-tuning of codes at the transition from Open coding to Axial coding

Open Code	***Volume***	***Change for Axial coding***	***Reasoning***
Decomposition and re-aggregation		Split the code: 1) Decomposition and re-aggregation (CAT 2) 2) Decomposition and re-aggregation (CAT 3)	The data content was too broad to fit into one category, as it referred both to the need for fundamental elements and the subsequent re-aggregation. As it is a key issue in the proposed approach that these needs to be separated, it is better to be more granular in the coding of this data.

New approaches needed		Split the code: 1) New approaches to the contextual changes (CAT 1) 2) New development approaches (CAT 3)	The data content was too broad to fit into one category, as it referred both to the overall approach to contextual changes in PA and the approach in digital development.
Service Delivery	5 references by 2 source	Merged to *Customer centric approach*	The data content referred more to the opportunity for more customer driven services based on technology and data, not the delivery process as seen from provider perspective
Disruption	2 references by 1 source	Combined with *Transformative change*	The volume is small and the content similar to another more dominant open code
Programs	2 references by 2 sources	Combined with *Program implementation*	The volume is small and the content similar to another more dominant open code
Common services	1 references by 1 source	Combined with *Service layer*	The volume is small and the content similar to another more dominant open code
Complexity	1 references by 1 source	Combined with *Increase in complexity*	The volume is small and the content similar to another more dominant open code
Mobil devices	1 references by 1 source	Combined with *Consumerization*	The volume is small and the content similar to another more dominant open code
Term digitalization	1 references by 1 source	Combined with *Ambiguity of term*	The volume is small and the content similar to another more dominant open code
Attitudes	14 references by 8 sources	Removed as the content was moved to more granular codes	Texts in this higher level code where moved to the more granular codes of CAT5

The original codes that were found to be either duplicates or too weak in explaining the phenomenon under study were combined with stronger codes related to the same issue as showed in the table. As the target of axial coding was to assign each open code to only one category, there was a problem with three codes, which were too broad to match only one category of the emerging structure. There codes where re-analysed in more detail to see how the data fit with the emerging categories and this resulted either in splitting the original into two new codes, which was the case for the codes "*new approaches needed*" and "*decomposition and re-aggregation*", or move all of the data to more granular codes, which was the case with the code "*attitudes*". The situation that occurred with code "*Decomposition and re-*

aggregation" is describing this challenge and how it was solved. The code captures experiences and views, which together suggest how digital benefits could better be realized, but in light of the emerging categorization the data content captured essential issues of both "Managing the fundamentals" and "Evolutionary customer centric development". Splitting the code into two, which each would include the empirical data that together with other open codes build the argumentation for each category, was a necessary step in the analysis, but obviously two aspects will remain closely related in understanding the digital structures and overall ecosystem change dynamics.

3.7. VALIDITY CRITERIA

In the design and execution of the study, special care has been taken to ensure the relevance and validity of the results. This sub-section presents the way the study has been executed against guidelines and recommendations and interpretative case study research (Walsham, 2006; Miles & Klein, 1999) that explores novel phenomena in its context (Eisenhardt and Graebner, 2007).

Eisenhardt and Graebner (2007) propose guidelines for building theory from case studies and explain how the inductive approach used to build theory from qualitative data is the other side of the coin from the classical deductive approach that will use additional data to test the theory. Using qualitative studies to formulate constructs, models or theoretical propositions is according to them always inductive, and conceptual models and theory is best developed by recursive cycles between case data, emerging theory and extant literature (Eisenhardt and Graebner, 2007). In this study, a need for such cycle was recognized in the early design phase and the data collection and analysis have consequently been done in parallel and iteratively, going back to the case data as well as literature when formulating synthesis and writing the propositions. Two issues that Eisenhardt and Graebner (2007) emphasize in particular are theoretical sampling and dealing with interview data. Theoretical sampling has been used in this study, both for selection of the empirical field and for selection of individual actors to invite for interviews. While interviews are recognized as highly efficient ways to gather rich empirical data (Myers & Newman, 2007), Eisenhardt and Graebner stress the concern about impression management and retrospective sensemaking by image-conscious informants. As a response to this challenge Eisenhardt and Graebner propose selection of *"numerous and highly knowledgeable informants who view the focal phenomenon from different perspectives"* (2007: p. 28). This advice has been followed to the extent possible in the study by including 21 ecosystem actors, who are in different roles but all fulfil the theoretical selection criteria of being in key positions where they are highly involved in the influencing, decision making, and

implementation of digitalization in the case ecosystem. This makes the informants highly knowledgeable of the focal phenomenon and the sampling from different actor groups ensures that we have included different perspectives.

As the study takes an interpretive approach, the more specific guidelines produced by Walsham (2006) and Klein and Myers (1999) can be used to guide the execution. Walsham (2006) claims that our theories concerning social reality are ways of making sense of the world in a socially constructed way and proposes a set of recommendations for conducting interpretivist research. He highlights the need to find a balance between acting as external observer and getting more involved. In this research I have tried to keep some distance to the informants and their problems, in order not to get too socialized to the views and problems of the informants. The disadvantage of keeping the role of external observer could be more difficult access or less willingness of informants to contribute with their experiences and ideas. This has, however, not realized in the case as most actors contacted agreed to be interviewed (21 / 24) and I did not feel in any of the interviews that they were holding back with information or would be unwilling to share their experiences.

Walsham (2006) also elaborates on the importance of planning and conducting interviews properly, including the choice of being passive in the interview versus active in directing the discussion and discusses the benefits and drawbacks of recording and transcribing. In this study the interviews were semi-structured with 4-5 topics where the following was introduced when the discussion on the previous one was running out. This directed the discussion to cover all the topics of interest, but allowed the informant to determine which experience they want to tell about and how long and detailed those descriptions would be. On the scale of active / passive, these interviews have been on the passive side with intervention and adding new cues only when the discussion seemed to stall or there was a risk of running out of time before all themes had been covered. I also had the opportunity to record and transcribe all interviews except three (one was denied by informant and two others were held in public locations where recording would have been unnatural). Walsham warns about high workload (that is away from other research efforts), potential impact on informants, and a risk that coding detailed transcripts might direct efforts to technical execution from the more valuable task of interpreting the data. Transcribing recordings did naturally generate more work, but I did not feel the other disadvantages. After asking permission to record, and at the same time ensuring that anonymity and confidentiality of informants will be protected, it did not take long before discussion was so energetic that I assume both parties had forgotten about the recorder. In the analysis, I feel

that the recordings have been priceless, and neither the profiling of actor orientation nor the grounded analysis would have been possible without the recordings.

A third and final aspect that Walsham (2006) highlights is the role of theory and his view is that although the choice of theory in the end is subjective and based on what speaks to the researcher, an open mind to different theories and broad reading and consideration of alternative theories would produce the best result. In the study at hand, the generativity of digital infrastructure spoke to me as a potential explanation of how actors would be able to make use of digital opportunities that goes beyond individual solutions or organizations. Other theories, such as institutionalism (DiMaggio and Powell, 1983), sensemaking (Weick, 2005; Maitlis and Christianson, 2014), sociomateriality (Orlikowski and Scott, 2008; Leonardi, 2013) organizational routines (Pentland et al., 2012; Feldman and Pentland, 2003), service-dominant logic (Vargo and Lusch, 2008, 2016) were considered in the early stages of the research, but the chain of arguments that digital generativity through relational affordance and temporal human agency could lead to distributed change and innovation, fell into place as the most promising path to take. The other theories mentioned still hold potential and are briefly discussed in the section of suggested further research.

The most detailed criteria for design and evaluation of interpretivist studies is provided by Klein and Myers (1999) with seven fundamental principles for the conduct and evaluation of interpretive field research in information systems. These seven principles, described in Table 17 below, are according to Klein and Myers not enforced as mandatory but offered as support for conducting and evaluating interpretivist studies. The application of the principles is left to the judgement of each author and the way they have influenced the design and execution of this study is presented in the third column.

Table 9 : Seven principles for interpretivist research in IS (Adapted from Klein and Myers, 1999, p. 72)

Recommen-dation	***Description (Klein and Myers, 1999, p.72)***	***Application in this study***
The Fundamental Principle of the Hermeneutic Circle	"Suggests that all human understanding is achieved by iterating between the interdependent meaning of parts and the whole that they form."	The study follows this principle by decomposing actor narratives to elements, which are conceptually labelled and re-built to increase our understanding through a storyline that is composed out of the empirical data.
The Principle of Contextualization	"Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged."	The literature section on digitalization in Public Administration explains the development from e-Government to more holistic approaches and the section on empirical setting in 3.4 presents the historical, political and technological development in the case ecosystem.
The Principle of Interaction Between the Researchers and the Subjects	"Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researcher and participants."	The approach has been a "middle ground" by use of broad interviews themes that focuses and advances the discussion, but allows for informants to communicate "their stories" and focus on the issues that have been relevant to them. The role of researcher has been mostly to encourage the informant and add cues when needed.
The Principle of Abstraction and Generalization	"Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that explains the nature of human understanding and social action."	The theoretical framework with affordance theory and temporal human agency explain how opportunities are relational and actors relate to the past, present and future in making sense of the phenomenon and taking action. Empirical details and interpretations have been related to this frame.
The Principle of Dialogical Reasoning	"Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision."	Iterations between data collection, literature and emerging findings has allowed for constant comparison and adjustments as more data is accumulated. The analysis is iterative by nature and the conceptual categorization is done iteratively.
The Principle of Multiple Interpretations	"Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it."	Several theoretical explanations have been considered in various stages of the research; in the design phase, in literature review, in analysis and in the suggestions for further research.
The Principle of Suspicion	"Requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants."	The actor bias is already part of the relational affordance claiming that actors behave out of their own perceptions and views. Researcher bias is mitigated through systematic inductive coding with conceptual labeling producing emergent categories

4. RESEARCH FINDINGS

This section presents the detailed analysis and the findings of the study. As the analysis has been designed to answer the two research questions, findings will be in two sub-sections followed by a summary that reviews how the findings answer the two questions.

The first part presents the findings that relate to individual actors. It presents how individuals in key roles in the case ecosystem relate to the opportunities and challenges posed by digitalization and is designed to answer the first research question: *"How are digital opportunities and challenges in a public service ecosystem perceived by the actors and how do the perceptions that underpin their response differ or align across actors and actor groups?"* The analysis draws on temporal human agency (Emirbayer and Mische, 1998) as a lens to understand how the perception is influenced by the past, present and future. Temporal human agency posits that these temporal orientations influence agency and that the interplay of actor habit, imagination, and judgment would be key to reproducing and transforming structures. The temporal dimension is in the analysis complemented with a categorization of how actors focus on different aspects of the phenomenon in their narratives, such as actions, constraints or governance requirements. Together these two dimensions, the temporal and content dimensions, form unique actor profiles, which are used to identify differences and similarities in agentic orientations of actors and actor groups.

The second part of the analysis is an inductive analysis to provide a synthesized description of generativity enactment in the case ecosystem. The analysis is based on the same empirical data, but the level of analysis is on the public service ecosystem rather than the individual actors. The analysis responds to the second research question: *"How are individual responses to digitalization enabled or constrained in the ecosystem and how can ecosystem governance be organized to support digital generativity?"* This second part of the analysis follows procedures recommended for inductive and interpretative research by Gioia et al. (2012) to produce a data structure that illustrates the emergence of second order themes and aggregate dimensions out of the field data.

Together the two rounds of analysis provide insights for the research problem of how the opportunities for generative change can be enacted in the case ecosystem.

4.1. AGENTIC ORIENTATIONS OF ECOSYSTEM ACTORS

The first part of analysis concerns the experiences and views of ecosystem actors (individuals).

The theoretical background and the conceptual framework presented before explain the reasoning and arguments for the strong emphasis on ecosystem actors. Socio-technical and socio-material views have shown that technological determinism is ungrounded and that social actors are instrumental in realising any opportunity for change that is offered by technology The theory of affordance complements this view with a relational aspect, claiming that opportunities are not the same for all actors, but dependent on the understanding, goals and abilities of the actor. The affordances turn to specific outcomes only through goal-oriented actors that perceive the affordance in relation to his or her objectives and acts upon it. This is the reason for taking individuals as a level of analysis in the first round of analysis. Explicating how actors understand the phenomenon in their specific context and how they respond to the opportunities and challenges in the ecosystem, provides a foundation for further exploration at the ecosystem level.

The empirical data for this first round of analysis consists of interview transcripts, which have been systematically analysed with software for qualitative research analysis (NVIVO). Secondary material discussed and collected during field work might have contributed to the contextual understanding and provided additional details to some of the issues referred to in the interviews, but as the emphasis has been on actor perceptions, understanding and orientations in relation to the phenomenon, this secondary material has not been included in the coding.

4.1.1. Uniqueness of agentic orientations

During the iterative process of data collection and analysis, analytic memos have been produced as reflective research notes on what potentially could be learned from the data (Miles et al., 2013). Interviews have been summarized into condensed description of informant's point of view. Looking at a few examples of these interview summaries shows already at a high level how actors differ in their agentic orientations based on role and position in the ecosystem, previous experiences and future goals.

ACTOR A: The first example describes the experiences of an actor in central government involved in policy making and legislation related to digitalization. The interview that lasted for 40 minutes contributed with many insightful examples of how the context is changing and new approaches will be needed to stay relevant and competitive as a society.

The perspectives discussed include those of changing roles in the ecosystem, the resistance to change and the lagging of legislation, also comparing digitalization to previous changes of similar kind in other areas such as telecom and media.

The informant stresses the importance of data as the fuel of the digital economy and the need to allow "data to flow", meaning that actors across private and public sector should be able to make use of it for innovations. The role of public sector is to enable and make sure that old regulations that hinder new services (or even make them illegal) are removed.

The informant provided excellent examples of past operational modes, which have been very "production-oriented" (also when speaking about other service industries), the consequences of that, and examples showing the surprising results that could be achieved when "opening up" for external innovation.

The current development model is, according to the informant, too biased towards the needs of project managers; trying to "guess" the needs, defining a solutions against requirements, and implementing according to specification, whereas the recent experiences show how broad access to data can produce unexpected and highly valued services in very short time. A challenge is, however, to move the learnings from these trials to the formal development model and governance system.

Many of these issues gain support from other actors as well, especially the emphasis on data and the need to change the way how development is done, but there is a unique "flavour" of how the actor compare to previous changes in other sectors and provide examples of successful and failed modes of operations. The short summary shows how the actor's perception of digital opportunities is building on past experiences and how the models of the past have become outdated in the present context, with less emphasis on the future-oriented projective orientation. This orientation could be influenced by involvement in previous deregulation efforts (insightful examples from the past), excitement about new examples where digitalization combined with new models have enabled radical innovation in very short time periods (role of data, experimentation and hackathons), but also the visibility into a broader set of digital initiatives provided by the position in a central ministry (pessimism about how most initiatives are too dominated by the needs of a project manager that needs control).

ACTOR B: The second example is a summary of the interview with an actor in distributed government. The interview lasted for about 1 hour and was summarized as follows:

Digitalization in public sector is a continuation. We have been implementing building blocks like "digitizing paper-processes" in the first wave (and in many cases still are), but the second wave

of digitalization will change the operational models more profoundly… towards a more customer centric direction.

The change would come through more open (providing examples of sourcing models and hackathons), sharing (e.g. sharing open source outcomes) and phased implementation (as opposed to multi-year programs that will be outdated when finished), on top of the building blocks that currently are being put in place. We need to take a broader perspective in our development, more collaborative approach based on shared data and establishing platforms. Taking such an approach, without running into the traditional mega-projects will be challenging and most of all it will be a huge leadership challenge.

It has implications on many aspects, including budgeting models, the target setting and monitoring, etc. When looking at the digitalization initiatives launched after the new government, I still see much of the traditional approach.

The initial view that digitalization is an evolution that builds on the ICT-enabled development done for decades (the building block idea) is a line of reasoning that is supported by many other actors, but there is a difference in emphasis on the evolutionary aspect as compared to the projective view that we are coming to a paradigm shift that brings disruption more than evolutionary change. This actor has a strong agentic orientation towards future opportunities, but also stress future challenges related to funding, target setting and leadership. This seems to be related to the fact that the actor is in a position in distributed government where he / she should promote the overall digitalization agenda but is hindered by many structural constraints. This leads to a projective orientation that aims for *deliberation* from current constraints (Emirbayer and Mische, 1999), such as taking a broader approach to development, renewing the budgeting model, establishing new KPI:s and monitoring of gradual progress, etc.

ACTOR C: The third example presents the views of a non-government actor actively participating in the implementation of digitalization initiatives in public service ecosystem. The interview lasted for 1 hour 20 minutes and contributed with many insightful views on how governance within and across initiatives could be improved. The most revealing topics were condensed to the following summary:

Real digital innovation capacity is still rare, but it's coming. At the moment, we are building capabilities for future innovation, but most initiatives are still driven by more direct short-term benefits. The desire and need to really unleash innovation can be recognized in the talks, however, even if not yet in actions.

And when we are getting there, it will require different development and governance modes. We need to find ways of advancing initiatives more gradually and step-wise, with continuous evaluation. Accepting evolution and the fact that you can't see a defined solution as the end point. Each step should provide immediate benefits as well as enabling something more. It is a digital evolution and no-one of us will be around to see the end of it. The change is comparable to the change we have seen in ERP-systems, where the solution used to be the target, but now we see the ERP more as a platform for future development.

The traditional ROI-model used today can be good for evaluating a single step in the evolution (indicating that it is would be a good investment on its own), but there need to be other modes of governance, which are more long-term and working across projects. Across digitalization initiatives, we need to manage the common digital assets; a kind of asset portfolio management. Not project portfolio management, but asset portfolio management comparable to how infra assets or working capital assets can be managed. Having such a portfolio would generate innovation just by people realizing what would be possible with assets available.

There are some elements in how the issues and challenges were expressed by this actor, such as the portfolio management approach to digital assets, which are unique, but the general view resonates well with other actors who also stressed the importance of more step-wise development with continuous re-evaluation and the need to promote and enforce the use of common digital assets. The temporal orientations of this actor tend to lean towards the projective future orientation, which is supported with a substantial amount of practical-evaluative reflections to ground the future-oriented proposals. This orientation is understandable against the role in one of the digital spearhead initiatives, where we find most of the broader ambitions of establishing components and platform for further innovation, but also the challenges of multi-stakeholder initiatives, which easily leads to tight specifications and strict project management control.

As seen from these three summaries, we can easily recognize different agentic orientations in how actors relate to the contextual changes and digital opportunities. As proposed by Emirbayer and Mische (1998) it is not a choice of one temporal orientation, but a relative focus where one or two orientations is more dominating than other(s). None of the interview summaries are purely iterative, practical-evaluative or projective, but normally it is possible to identify one or two orientations that are more dominant than a third.

While preparing analytics memos and summarizing actor interviews, we also found another difference between actors. The actors emphasize different aspects of digitalization in the ecosystem as they explain their experiences and views. As mentioned in the design section, the

data collection strategy was to approach the informants with a loose interview structure to allow for them to put emphasis on the areas that they found most relevant. This resulted in a "content" difference between actors. Some wanted to use much of the interview time to discuss how they see the contextual changes, whereas others saw it as more relevant to discuss actions taken or constraints they have run into, while yet some others quickly directed the discussion towards governance models that either support or limits the ability to make use of new digital opportunities.

These two orientations, the temporal and content orientation, have been used to form a two-dimensional actor profile.

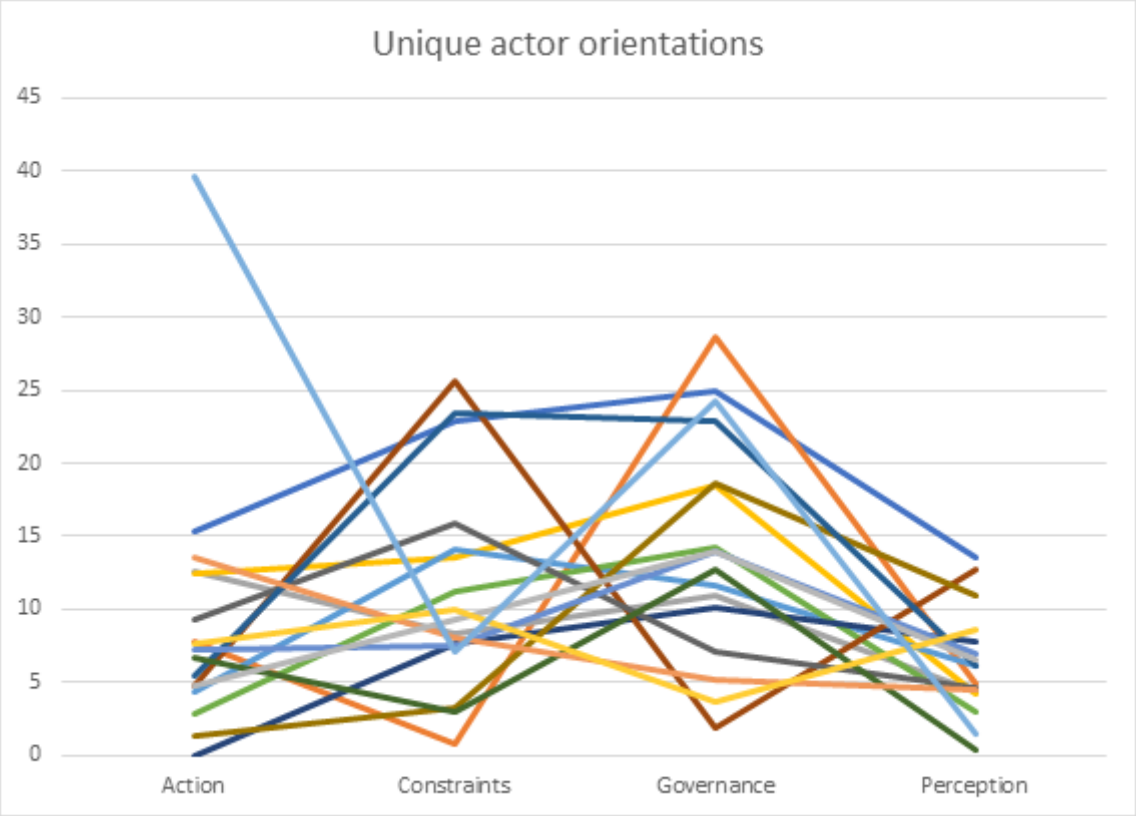
4.1.2. Content orientation of ecosystem actors

The first dimension of the actor analysis, indicating the relative weight that actors gave to four main themes of the interview, is the outcome of a first cycle coding. The categories are:

- the actor *perceptions* of digitalization in the ecosystem and how it differs from previous eras of ICT enabled development,
- the *actions* taken as a response to digitalization, or would be taken unless constrained by internal or external factors,
- the *constraints* that limit actors in their efforts to make use of new digital opportunities, and
- the *governance* aspects that should enable better response models and support the digital success of the ecosystem as a whole.

A quick review of the outcome of first cycle coding shows there is a significant variation in how they approach the phenomenon. Although all of the actors are well-informed and have substantial experience in the field, they clearly emphasize different aspects of the phenomenon, as shown in Figure 11.

Figure 11 : Content orientation of ecosystem actors



The diagram in Figure 11 shows that there are actors who focus on constraints more than actions, others who focus on most on governance and less on all other issues, one who has a peak in actions that clearly exceeds all others, etc. The only strong conclusion that can be made from the diagram is that they are different. Some nuances can, however, be recognized, such as a rather even distribution in the areas of governance and constraints and less content in the category of perceptions. A reason for the interest in governance might be that the study has been focused on digitalization in public service *ecosystem.* This was introduced already in the interview request and stated at the beginning of each interview, which is likely to have brought attention to the challenges associated with collaboration and cross-organizational governance. On the other hand, the topic of governance was usually discussed at the end of the interviews, which could have cut the discussion short if some informants were running out of time.

The rather small proportion allocated to perceptions is a small surprise considering that the phenomenon is broad and complex and there are different views on what counts as digitalization and how to respond. All interviews were introduced with a broad and open question of "how would you describe the difference between the digitalization that we speak about today and the past decades of ICT-enabled development", which opened up for the discussion on how they

perceive the phenomenon. All informants had a surprisingly clear answer on the topic, although they differed considerably from each other.

The categories are below presented in the order that they most commonly were introduced and discussed in interviews. The interview guide is presented in Appendix B for reference.

Perceptions

Although *perception* was usually not (with one exception) the most dominating area of discussions in interviews, it does contain many insightful views on how the actors see and understand the digital changes in the ecosystem. The introduction and prompts at the beginning of the interview was designed to leave the route open for the informant to elaborate on how they see digitalization, its drivers, the difference to previous phases, and possible future development. The small difference in how much emphasis actors put on this category does not mean that they all think about the phenomenon under study the same way. On the contrary, actors did express very different, and sometimes opposite, views in the reflections on the topic.

First, many actors perceive digitalization as an evolutionary process building on what has been done before, but at the same time they feel that it is, or will be, dramatically changing the logic of organizational development and calls for new development and operational approaches. This can be seen in quotes such as *"We have the evolution that goes along the evolution of the internet." "It goes much further back, 50-60 years"* and *"Absolutely, it is a continuation"* versus views claiming that we need *"totally new ways of working"* or are approaching a *"paradigm shift".* The difference in perceptions indicate that we might be right at the shift between an era of ICT enabled organizational development and a digital era, which would require new approaches, roles and operational models. This would be supported by informants explaining their experiences, expressing views that the "old way" of design, implement and operate will not be sufficient any more, like "*We cannot start by analyzing all the required public capabilities, build an information architecture and then decide that 'let's implement this'*. Some say that the old way of working is not feasible any more today and others say that it will not be feasible in the future, which indicates that there is a difference in how far the actors perceive the digitalization to be today.

The temporal aspect does indeed connect the different perceptions into a progression over time, where evolution of digital structures has reached, or is reaching, a tipping point where the evolutionary technology change can have disruptive socio-technical consequences. One of the actors expressed this in the following way: *"There has been some foundations that need to be*

in place. You cannot jump directly to some 'transformative digitalization'". More details on the actor perceptions along the temporal dimension will be discussed in the following subsections.

Other dimensions of how the actors perceive ecosystem level digitalization, include:

- How digitalization is a "business issue", but you still need to understand the technology, what it enables and where its limits are in order to take advantage of it and enable digital innovation, such as "*There would not be any digitalization if development of technology would not have enabled it. It is useless to put these* [= business and technology] *against each other. … The business would not change unless technology would have enabled new ways of working".*
- How the roles of public administration vs. private organizations are changing to allow and attract more actors to participate in digital innovation in the ecosystem, such as "*The paradigm change of Public Administration is that all structures, organizations, leadership models, culture and processes are built for a predictable world. A world where you can approach the future in two ways; by planning or by preparing. Neither one of them will work very well in today's world",* and *"We should encourage the private sector to participate in development. 'Look, we have these asstes. You can take advantage of them'. Activation is needed!"*
- How digitalization would require either more or less centralized control and coordination, such as "*And I do believe that top-down guidance is sensible to do, but how it is done is the question",* and *"In the 90s, we tried to find a more centralized way of operating, … , and since then we have moved back to the decentralized direction. It has not come to an end, fortunately I would say, because now we are in a new situation where we should offer compatible and connected platforms."*

Actions

The category of *action* generated most discussion in the groups of central government and international reference actors, but much less among the non-government actors.

This might be explained by following reasons. First, central government actors might have a natural inclination to emphasize what they have done to promote digitalization as it has a central role in the government program and they have positions where they are expected to advance it.

Second, the objective of including international reference interviews in the study was to include persons with a broader experiences and could compare the case ecosystem with experiences in

other countries. This might have influenced the wordings of the researcher in the interview situation towards "can you tell me what has been done / what has worked well in other countries" rather than the preferred wording of "can you tell about your views and experiences…" that normally was used in the interviews. This resulted in more responses such as *"we got the feeling that they can do even more. They can build up more proactive delivery service delivery, they can also improve the articulation btw different levels of government, etc."* that are labelled as actions.

Third, the non-government actors might not see or appreciate all the actions that are being taken as they are mainly involved in the implementation of individual digital initiatives.

Looking across the groups, the analysis shows that data acquired related to actions is quite fragmented, including actions taken on a personal level to lead the change, "*Yes, I have been an entrepreneur in a way. As a term I have not used it, but it's just what you need to do: you have to take risks. [..] I think it is more fun at work with new stuff happening*", actions taken in the formal initiatives "*We have been running this kind of club, where the mgmt can together talk about business prototyping etc*.", as well as more experimental actions sometimes taken "under the radar", such as *"We built mechanisms that enabled project amendments during the next five years if something seemed to be a "dead end" or otherwise failing to realize the expectations"*. As a consequence, limited conclusions can be made based on this data in the in-case analysis and comparison between actor groups, but the detailed data will be useful for the cross-case consolidation, despite being fragmented.

Constraints

The line between what should be considered governance and what is a constraint can sometimes be blurry, but the code definitions prescribe that passages that express challenges of driving through desired actions, normally from the viewpoint of a single actor, would be coded as constraints, whereas the views on roles, coordination and decision making, often involving multi-actors or the whole ecosystem, would fall under governance.

The analysis shows that non-government actors emphasize this category over the other three. A reason for the higher interest in constraints might relate to the fact that they are excluded from the policy discussions, and might not be part of early experimental activities to advance digital development, but do run into the constraints and barriers in the digital initiatives. The practical implementation role also reveal constraints that might be unnoticed by policy makers. The examples provided indeed show that the views on constraints come from first-hand

experiences, such as "*One thing is the mismatch between a "waterfall"-funding model and agile software development model*", "*It's difficult to drive change if you don't have own budget and own resources",* or *"They mean well, but already a look at the slidesets shows that everything is coming from the desk of the project manager. They start by "guessing" the need, which is formulated to a project, which is then resourced and implemented."*

The non-government actors, and the distributed government actors, also showed more frustration when discussing constraints, whereas the actors in central government discussed the challenges constraining digital development in a more neutral tone. *The administration is so sector-driven that it is <u>really</u> difficult to get anything done!" and "That's the point! You cannot lead with the old waterfall model"* are examples that reflect an underlying frustration.

<u>Governance:</u>

The analysis shows that most of ecosystem actors devoted a large share of the time to ecosystem *governance*, but we can also identify differences in the narratives related to governance. The central government actors relate to their experiences of driving the digitalization agenda, which means that they highlight governance aspects that would match societal changes and the changing role of public administration. Examples of this include "*We come to the question of how agility and responsiveness can be achieved in the ecosystem culture. It is really about the national culture and changing the governance model*", "*The role will be to include the society to build public good. And the roles of PA will be more on the empowerment and enabling through partnership*" and *"The assumption of the old "design paradigm" is that you would be able to clearly define the problem. This is not anymore the case*".

The international actors discuss the governance from a policy point of view and elaborate on models that have been successful in various countries. The governance models discussed are at a higher level and relate to the paradigms of public administration, such as "*this very practical 'once only'-principle will be driving a lot of transformation and a lot of revisiting of legislation and procedures"*, "*Hand in hand with Digital Government, we work with Open Government, which means deeper interactions with citizens. The digital world will provide much better tools for this than before*" and *"The paradigms have changed, and you need to have a more responsive mode of working"*.

The distributed actors (i.e. distributed government and non-government) also showed great interest in governance but their views and propositions are more down to earth and often linked to the actions taken and especially to the constraints that they experience in the implementation

of digital change initiatives, such as *"I would repeat that we have institutions, collective agreements, etc. from the old times. This should change."*, *"There are laws that are rooted in the 19th century. Legislation may not yet be up to the needs of such a digitization effort"*, and *"As long as the distribution of money goes the traditional way following administrative sectors* [it will be difficult to achieve change]".

An area, which was stressed by actors in all groups, is the governance challenge related to isolation, fragmentation, administrational silos, transparency, "not-invented-here"-syndrome and a general lack of collaboration across organizations. This is reflected in quotes such as, *"When it comes to governance, I would urge the need for cooperation", "There are silos, fragmented expertise, and provincial thinking.", "These are sub-optimizations and silo thinking" "There are many forums where one can express concerns about how bad things are. But in those forums there is no decision-making power, so they are on average a waste of time", "Horizontal co-operation between various departments is difficult because people are ultimately responsible to their own superiors*" and many more.

This high emphasis on governance issues are in line with initial practitioner discussions in the early steps of the research, where both central and distributed government actors expressed an interest in how digitalization challenge existing roles in the ecosystem and how it might call for new modes of collaboration and development. It was therefore not surprising that governance would take a central role in the discussion, but in addition to the share of time allocated there was often also an increased intensity and "energy level" in the discussion when discussing governance. Statements such as "*Now we are coming to the core of the problem* [when asking about governance]*! There is a really big challenge with execution*", *"Now we have those new spearhead projects and my fear is that they will still be run as "mega-projects", instead of taking one step at a time!"* and *"The "Usual Suspects" meet each other, and that conversation doesn't really create very much new as outcome!"* include a passion that was more frequent in discussion related to governance than in other categories. Telling is also that these more passionate statements normally came from actors in either non-government or distributed government.

Differences in content orientation between actor groups

In respect to the content orientation, governance issues caught the highest attention in all groups, and perception the lowest, whereas we see a difference between groups in how much actors emphasized action and constraints. Both central government actors and distributed government actors dedicated, in average, most of the interview time to governance and approximately equal share to actions and constraints. The two other groups show a different profile with less relative emphasis on governance and more on either actions (international group) or constraints (non-government group).

The higher focus on constraints among non-government actors is interesting and indicates that there are barriers against benefits realization that the non-government actors face as part of implementation initiatives but government actors, both central and distributed, might be unaware of. The focus on actions taken or desired is also unevenly distributed across the groups, with non-government actors taking least time and international reference actors spending the highest share of the available time to discuss actions. The reason why international actors devoted so much time to this category was because they contributed with experiences from different countries and could tell about what actions have been taken and which of them have been more or less successful.

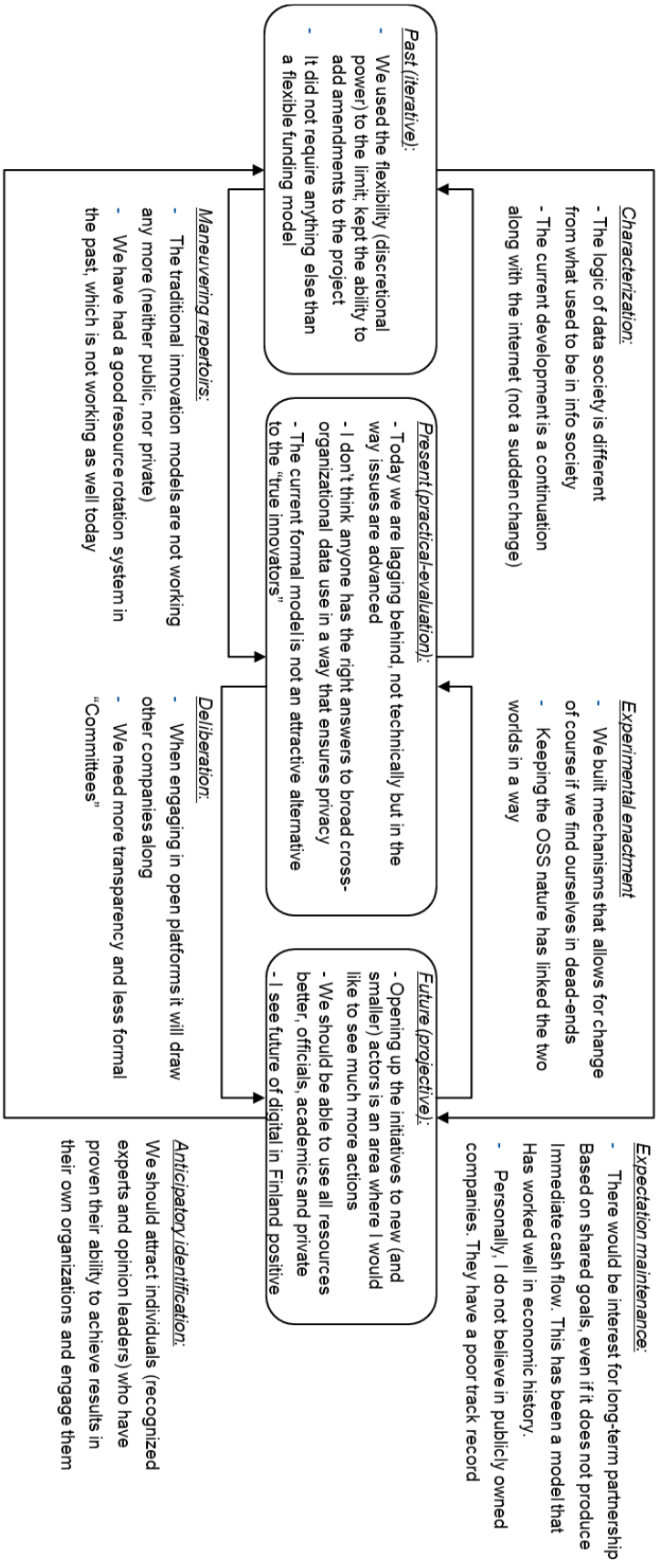
4.1.3. Temporal orientation of ecosystem actors

The temporal dimension of actor profile is based on a second cycle coding, where all data elements of the first coding iteration have been assigned a second label indicating the temporal orientation.

Actors differ in temporal orientations and although most of them are normally guided in their agency by one primary orientation, all three orientations do work in parallel and they can all be found in the empirical data. This is illustrated by the example in Figure 12, which describes the temporal reasoning of one of the actors in the study. The interview data is here mapped to the temporal frame of Emirbayer and Mische (1998).

Mapping empirical data to this model by Emirbayer and Mische (1998) explicates how the actor relate the phenomenon to past experiences, the potential it holds in relation to future goals, and its practical instantiation in his or her current situation.

Figure 12 : Temporal orientations of one of the non-government actors



The non-government actor illustrated in Figure 13 above is actually one of the most balanced in the use of temporal orientations (13 % of the total transcribed material related to the past, 14 % to the present and 14 % towards future opportunities) and this shows why it is important to acknowledge all temporal orientations to understand the reasoning and agency that follows.

The example shows how the actor is using selective attention and reactivation of past experiences in the reasoning about current contextual challenges and future opportunities. Further, it also describes how the different temporal orientations are connected to each other (the arrows in the Figure 12). The *manoeuvring repertoires* position past experiences of the actor in relation to the new context and *characterizations* are used to make sense of the current situation by relating it to past experiences. In a similar way, *deliberations* are used to describe how actions of today will promote future objectives and *experimental enactments* can be seen as operational modes of the future which are tried out in the present. The direct interplay between past and future was less frequent in this interview, but some elements of *anticipatory identification*, drawing directly from the past to the proposed future, and *expectations management*, explaining the proposed future with past experiences, could be identified.

As pointed out by Emirbayer and Mische (1998; p. 964), and seen in the example above, actors have several temporalities in parallel but are often led in their actions by one primary orientation: *"They can be said to be oriented toward the past, the future, and the present at any given moment, although they may be primarily oriented toward one or another of these within any one emergent situation."* The leading orientations vary by actor and in this study we find that many actors have a strong inclination to project the phenomenon towards future goals in their reasoning, whereas others draw mostly from present situation and a few show more balanced orientations, like the example above. Table 10 below shows the orientations of three actors to visualize the differences.

Table 10 : Temporal orientation of three actors in the study

	Distributed government actor with predominantly present orientation	Central government actor with predominantly future orientation	Central government actor with balanced orientations
Future	Medium	High	High
Past	Low	Medium	Medium
Present	High	Medium	High

Understanding how the actors in the case ecosystem use temporal orientations in their reasoning is a basis for building shared understanding, initiating policy actions and taking other measures to realize the benefits of digital opportunities, and exploring these orientations is the focus of this subsection.

Past, present and future orientations

Analysing the findings across all actors, shows that there is a strong tendency to lean towards the practical-evaluative orientation, i.e. the present, as well as the projective orientation towards the future.

On the contrary, actors in average rely less on the past in explaining their experiences of contextual changes, digital opportunities and related challenges. The strong practical-evaluative orientation might reflect the sampling strategy to target actors who are in the middle of digital change, are faced with real opportunities and challenges, and have a role of either influencing or deciding about actions taken. Grounding their views in the *present* situation supports the view that the informants are not among those who like to talk about the "hype" and a digital future without a connection to the challenges of reality. This finding emerging from the analysis raises an interest in the category of *past* orientation. Why is it less dominating than the other two orientations and which past experiences are being used as references for understanding future digital opportunities?

Looking in more details at the text coded to past orientation shows three aspects of past experiences that are commonly referred to; a comparison to similar socio-technical disruptions of the past, the past evolution of digital structures, and the mismatch of past governance models in this new context. Representative samples of actor experiences with past orientation in these areas are shown in Table 8 below.

Table 11 : Data samples coded as reflecting past orientation of actors

Past sociotechnical disruptions	The evolution of digital structures	Mismatch of past governance models
"In that situation two aspects were important; the technical development that forced regulators to do something in the first place, and the decision they took to remove constraints and allow for competition." "In our thinking digitalization has something in common with the telefax before, although the scale is different; technical innovations can produce broad sociotechnical impact." "Not adding constraints for innovative newcomers, such as WhatsApp in IP-telephony, but rather remove old regulation to make competition fair." "A good example is TV-broadcasting. We used to have TV-channels, i.e. silos that can be compared to public agencies that were responsible for the whole production chain."	"I think it is an evolution and we should not try to separate it from context." "It is not all happening just now, it is not even the result of Internet, but it goes even further back." "We have the evolution that goes along the evolution of the Internet." "These have been some of the fundamental building blocks that must be in place. You cannot jump directly to transformative digitalization." "The first wave was a kind of getting away from papers and the second, which builds on the first, might be how we totally redesign our operations to be more customer-driven."	"You cannot lead this change with the old waterfall model." "During the last year I have found myself wondering why there is no desire to proceed. People are so careful to do something wrong." "We cannot first analyze everything, then build an architecture map and finally agree that let's start implementing according to this." "What disturbs me is the lack of transparency." "If you have this kind of mindset, you cannot have 5-years pre-planned project implementation. In 5 years the paradigms have changes, and you need to have a more dynamic model." "The whole apparatus is built top-down." "Ten years ago we thought the end of the path is when the specified solution is ready."

Digitalization is often in media and literature compared to the industrial revolution, but the interviewees provided comparison to past socio-technical changes at a more detailed level. The comparison to deregulation in telecom pinpoints the role of public administration as an enabler of change. A comparison to media industry was also used to highlight the shift from production- to consumption-driven logic. The view that regulation normally is created to protect the

interests of some groups that otherwise would be vulnerable in the change, but easily becomes a barrier when situation changes, is very valid in the context of digitalization and provides an experiential ground to build on in this new situation. The more recent reference to changes in media industry highlights how the inherent combinatorial characteristics of digital artifacts change the roles in an industry. This is valid in a public service ecosystem in the same way as we have seen it happen in media, financial services, telecom etc.

The views that relate to a past evolution of digital structure was common among the actors. This duality of evolutionary change and transformational potential is a key element in relating digitalization to past development and highlights the importance of acknowledging temporality. The empirical material reveals two views, often included in the narrative of the same person, that explain both the similarity and differences to the long history of ICT-enabled change. Informants include a reference to building blocks, sometimes called fundamental elements or digital assets, which have been building up over the years and explain how the breath and maturity of these structures can enable transformative impact; a disruption through socio-technical configurations rather than a technical disruption. The way these building blocks are built and managed will, however, determine how well they enable transformative change and this brings us to the third issue where informants rely on past experiences: the governance model.

Several actors also used the past orientation in discussing why "old models" would not be sufficient in the digital context of the future. Progression from analysis, specification, implementation and operating individual digital solutions does not work well as increasing complexity makes initiatives even longer and both structural opportunities and societal challenges would call for improved responsiveness. The message is that traditional stage-gate development models are not fit for digital change that approach opportunities more holistically.

In general, actors in different groups used similar examples when relating to past experiences. This was not the case with present and future orientations.

4.1.4. Differences between "Policy makers" and "Implementers"

The analysis of present orientations reveals an interest in current institutional settings, constraints related to financial, sourcing and legal practices and the current program management and governance. Future-looking issues such as need for more collaborative development, changing roles in the ecosystem and a setting that allows for more agility and responsiveness to changing circumstances are also considered to be of significant relevance.

Interesting in these two temporal orientations is that data across the four actor groups (central government, distributed government, non-government and international) shows a difference between central government actors and international reference actors on one hand and the distributed government actors and non-government actors on the other hand.

The first group have a stronger orientation towards the future and a review of the coded elements shows the actors are more concerned with policy making whereas the second group that rely mostly on present orientation is more concerned with the implementation of digitalization initiatives. Based on this difference we name the first category "*policy makers*" and the second category "*implementers*" for further analysis. The first group is inclined to take a longer time perspective and consider future impact of contextual digital changes and policy actions taken or considered. Actors involved in implementation of changes, on the other hand, tend to link their views to experiences of current initiatives and related challenges, which results in a stronger orientation on the present.

"Policy makers" are projecting more to the future

Actors in the "*policy makers*" category, consisting of central government actors and international actors, take a predominantly projective orientation in relation to the phenomenon. This is important to know as the enactment of the generative affordance is dependent on goal-oriented actors (Majchrzak & Markus 2012; Markus & Silver 2008). The topics that caught most attention among the actors are governance structures that would be suitable for the new context and actions that will improve ecosystem capabilities to take advantage of new opportunities.

In relation to future governance, three main topics emerge; 1) the need for better coordination and collaboration across organization and actors in the ecosystem, 2) the changing roles in public services delivery, and 3) the necessity of increased responsiveness and agility.

First, actors in this category feel that future governance should break the isolation between the private and public, as reflected by the views that "*Together with companies and citizens. Hand-in-hand*." and "*The open government is about deeper interactions with citizens and digitalization gives the tools for this*", as well as between public institutions, represented by "*No individual organization can solve these issues. They need to be solved together*." and "*The leadership needs to be across the ministries and that is going to be a challenge due to political interests*". The isolation and fragmentation should be replaced with shared direction, as found in the quotes "*We need goals and a shared agenda across the administrative sectors. Now we*

a very fragmented field where everyone drives their own agenda.", and "y*ou need to have some kind of cross-cutting coordination mechanisms that consolidates the centralized and decentralized models.*"

Future governmental roles will, according to these actors, change to enable, engage and secure, but provide proportionally less of detailed service definition and delivery: "*If the role of public sector is to enable, there will be no conflict*.", "*The role will be to engage civic actors in creating value for the whole society*." and "*The role of public sector would be to ensure service availability, not to define in detail how they are provided and not to produce all of them.*" Most actors agree that in an increasingly complex environment, the central role of public administration will be to build the frameworks, set the overall rules & principles, and enable all ecosystem actors to produce value in their own role, including citizens and private actors; "*Our role is not to define all services to lowest detail and definitely not to deliver all services*", and "*We do know that many competences are in the private sector"*.

This direction, i.e. increased coordination and collaboration and shifting roles, should produce increased responsiveness and agility: "*There need to be long-term thinking but shorter steps, e.g. yearly, and that would increase the agility, I think.*", "*It is important to find a model that allows for agility while also doing long term enterprise architecture planning*." and "*The winning economies will not be those with best general conditions, but the ones that are able to use the conditions creating new and learning*.". The actors stress agility and responsiveness as key drivers and goals for future governance with comments such as "*The question will be how we can create a culture of agility and responsiveness in the ecosystem*", but also recognize the challenge related to such a change of culture; "*The challenge is huge, because it is a fundamental change of structures, organizations, leadership, culture and processes*." and "*Are governments prepared and have the right structure to drive and lead this change?*"

In relation to future actions, three topics emerged from the data collected from "*policy makers*"; 1) an increased focus on fundamental digital assets, 2) actions supporting and motivating actors to do and learn together, and 3) the need to actively promote the use of common assets and the chosen ways of working.

The strong emphasis on digital assets, primarily on the role of digital data but also technical services and platforms, is captured in the following actor comment "*As data is the fuel of the economy, we need to ensure that data can flow freely."* The role of digital data was an important issue in the reasoning across all actor groups, but most dominating in relation to future actions among "*policy makers*". Actors stress the role of data, "*I would focus on data sources and the*

management of those.", as raw material for digital innovations "*We should provide more and more "digital raw materials" for service production instead of maintaining the structure of agencies*" and "*We see that developers can do amazing stuff over a weekend when "raw data" is made available. This is where we should put focus over the next few years"*. In addition to digital data, the need to provide well-defined services and support emerging platforms is among the desired actions. Data, shared services and other fundamental elements provide platforms for digital innovation; "*People will add the elements they need for their own activities, but the basic elements are the ones that we share*".

On top of the shared fundamental elements, a new approach will be needed. Instead of every organization building their own solutions, the actors emphasize the need to do and learn together. This does not happen in a setting where initiatives are done in isolation, but specific actions are needed to motivate, and sometimes enforce, actors to contribute and promote both the available assets and the value of this mode of development. Actors express this with views such as "*The only way to keep up with changes is to tap into the joint development*", "*The key capability will be to solve upcoming problems quickly and efficiently when they appear*" and "*Tying it all together could be 'doing together and learning together'.*" Although we can hear voices for a motivational approach, "*we need to go the path of active encouragement*" and "*we need to give the opportunity to innovate and encourage, coordinate and reward"*, as well as for enforcement, "*we need to enforce across administrative sectors and say that 'this is how to do it'"* and "*in the administration it is only enforcement that works*", the majority of actors tend to agree that the overall route to distributed innovation is the one of motivation, encouragement and reward.

In order to achieve this change, i.e. a horizontal platform of fundamental digital assets on top of which actors do and learn together, administrations need to focus more on promotional activities: "*In the future it will be more about promoting desired directions together with citizens and corporations."* and *"I think there is nobody promoting the use of shared components and solutions.*"

"Implementers" are more rooted in the present

The "*implementers*", i.e. the non-government and distributed government actors, differ in their views both in their temporal orientation and the topics they emphasize. These actors also express many views on the impact of governance, but now predominantly with a present orientation and complemented with constraints rather than actions.

In the data related to present governance we see four topics emerging; 1) leading the change, 2) project governance, 3) formal governance bodies leaving little room for innovation, and 4) the governance related to financial administration. Distributed change requires leadership rather than management and actors involved in implementation express concerns related to current state; *"The leaders are smart people, but used to invest in buildings and infrastructure*.", "*My personal feeling is that ministry of finance is not the best actor to coordinate digitalization as the traditional approach is to allocate scarce resources and constrain spending*.", and "*The problem is that there is no natural home-base for public sector digitalization.*"

Implementers express frustration over current project governance in comments such as "*We have major program governance problems", "we expect a productivity leap, but have not details or measures on where it would come from*", "*my concern is that the digital lead initiatives are still this kind of one-off mega-projects, instead of gradually progressing towards set targets.*" and "*moving from talk to action is a major challenge. A lot of good ideas, but they do not evolve to smart initiatives.*"

General governance outside of projects is seen as too dominated by formal structures, such as "*the usual suspects are meeting again and that discussion is not producing very much new*" and "*most officials select the formal route, unfortunately*", which leave little room for innovation.

The last topic of governance, which raises concerns among "implementers", is related to financial governance of digitalization. Actors tell how the planning is done in strict budgeting frames; "*All our process, investment calculations, ways or organizing and addressing stakeholders, etc., build on the assumption that there is a concrete (financial) target.*", "*We use traditional ROI calculations for first wave of digitalization.*" and "*The CDO role is challenging if there is no budget or resources*."

The constraints emphasized by these actors relate to 1) "hard structures", including budgeting model, legislation and public sourcing, 2) the isolated development, and 3) the use of a project model that might have been well-motivated for ICT-development but is unfit for the digital context.

The issue of current financial planning and control was raised repeatedly as a constraint, some of the comments being: "*There is the yearly plan and that's what you have to do, when in real life we should keep doing and respond to what is coming up.*", *"All the structures; investment models, organization and stakeholder management builds on a well-defined target state*.", *"As long as the budget allocation structure remains within administrative sectors it will be difficult.*" and "*It is waterfall-funding; we speak about agile change but the funding is from the old world*." In addition, we heard about the legal constraints, and especially the fact that too much details are being included in legislation, examples being "*The detailed legislation might be a way to secure yourself. Increasingly we build into legislation how things should be implemented instead of what should be achieved*." and "*When we did this NN-law; incredible examples of how people almost tried to get the XML-schemas written into the law*." and the limitations that public sourcing legislation put on "open ended" contracting, with comments such as "*Sourcing specification is one constraint*" and "*The sourcing legislation, process, people and competences. It takes a very competent organization to prepare early stage specifications".*

In addition to hard constraints, implementers see the fragmented and isolated development that prevails in the ecosystem as problematic. The views are very much aligned on this topic as can be seen from these examples; "*There is a lot of mental constraints against sharing ideas and data over the walls*", "*an area where we need improvement is to break the "not-invented-here" thinking*", "*we still run into this that when you propose an idea from abroad you get the response that it won't work here*", "*it is not working inside one organization so wishful thinking that it would work across organizations and sectors*", "*they all want to do it themselves, no cross-sectoral thinking*" and "*organizations do not know how to work together so they sub optimize instead of an end-to-end process.*" One actor in the implementer category concluded that "*we have the sub-optimization and silo thinking. Hard to see how we can make progress with these constraints*".

Finally, implementers find that the project model, might have been well-motivated for ICT-development but is unfit for a digital era, is a major constraint towards digital innovation based on shared digital structures. "*This is a challenge. We start with work estimates and schedules instead of starting to work towards a set direction*", "*I feel that the changes are so quick that building a solution for a year means that context has changed or the opportunity is gone*" and *"You cannot lead this change with the old waterfall model."*

4.1.5. Areas of alignment and tensions

Together the three temporal orientations, the two actor categories and the areas of interest, summarized in Table 9, form the basis for human agency in the ecosystem.

Table 12 : Summarizing findings across orientations and the emerging actor categories

Category	Iterative (past)	Practical-evaluative (present)	Projective (future)
Policy Makers	WEAK:	WEAK	STRONG: • Future governance models • Actions to achieve desired future state
Implementers		STRONG: • Current governance models • Current constraints against realizing the benefits	WEAK

The temporal orientations of ecosystem actors, i.e. the way they draw on past experiences, relate to current situation and project towards future goals, is according to the theoretical framing the basis for responding to new digital opportunities. Each actor is according to the self-efficacy assumption of human agency (Bandura, 2000) free to act in ways that they find purposeful for themselves, but ecosystem success will be dependent on a shared understanding and alignment of actions between participating actors (Adner, 2017). However, as the success of an ecosystem is dependent on "*alignment structure of the multilateral set of partners*" (Adner, 2017), we are also interested in knowing more about the similarities in temporal orientations.

In response to the second part of the first research question we continue the exploration into areas of alignment among actors. Despite the differences in temporal orientations between actors, and to some extent also between actor groups, we do recognize areas in which most ecosystem actors tend to be aligned, such as *the need for agile governance*, *the need for cultural change* and the views related to *tensions on flexibility versus control*, *continuity versus disruption* and *technology versus business.*

The need for agile governance

The data elements related to governance are numerous and include both experiences from the past, such as *"It used to be the only way possible, but is not fit any more"*, opinions on the

present, like "*I am a bit scared about how the digital lead initiatives are run. Sounds quite traditional",* and wishes for the future, such as "*The challenge will be huge, because it is a fundamental change of structures, organizations, leadership, culture and processes.*" Despite the different temporal anchoring, there is a common message in all of these experiences and views. Actors speak about a governance model that today is too rigid, too closed and build for a predictable world. The view that comprehensive digital change cannot be first specified and then implemented in a multi-year project was expressed by several actors; "*This is a challenge. We start with work estimates and schedules instead of starting to work towards a set direction"* and "*We cannot start by analyzing all the required public capabilities, build an information architecture and then decide that 'let's implement this'. It's impossible in today's changing world*". Most of the views on governance stress the lack of, and need for, agility, collaboration and learning along the route; "*More than central control I would speak up for the need to increase collaborate in public administration",* "*No individual organization can solve these issues. They need to be solved together"* and *"Summarizing it all together could be doing together and learning together".*

A tension between freedom and control

Still in the area of governance, we see a tension in how actors call for both control and coordination but also the freedom and ability to try, learn and adjust: *"Top-down guidance is needed to ensure that citizens get their services", "As I said before, small pieces are done everywhere but they do not fit together"* and *"Innovation is in the end about people. We need to give room to the real innovators"*. This tension sounds like the change / control paradox described in literature on digital infrastructure (Tilson et al, 2010). A more detailed analysis of the text elements relating to this aspect indicates that there is a temporal aspect in these seemingly contradicting quotes. The coordination and control aspect, or top-down guidance as some actor call it, is normally seen as either ensuring compatibility or providing long-term guidance keeping the distributed development within "railings" that would ensure that actors work towards same goals and keeps architectural coherence and compatibility. Using the terminology of temporal human agency, we can see it as a *deliberation* towards a better future: *"best elements of top-down control is that you articulate what should be accomplished and help to clear obstructions"* and "*The public sector's approach to the future should be to open up the future. It should always be increasing the degrees of freedom"*. On the contrary, the views that describe a too constraining top-down control relate to present tense and the limited maneuvering room that individual actors have to explore new ways of working, such as "*the "Usual Suspects"*

meet each other, and that conversation does not really create very much new outcomes", "*whatever can be achieved with this budgeting model*", "*We should have more flexible practices than fixing a budget for four years. […] slows down decision making and adds more barriers to action and not vice versa*." and "*There is a school of legislators that believes that the law should define everything as precisely as possible"*. The following quote captures the frustration some actors have with the current governance "*They mean well, but already a quick look at the slidesets shows that everything is coming from the desk of the project manager. They start by "guessing" the need, which is formulated to a project, which is then resourced and implemented"*.

A tension between continuity and disruption

Perceptions of structural digital opportunities include a few interesting tensions as well, which can be described in the light of implicit or explicit temporalities. The first is a tension between continuity and disruption. Looking backwards, actors see digitalization as a continuous evolution that has been going on for several decades, whereas the disruptive potential is explained with a projective orientation. Without the temporalities we might find statements like *"We have the evolution that goes along the evolution of the internet." "It goes much further back, 50-60 years"* and *"Absolutely, it is a continuation"* incompatible with such disruptive views as *"totally new ways of working"* or *"paradigm shift".* Adding the temporal aspect connects the data into a progression over time where evolution of digital structures has reached, or is reaching, a tipping point where the evolutionary technology change have disruptive socio-technical consequences. One of the actors expressed this in the following way: *"There has been some foundations that need to be in place. You cannot jump directly to some "transformative digitalization""*.

A tension between business vs technology driven change

Another tension relates to perceptions of the phenomenon as a technological change or more of an operational or "business" change. This is partly related to the previous question of evolutionary change versus disruption and follows the temporal logic that the technological change has been and will continue to be evolutionary whereas operational changes can have both evolutionary and disruptive potential. The actor views that "*I don't see that much change in technology over the last 10 years*", "*We have reached a point where more and more components can be combined*" and "*There would be no digitalization if technology would not have enabled it*", reflect the evolutionary aspect of technology and how it should not be a question of either or, but an understanding of how evolutionary technology development has

enabled both evolutionary and disruptive operational change. This aspect was well captured in the expression of one of the non-government actors "*I have sometimes asked how to recognize the trendy digi-byte from an ordinary ICT-byte*".

The need for cultural change

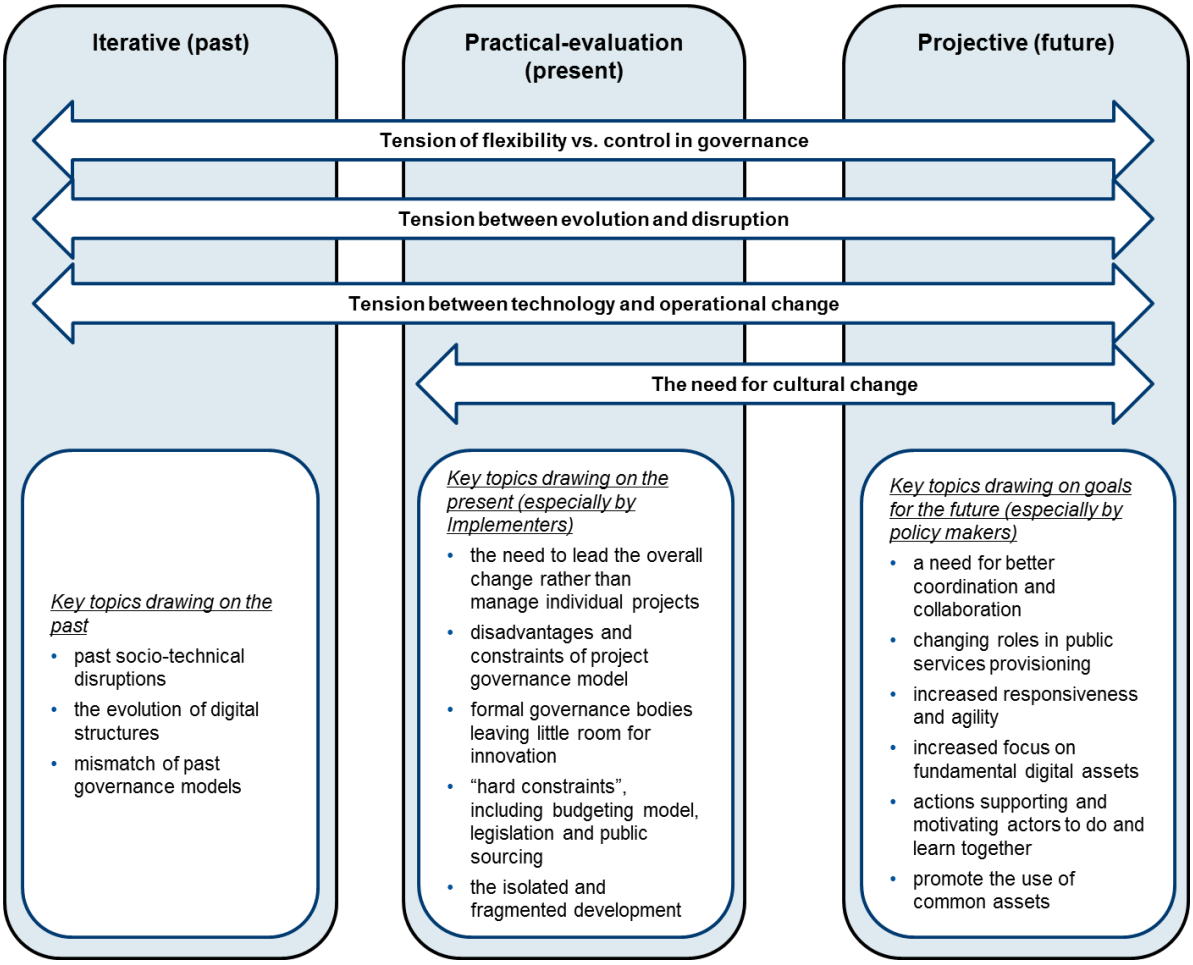
Finally, we can see an alignment among actors in the need for cultural change. This stretches over the present and future orientations, with less empirical data related to the iterative orientation. Actors refer to current challenges such as isolation and not-invented-here attitudes, using formulations such as "*There is a lot of mental constraints against sharing ideas and data over the walls", "An area where we need improvement is to break the "not-invented-here" thinking",* "*Organizations do not know how to work together so they sub optimize instead of an end-to-end process*." and *"Then we have the sub-optimization and silo thinking. Hard to see how we can make progress with these constraints".* The other view is represented in expressions on how the future culture need to be to match digital opportunities and challenges. Actors emphasize the value of openness, working together and building on what others are doing. Some of the views expressed to emphasize this include "*My advice would be Work together*", "*do it together with partners"* and *"leave it to the people and their imagination to find out how"*.

4.1.6. Summarizing actor level findings

The way these areas of flexibility vs. control, continuity vs. disruption and business vs. technology emerged from analysis as compatible and to some extent even complementary, despite seeming opposite at first glance, is attributed to the use of temporal human agency as a theoretical lens.

Accounting for the differences in agentic orientations that actors draw on in their reasoning and responding to structural affordances, is shown to be of relevance. Each actor has a unique set of orientations, which influence enactment as such, but the analysis also shows an interesting patterns across actors as illustrated in Figure 13.

Figure 13 : Emerging topics in the temporal human agency framing



The three topics emerging from past orientations match the cross-temporal topics of evolution towards disruptive impact and the tension between agility and control in the governance, the constraints of the present indicate a need for governance and cultural change, and the projective actions and views complement the mapping of agentic orientations.

This representation of actor reasoning in the ecosystem, including the areas of alignment and differences between actor categories, contribute to the understanding of how digital generativity can be enacted in the ecosystem. Actors take an interest in current constraints and governance challenges as well as actions that could *deliberate* (Emirbayer and Mische, 1998) from current constraints into a future model. *Experimental enactment* of these projected ways of working is started by still limited, i.e. the analysis also gives support to those actors that claim that they "*do not see much new yet"* or *"seems to be more talk than action"* when it comes to change that reach beyond individual well-specified initiatives.

The first round of analysis has shown how individual actors in the public service ecosystem relate to the phenomenon through different agentic orientations and how those differences reveal tensions between actors and actor categories. Using a two-dimensional model, which was created for the purpose of the analysis, the study shows that each actor has an individual profile in the way they draw on temporal orientations and emphasize different aspects of ecosystem digitalization. The actor-level variation in both dimensions is shown and illustrated with examples.

Comparing profiles across the four actor groups, the analysis reveals more about the differences and alignment in the ecosystem. First, there is no systematic difference between the views and orientations of actors in the government and non-government actors. This could have been the case, considering a strong message about isolation and lack of transparency that was conveyed in many interviews, but comparing the profiles of government actors with the one of non-governance actors confirms that there are only small differences between the group profiles. Instead, there is a bigger difference between policy makers, including central government actors and the international reference actors, and actors more involved in implementation of individual digital initiatives, i.e. distributed government and non-government actors. Actors involved in policy making tend to rely more on projective reasoning and stress the future governance needs and the actions taken in response to digitalization, whereas the ”implementers” rely primarily on practical-evaluative orientation and emphasize the current governance aspects and the constraints they have experienced along the route.

Based on the analysis, we can confirm that each actor is in a unique contextual situation, with unique previous experiences, unique present challenges and unique objectives for the futures, and as a consequence they relate to digital changes, opportunities and challenges differently. This influences the enactment of digital generativity as affordance theory state that the enactment of any structural affordance is based on goal-oriented actors that make use of the affordances according to their perception, ability and motivation. At the same time, the experiences tell that actors cannot act on their own but success in a digital ecosystem depends on communication, collaboration, working together and learning while doing so. On a more fundamental level, already the definition of ecosystem as “*alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize”* (Adner, 2017), indicates that differences and alignment revealed in the analysis can play an important role in realizing the potential of digitalization.

The findings tell about areas where considerable alignment across most actors can be found. Some of these are explicit, like the need for more agile and responsive governance and a need for cultural change to break the habit of working in isolation and run implementation projects as standalone initiatives, where others are more hidden and might look as contradictions at first glance. These tensions, including the views related to freedom vs. control, evolution vs. disruption and technology vs operational focus, are better understood in the light of temporal analysis human agency.

All of the individual reasoning, the differences between actor groups and the areas of alignment provide insights that can help actors in the ecosystem to make use of the structural digital generativity. This provides a basis for the next level of analysis, which will be synthetizing actor experiences to the level of the case ecosystem. Acknowledging the fact that each actor relates to opportunities and challenges differently based on experiences, current situation and future goals, we shift focus from individuals to the ecosystem by superimposing the individual experiences to a more complete understanding of the phenomenon at the ecosystem level.

4.2. Ecosystem level synthetization based on actor experiences

The second round of data analysis synthesizes the individual actor experiences to an understanding of how digital generativity can be enacted in the case ecosystem.

The loose instrumentation of data collection has allowed informants to provide data on aspects that are most important to each of them. As a consequence, the empirical data is not directly comparable between actors, but the advantage is that the individual level data can be superimposed to a more complete picture of the ecosystem. The actors selected and invited to the study have important roles in the ecosystem, influencing and deciding about organizational and ecosystem level response to digitalization, which means that their views and experiences can be considered relevant for ecosystem success. One actor might explain an aspect of the phenomenon that has been significant to him or her, while other actors focus on some other aspects that have been more relevant to them. In line with the conceptual framing of affordances as relational constructs and the role of temporal human agency, the study is not trying to assess which of the aspects would be more important, but to build an overall understanding of the digital generativity enactment in the ecosystem.

The method for achieving this has been to employ inductive data analysis. The goal with the approach chosen is to generate a well-grounded representation of the case situation, which takes into account structural factors while still foregrounding the actor experiences. The five

emerging categories are below be presented with their respective sub-categories, open codes and supporting verbatim from the empirical data.

4.2.1. Category 1: Contextual changes and the role of public administration

The first category that emerged out of the open coding relates to the contextual changes as it is perceived and experienced by actors in the case ecosystem. It includes the open codes presented in table 12 below, which are presented as three distinct sub-categories to help structure the content and build a narrative through selective coding.

Table 13 : Contextual change and roles of public administration

Sub-category	***Corresponding Open Codes***
The contextual drivers	• Increasing complexity and interdependencies • Breaking boundaries • Political and financial drivers
Increasing technological complexity	• Continuation on ICT development • The ambiguity of term digitalization • Impact of consumerization and mobile devices • The digital transformation
Changing role of public administration	• Roles and responsibilities • Role of public administration • Digital public administration vs. digital economy

The message that the text passages in this category convey is an awareness of increasing societal complexity, with problems that are increasingly cross-sectoral and interdependent by nature, and concerns about the ability of public institutions to keep up with the changes and remain relevant and efficient in providing public services. A common view among actors is that the mission of public administration has not really changed, but the demands, roles and ways of fulfilling the mission are changing due to societal and technological changes. The increasing complexity has two sides, a societal and a technical, which are reflected by the first two subgroups. The third sub-group, the changing roles in the ecosystem, can be considered a consequence of the two.

<u>The contextual complexity:</u>

In part, the contextual change is related to the problems that administration is facing, which have become more interdependent and could be considered so called “wicked problems” (Rittel & Webber, 1973). Wicked problems are situations where it is difficult to define either problem

or solution, and based on the empirical data there seems to be a connection between the wicked, interdependent situations and digitalization in the case ecosystem.

The increasing complexity of public administration, and the wicked problems they are facing, are often discussed in relation to the "grand global issues", such as climate change, urbanization or inequality (Kim and Zhang, 2016), but in the empirical data we see that same type of interdependent challenges are found in smaller scale as national or local problems. The reason why informants find it important to discuss these contextual challenges in an interview that was supposed to be about their response to ecosystem level digitalization is that the two topics are considered to be connected. This is represented in informant comments such as *"complexity comes from latin and means networked", "It's about issues becoming more interconnected and ICT is the technology that accelerates this development"* or the simple statement that" *the whole administration is becoming one level more difficult*".

One of the issues that increase interdependencies is the trend to cross sectoral and organizational boundaries. Industry boundaries are blurring, there are more digital data flows between the administrations and private sector than ever before, and there is a drive to increase the cross-organizational and cross-sectoral cooperation within the administration.

Apart from this increase in complexity, which seems to be partly related to increasing cross-organizational activities and use of digital technologies, there are other drivers for public sector digitalization (OECD, 2015). The international reference interviews were invited to take part in the study with the special purpose of providing external references to support the case ecosystem analysis. With regards to this question about what is driving the digitalization in various constitutions, the informants agree that priorities vary in each administration but political and financial drivers are normally part of the reasons for promoting digitalization. The economic downturn of the last decade has kept digitalization on the political agenda and the role of political hype should not be underestimated as a driver. Comments on the contextual drivers for broader digitalization include "*The financial crisis constraints on the public service is an interesting driver to stop administration to reinvent the wheel but work together on the common tools, functionality and services*", "*If we could identify typical drivers, there would be the political one. This is a "sexy" area as politicians want to innovate, show that they are modern, they are driving the change, leading the change*" and *"Political ambition one of the drivers and to go for the cost efficiency, not only budgetary cost efficiency, but also to meet citizen expectations on efficiency"*.

The main finding from this sub-category is that there seems to be a connection between increasing societal complexity and digitalization, and the empirical data indicates that the link might be bi-directional. The complex challenges require holistic cross-organizational solutions and the holistic and integrated solutions increase complexity further. This increasing complexity and how it relates to the development and use of digital platforms and infrastructure, as well as how it requires new development approach and governance can be considered a backdrop for understanding the ecosystem dynamics and response to digitalization.

Increasing technological complexity:

In addition to the more complex challenges that the administration is facing, there is also an increased technical complexity. Informants reflect on how technology has been used in public administration and how the situation is changing as a result of both contextual drivers and technology trends. The fast development of consumer technologies and end-devices makes the variation in the frontend more complex to manage and the ambition to cross silos and support inter-organizational demands increases the dependencies and complexity in the back-end, and some of the informants express concerns about the ability of public organizations to keep up with the challenge.

An interesting finding is that the technical complexity is actually accentuated by the very same digital characteristics that provide the generative affordance, i.e. high standardization and inherent compatibility, the editability of digital artifacts, the ability to repurpose digital equipment, etc. These characteristics have opened up new opportunities for development, but as a consequence also increased the interdependencies as digital is embedded in almost everything that is done in organizations. The challenge that actors are facing due to the technological complexity is well captured in the following quotes; *"It is a complex web with a lot of actors, private and public, and it becomes more complex all the time with more connections and more dependencies."* and *"It is impossible to think about service delivery without all the possibilities that technology brings, it is impossible to think about citizen involvement without having in mind this."*

An ambiguity of terms adds to the "real" complexity. The many different ways of discussing the technological aspect of digitalization and what it means to each actor, covering issues from consumerization and mobile technologies to more backend trends such as artificial intelligence and machine learning, shows that there is an added layer of complexity that has to be overcome before coordinated response can be achieved. As one informant responded when I said that I would start by introducing the topic to make sure that we speak about the same thing; *"Yeah,*

I'm almost certain that we DO NOT speak about the same thing. This is really a challenge as the term is so blurred. You can mean radically different things with the same term. "

Changing role of public administration:

As mentioned above, there is no indication in the empirical data that actors in the ecosystem would see a change in the mission of public administration, but there is a strong message about changing roles in service delivery and development, which is related to the contextual changes and technological development.

One informant in central government summarized the situation as *"Traditionally we have seen two roles of PA: 1) the enabler through regulation, meaning that the PA is creating good conditions for business, and 2) the implementer, which also can influence the economy through public services and public sourcing. This is not enough anymore.* "The message is that the complexity and the interdependent challenges discussed before have made it impossible for the public administration to keep competitive, or even relevant, with the traditional top-down approach. The same informant concludes that "*No organization or company in the society will be able to solve the issues we are facing alone. They have to be solved together, which brings us to the question of how we can do it, and that means that public, private and third-party actors as well as individual citizens become tightly integrated with each other".* This is the view that is communicated by many actors, both in the central and distributed government as well as by the non-government actors; that there need to be more active involvement of private companies and citizens in the development and delivery of public services.

This raises the question of how private actors can be motivated to participate and whether the administration has the ability to coordinate and lead the more distributed development. Clarity in the roles and how private sector can contribute, while executing their own strategy is desired and some statements about future role of public administration are provided.

First of all, there is still the need for regulation, rules and principles, and this need for centralized control is emphasized in relation to data privacy and cyber-security. Second, there is still need for implementation and delivery of services, especially in areas where long-term investments are needed and the ability to measure the services acquired from the market is poor. As the mission, according to actors, has not changed, and there will be areas where private sector is not willing to invest, the administration would obviously be implementing and delivering services, but this should not be the default role with exclusivity.

In the area of promoting and facilitating digitalization some point out the challenges related to separation of private and public digitalization. Basically, the idea in the case ecosystem has been that the Ministry of Finance lead the public sector digitalization and the Ministry of communication lead the other aspects of digital economy and society. This is in contrast with the previous finding that there is a broad understanding that public sector needs to be more open for private contribution and involvement in public service offering. One of the challenges is highlighted by the following quote from an actor in distributed government *"Separating private sector digitalization and public sector digitalization creates a lot of walls. Think about the data. It cannot be different data sources in the private sector and public sector."*

Finally, there is the aspect of innovation, which sometimes brought the discussion to roles in the ecosystem. As mentioned by several actors, there is a lot of competences and innovation capacity in the private sector and excluding them would not serve the digitalization objectives. The challenge of integrating public and private actors is, however, recognized and this topic will be related to the following three categories of the axial coding.

The conclusion of the first emerging category, the contextual change and roles of public administration, is that the environment is becoming increasingly complex and interdependent and some actors have difficulties to manage and maneuver in the ecosystem. Interestingly, this is partly due to the same digital characteristics that are proposed to provide new opportunities for digital innovation as the compatibility, editability and other digital properties increase interdependencies in the ecosystem. There is an iterative cycle where complexity feeds interdependence, which calls for networked digital response and use of interconnected platforms rather than stand-alone applications, which further increases the complexity and dependencies. A call for more open and collaborative development and innovation is presented, which should attract, allow and enable a broader variety of actors to contribute to a joint response to challenges and opportunities. This will challenge established roles and responsibilities in the ecosystem. Some, but not all, actors are aware about the major impact that it might have on organizational structures, institutional legitimacy and professional identity of civil servants affected.

4.2.2. Category 2: Manage the fundamental building blocks

This section describes the first of two categories that relate to a digital architecture commonly referred to as layered modular architecture (Yoo et al., 2012). It links back to the temporal orientations described in the actor level analysis as many informants reason about how activities of the past and today will provide the building blocks for future digital innovation. It includes

a number of suggestions about how the potential of digitalization can be realized through separation of fundamental digital elements, as well as concerns that the initiatives today are too monolithic and thereby not providing the stepping stones towards a shared digital infrastructure that could be reused for new, yet unknown, purposes.

The actor insight on the value of granularity is supported through three sub-categories, which provide perspectives on a) how digital technologies provide the fundamental opportunities for flexibility and digital innovation, b) what the fundamental elements would be, and c) how the value of separating these elements could be realized, as illustrated in Table 14 below.

Table 14 : Managing the fundamental building blocks

Sub-category	***Corresponding Open Codes***
Technology as fundamental enabler	• Technology aspect of digitalization • Building the foundations for digital innovation • Architecture • Decomposition and re-aggregation
The fundamental elements	• Data as key asset • Platform logic • Service layer
Cross-boundary governance of digital building blocks	• Promotion of common services • Digital asset portfolio

<u>Technology as fundamental enabler:</u>

The discussion on how actors perceive digitalization and how they respond incorporated a dual message on the role of technology. Some informants stress the need to focus on operational vision, process opportunities or data and content, but there is also emphasis on the importance of understanding technology and the impact of architecture with views such as "*in the end digital innovation happens 'under the hood'*". Some informants express their beliefs in the crucial underlying role of technology, and sometimes even frustration over the one-sided business- and process-driven discussion; "*as soon as you speak about digitalization there is one or two persons saying that 'let's remember that this is not about technology, but operational change'. Nice wish, but operations will not change unless technology would have enabled it*". This "defence speech" for technology supports the literature on digital structures, which claim

that there is an inherent opportunity for distributed change and innovation in the digital technologies, but it needs to be unleashed by the actors.

The technology opportunity is most commonly referred to as building blocks, stepping stones, fundamental elements or the two waves of digitalization. Informants tell about what is happening at the moment as the foundation for future transformation or platform for innovation. Ways to describe this include "*what we have done are kind of building blocks that have to be in place. Without them, you cannot jump to any digitalization*", "*I have said that we have soon surfed the first wave of digitalization, mainly getting rid of paper"* and *"I would say that we are still, both as a society and in organizations building enablers for digital innovation".* The development of today is needed as a foundation although not all initiatives have broad, transformative potential. Solving isolated problems with a specific digital solution can be very well motivated and the traditional tools for evaluating feasibility and impact, such as business case models can be well suited for that, but the grand opportunity would be to do it in a way that creates yet another stepping stone for future needs. This is a crucial insight: the way wave 1 of digitalization is implemented will determine if solutions can be used as building blocks or stepping stones or if they will remain isolated single-purpose solutions. There are views such as "*We have the traditional ROI-calculations, which are used to show that the investment is sound, but on top of that we have the potential for digital innovation"* and *"speaking about the productivity leap in administration and the rather big investments, they are still only the first step towards future innovations and new ways of working.*

The most visionary informants elaborate on the combinatorial aspect and use metaphors to explain the exponential impact of fundamental elements, such as referring to elementary physics where everything around us is just different combinations of atomic elements: "*it can be explained with two pictures: the first picture is the standard model of physics. A few particles, only few. The second picture is the Galaxy, because as I said everything goes back to the fundamental elements"*. The discussion on how the technology is moving from the first wave of digitalization, creating the building blocks, to the second wave, which would be more transformative and make use of the available building blocks. This view on the underlying technological logic that needs to be understood to reach the transformative impact of digitalization, is approaching the literature on how a layered modular architecture would provide opportunities for evolutionary change similar to genomics (Yoo, 2012) and unbounded opportunities for digital innovation (Brynjolfsson and McAfee, 2013).

Informants are, however, concerned about how this can be achieved and see that not all initiatives that are called digitalization will produce re-usable building blocks; "*I am a bit concerned about the spearhead projects. It sounds like rather traditional approach. I do hope that they would be take a different view in these projects"*. The two other sub-categories address these concerns by capturing the type of digital assets that would be appropriate building blocks and the support structures that would be needed to capture, maintain and make use of the building blocks.

The fundamental elements: The importance of data as a fundamental element, or the "*fundamental fuel of digital era"* is acknowledged by most actors in the case study. The data should, however, be accompanied by an equally well managed service layer, and together with some support functionality these form a foundational digital platform for public services.

The fact that well-managed and controlled but accessible data and meta-data *"will enable public administration to do new things with and for the public*" is the one of the most broadly shared views in the case study. The data must be allowed to break free from the silos and "move" across boundaries to be used where it can provide value. The word move does come up in the discussion with two different meanings, however. On one side, there is the opportunity to move data from where it is created to where it can be used and that is covered as a major opportunity of digitalization, but there is also the concern that moving data from one source to another will take away the opportunity for real-time services and increase complexity as it creates duplicates and synchronization challenge; "*The issue is always to go back to the data. Because then you can have real time service delivery. And not one, which where the data is one month old or one week old*" and "*You need to have a data management structure that will make sure that the data is properly managed, accessible and not unnecessarily replicated. To avoid obsolete data in the system. You should always try to go back to the original data"*. The better way to use data would therefore be to allow access of data at the source, instead of copying data sets as is often the case today.

This brings us to the importance of well-managed and controlled services. One of the most commonly referred to digitalization initiatives was the KAPA project, which essentially provides a platform for publishing data access to other organizations through a centralized service bus and managed API:s. This is by many seen as a key element in the case ecosystem and expectations are high, although some initial scepticism on when the services would be available and to what extent they will provide what is needed were expressed. An interesting link to academic literature is the experimentation with boundary resources, which was told by

one of the informants. The use boundary resources, or more systematic API-management as more commonly referred to in the empirical field, is a trend that takes the next step from Open Data towards Open Services ecosystem or "Government as a Service", as one informant expressed it "*It enables technical speaking a web service Society […] And this is really how I see the evolution reaching where the… let's say, we have reached the mindset of those who are in really into it… let's say Ecosystem of API:s or platform economy. Basically, as Government as a service, if we go back to the cloud terminology*". Overall, the emphasis on interfaces and services is reflecting the challenges of reuse experienced and expressed in the interviews. A balance needs to be found between too broad "elements", which would not provide the common ground for reuse, and a too fine-grained services.

Well-controlled and well-managed data and related shared (technical) services creates a platform for cross-organizational service development. The informants reflected on the need for, and current state of, digital platform in the ecosystem, but the amount of references and related experiences were rather low compared to the importance of the topic that would be assumed based on the literature review.

The governance of digital building blocks:

The sections above stress the importance of well-managed digital assets that together form a shared platform for digital services and new innovations. This raises the question on how the governance should be set up to achieve the desired level of cross-organizational access and use while retaining the needed level of control. Two aspects emerge from the data where actors share their views and experiences on this topic; the need to organize the governance of digital building blocks in a different way compared to the governance of digitalization initiatives, and the need to support the identification, management, promotion and use of these building blocks with centralized funding and resources.

The different governance logic related to the building blocks is explained in different ways, one of the more thought provoking being an "asset portfolio management" approach. "*Always when building something new we would add to this portfolio of national digital assets*" and "*and when building new we would not start from scratch and build point solutions. We would build on top of what we already have*". The comparison to other infrastructure assets, such as transportation or communication infrastructure or buildings, explains the logic that builds on a lifecycle management of national digital assets. It would be important to have systematic needs identification and investment process, management of portfolio assets, further development to optimize use, and ramp-down when life-cycle comes to an end or better alternatives become

available; "*someone need to know what we have, govern the portfolio, guide development of additional assets and promote use"* and "*we should encourage the private sector to engage as well. Tell them that 'look, this is available. Come and use it'"*.

Establishing model that supports identification, design, implementation, maintenance, promotion and support of fundamental digital elements, requires resources than no single actor is willing to put in for the common good. Ecosystem actors confirm that the resourcing aspect related to shared, digital building blocks will be a major issue impacting the success of realizing benefits of digitalization at an ecosystem level. As mentioned by one of the actors inside government: *"Reuse is not achieved by enforcement, but there need to be time and money. Now there is not even interest. I guess all energy is used for running your own business."*

4.2.3. Category 3: Evolutionary customer driven development

The next category contains empirical data on actions, experiences and ideas about operational and service development that would make use of the fundamental digital elements. It includes data on constraints of traditional development models, proposed approaches for better outcomes, and suggestions for more experimental and gradual initiatives as well as the actor views on how these more open approaches might be limited by security and privacy concerns. The passages that have been coded to the category include both references to the kind of development that should be avoided, i.e. the negative experiences related to current modus operandi, and suggestions for what should be the new model for digital development. The structure of the category with 5 sub-categories and the open codes they build on is presented in table 14 below.

Table 15 : Evolutionary customer driven development

Sub-category	***Corresponding Open Codes***
Experiences and limitations with current development model	• Monolithic initiatives • Automation and cost efficiency • Implementation challenges • New development approaches needed
Holistic and customer driven approach	• Customer driven approach • Holistic development
Experimental, gradual progress	• Gradual change in initiatives • Experimentation • Check and verify continuously

Evolutionary change	• Innovation logic • Digital evolution • Agile • Decomposition and re-aggregation
Limitations	• Security and privacy

Experiences and limitations with current development model:

The overall driver for this third category is a perceived misfit between the dominant development model and the needs and opportunities of digitalization, as experienced by the actors. Most actors touch upon challenges they have experienced with the current way digital development is undertaken. Addressing one process, one customer situation or one opportunity at the time, with one initiative targeting one solution is not well-suited for complex, so called wicked problems, and it does not seem to be realizing the broader potential of digital structures. The drawbacks of traditional monolithic development initiatives are discussed in relation to both contextual changes and digital opportunities, and the essence of these discussions are well captured in the following quotes; "*That's the point! You cannot lead with the old waterfall model. We cannot start by analysing all the required public capabilities, build an information architecture and then decide that "let's implement this". It's impossible in today's changing world*", "as *the internal development is very slow, due to many sources of friction, the only way to stay afloat would be to tap into joint development*.", and "*The assumption of the "old design paradigm" is that you would be able to abstract and define the problem*." An interesting finding related to these statements is that they are all expressed by the representatives of the central government. Sometimes it is easy to think that the challenges of implementation initiatives would be unrecognized by the higher leadership in central government, but this is not the case in the case ecosystem as all actors in central government recognized the misfit between digitalization objectives and current development and governance models.

It might even be the opposite that distributed government actors are more at ease with isolated development because they can drive their objectives more effectively in projects that have limited scope and complexity. The experiences of the distributed government actors also suggest that new approaches are needed, but their statements are often more specific relating to e.g. the KAPA initiative, the lead initiatives launched based on the government program, or their own internal experiences of digital government development initiatives.

Holistic and customer driven approach:

A synthesis of actor experience and views would be that a more holistic and customer driven approach is needed to respond to these changes. Holistic meaning that it is not limited to organizational boundaries, but addressing the problem, issue or customer situation as a whole, and customer driven meaning that there is increasing participation of customers and citizens in all stages of public service development, as reflected by one of the actors *"It means that you need to bring the citizens on-board in the definition of projects, to bring them on board when designing policies, implementing policies, monitoring policies, etc. And that is one of the key things; if you have this kind of mind-set, you cannot have 5-years pre-planned projects"*.

Neither one of these aspects are totally new in public policies or development of public services, but there seems to be a link between the contextual challenges and trends expressed, the proposed approach, and the opportunities of digitalization. Explicating the need for new approaches in relation to digitalization, gives a stronger case for the change and at the same time more meaning to digitalization as a term. As mentioned in the introduction, there is an ambiguity with the term and linking it to the policies and trends that already exists in the public administration will make it easier to form a shared understanding and thereby more aligned actions in the ecosystem.

When iterating between the data in this sub-category and the literature, there is a striking resemblance between the empirical data and the OECD recommendation for Digital Government, which stresses the holistic and customer-centric reforms that should be enabled and achieved by digitalization with special emphasis that Digital Government is not about introducing more technology into the administration in the same way it has been done before (OECD, 2014). Based on the empirical data, the recommendation is pointing in the right direction, but achieving the change in how digital development is approached is difficult and the majority of this proposed change is still not achieved.

Experimental and gradual progress:

With regards to digital development programs, the empirical data provide a strong message against multi-year implementation projects with predetermined specifications. Instead, the actors call for a more gradual approach with ability to adjust course based on learnings and changes in the environments.

The experiences of the actors, who actively promote this more step-wise approach, tell that real change happen through small steps in the right direction rather than through too ambitious one-time disruptive initiatives. The reasons for this is, according to informants, not only the growing

complexity of large monolithic projects with many stakeholders, but also the counter-reaction that a too ambitious change project will raise. A conclusion would be that there is the need to find balance between long-term vision and direction and the ability to advance in shorter steps, keep options for further development open, and adjust or fine-tune the path as the development advances. These experiences are reflected in views such as "*Prototypes are born all the time. Which increase trust when top management sees that 'Oh, it can actually be done differently'", "we need a long-time perspective, but steps for each year", "we need a shared vision about target state, but implementation must be broken into smaller steps"* and "*you cannot take to big leaps, then nothing will change"*.

This message is well in line with the formal objective of experimentation culture, which is stressed in the 2015 government program. The need for a culture of experimentation, and the needed development and governance model, is supported by the actors, but there is a degree of pessimism among actors about how well this has been achieved so far. This pessimism is most visible among the non-government actors. The scepticism is also expressed in relation to the newly launched digitalization lead projects that are part of the government program implementation.

An interesting finding from the data on proposed step-wise development model is that majority of material in this category comes from the experiences of the distributed government actors and the non-government actors. The central government actors and international reference groups, who are more concerned with the policy making and the coordination and governance aspects, are not very concerned.

Evolutionary change:

The experiences of actors in the ecosystem propose that a development model, which builds on iterative aggregation of fundamental digital elements into new combinations rather than once-off building of stand-alone applications, would provide better responsiveness to respond to environmental challenges and wicked problems. The outcome would be an evolutionary and combinatorial change process that a) produces fundamental digital assets that can be taken into the digital asset portfolio, i.e. digital infrastructure, and b) use, combine and complement the existing assets in forming solutions to complex and rapidly changing societal problems.

Evolutionary change is in line with the interest in how generativity can be enacted in the ecosystem. The evolution is continuous, we have seen "*the evolution that goes along the evolution of the Internet"* and "*none of us will be around to see the end of it*". The combinatorial

aspect resonates with the literature on innovation and digitalization and describe how "*if you have x basic services, you have y possible combinations. You have resolved the problem because. You have a nearly infinite amount of combinations, and we see it in other sectors. People have a huge imagination on how to do it*". Other actors continue that *"This for me the fundamental aspect of how it enables us to focus on API:s. Then you leave it to the people and their imagination to find out how they want to compose it and order the elements to get something out of it. It provides infinite, or almost infinite, opportunities for combination"*

Limitations:

Achieving such a change in development approach and organizational culture is recognized to be a challenge, however. Despite all the views that the current model is insufficient and a need for more responsive and flexible models, there are three topics, which were expressed as major barriers towards the change; the organizational culture and power constellation in the administration, data security and data privacy. The cultural aspect will be discussed in more detail in the next subsection and the two "hard barriers" related to security and privacy below.

Most other limitations, such as legislation or budgetary constraints or governance problems can be removed or overcome if there is a strong enough will, but data security and privacy are considered to be "hard requirements" that cannot be jeopardized as that would impact public trust in government and public institutions; "*these issues you have to be afraid of sometimes, but we are maybe too cautious. They call for new approaches*", "*Security, and even more so, the interpretation of security requirements is constraining*" and "*Data privacy needs to be respected and governments should make sure and guarantee that it's respected"*. Security and privacy concerns are broadly shared and discussed as barriers to cross-organizational and public use of data, services and other assets. This can further be complemented with a requirement for data correctness and quality, which for public institutions is at a different level compared to consumer applications. This was not broadly mentioned, but well explained in one of the last validating interviews where a CIO in distribute government explained why agencies are a bit more reluctant to tap into the opportunity for combinatorial innovation that we have seen in the consumer market and start-up scene. On the other-hand there is also a recognition that the security measures and data classifications might sometimes be overly restrictive; "*placing data security in the right perspective is important. Security people like to say no as first response, but the business risk impact should be done in right place. It is not the job of data security people*".

In summary, these sub-categories remind us of the paradox of change and control, which in IS literature is proposed to be a major challenge in digital change that spans across organizational boundaries.

4.2.4. Category 4: Dual governance and institutional arrangements

The next category describes actor experiences, reasoning, ideas and propositions regarding the kind of ecosystem governance that would support them in their response to digital opportunities. The Open Codes of this category have been grouped into four subcategories (Table 16) and have a special relation to the two previous categories; the fundamental elements and the holistic customer-driven development. This is because an enabling ecosystem governance should cover both the management of fundamentals elements and the governance of digital development, but the requirements differ significantly between the two.

Table 16 : Governance and institutional arrangements

Sub-category	***Corresponding Open Codes***
Structural arrangements	• Hard structures (public sourcing, legal frame, budgetary frame) • Resource management • Centralization vs. decentralization • Formal vs. informal processes • Transparency
Leadership and KPI:s	• Attracting innovators • KPI:s and incentives • Motivation vs. enforced
Governance for collaboration	• Joining forces • Shared vision
Time dimension	• Different maturity • Long term thinking

Structural arrangements:

The most dominant views in this category relate to the structural arrangements that support or constrain ecosystem actors that try to make use of digital opportunities. This is expected and in line with the theoretical framing of the study with digital structures providing new affordances for change, actors being instrumental in enacting the affordances and other structures constraining it. The structures that influence the ability of actors to respond to new digital

opportunities can be categorized as hard structures, such as budgetary and legal structures, and other structures, including resource management, competences, and processes.

The way budgetary resources are allocated in public administration was seen as a major constraint against generative change. The most prominent challenge does not, based on the actor experiences, seem to be a lack of funding but the difficulties in achieving the needed flexibility and cross-organizational response in the existing budgeting framework. This challenge raised statements such as "*the whole budgeting structure is favouring large programs", "everyone tries to get as much of the funding as possible for themselves", "well, let's see what can be achieved. […] Can the funding be channelled? As long as the funding principles follows the traditional sectors?"* and *"it is not a technology problem, but a budgetary."* The question is brought up in the interviews by most of the informants as problematic, with the exception of the international reference group, who were not very explicit on the aspects related to funding. One of the key problems relate, according to the actors, in the too centralized management of funding for digitalization, which is considered to be old-fashioned "empire style" leadership that is in conflict with the ambition to support experimentation and innovation; *"now it seems that funding is being further centralized. At best if could provide flexibility, but at worst it slows down decision making further and adds burocracy".* As the investments in digitalization essentially are investments in public services and operations, centralization of digitalization funds to one budgetary moment that is "*managed as a corporate investment board"* assumes that the board member would have the sensitivity to see opportunities, knowledge to prioritize and wisdom to decide on all digital investments across the whole public sector. This is challenged by actors in all three actor groups, in distributed government, central government and non-government with comments such as *"well it might solve problems, but more it looks like 'the empire strikes back'"*.

As discussed above, the fundamental building blocks with potential for broader use in the ecosystem need to be centrally coordinated and could be described as a national digital asset portfolio. The need to identify, develop, managed and support shared digital building blocks does motivate for centralized funding and there is evidence in the actor experiences that the current model is too fragmented in this respect; *"good things happen all the time. Happens here and there, but small pieces that does not benefit anyone. Someone should have the ability and insight to put them together"*. A stronger resourcing, funding and coordination in respect to the fundamental elements could be well motivated but it does not bring responsiveness or customer driven innovation.

A strong centralization in the way service and operations development is done is unlikely to support the service and operations related digitalization objectives. A key success factor in innovation is the ability and motivation to try out new things and drive them through all the way to a successful outcome. The entrepreneurship attitude discussed with some informants is important and a very centralized and formal ways of working with boards and committees and approvals before anything can even be tried is likely to slow down innovation and change. This view is supported with experiences and views such as "*innovation is between the ears of the people. We need inspired people", "working in committee mode is not attractive to the real innovators*" and "*I have been acting as an entrepreneur in the sense that you have to take personal risks"*. No indications in the case study, not even from the central government actors, indicate that the digitalization outcome would be better achieved through centralized funding and prioritization of opportunities. In a couple of discussions, the benefits of partial funding from central budget were discussed as they speed up development of good initiatives that might otherwise not be launched, "*helps to get the wheels moving"* while carrying part of the costs still adds to the commitment of the participating organizations, "*the units are committed to outcomes by paying part of the costs"*.

A second group of views and experiences that could be classified as a "hard structure" is the legislative framework, including the public procurement legislation. In respect to legislation, there are especially two issues that are considered problematic: the fact that legislation is lagging the pace of technological development and the self-created constraints due to too specific laws on how services shall be delivered and sometimes narrow interpretation of existing legislation in cases where a wider perspective could be taken. "*Laws that slow down the introduction of new services, which objectively seen are better than existing"* and "*legal constraints that are not technical, but in our minds and interpretations*" are reappearing topics related to the legislative framework. Most of the informants working with digitalization speak about the benefits of a more open legislation but tell that there still is a school of public officials who think that the solution to more complex challenges is a more detailed legislation.

There is obviously a number of references to public procurement legislation, which can be expected when discussing constraints against innovation in public administration. The actors might "*sometimes goo behind the public sourcing legislation, lifting their hands and saying that this is how we have to do it",* but the conclusion that can be drawn from the empirical material is that the sourcing related constraints would actually be less constraining than barriers related to funding, other legislative issues, governance and attitudes. Just as some officials

might go behind the public sourcing legislation when they do not want to consider new approaches, it seems like some of the informants felt that they need to mention the sourcing related constraints, even though this was not their primary interest.

Leadership and KPIs:

The structures related to leadership, target setting and KPI:s are less tangible than the budgetary and legislative frameworks, but considered as very impactful when it comes to the ability, incentives and motivation to innovate and make use of cross-organizational digital opportunities. A decentralized public sector, which follows the NPM-paradigm that agencies should be independent and even competitive vis-à-vis private companies is reflected in the target setting and KPI:s. In combination with a rather short-term view on development, it results in more closed units in the ecosystem. The data shows that there is are challenges both the attractiveness to draw contributions from outside of own organization, such as one non-government actor summarizing the whole interview with "*I would get back to the topic of attractiveness we discussed"* and the willingness to contribute to goals external to own organization; "*as a leader you must accept that you cannot only drive the interests of your own agency"*.

A too formal mode of operations, with *"committees with the 'usual suspects'"*, "*discussion forums without real power*" and "*formal working methods passing the ball"* takes down the level of innovativeness and ability to experiment and as a consequence scares off some actors that would be able to contribute. Some informants call them "*the real innovators*", i.e. those who want to do, try and learn rather than sit, talk and speculate. This attractiveness is a matter of openness and transparency as well as encouragement to get them who might have poor experiences from the past to give it another try. The attractiveness is an issue that applies to both internal and external actors, as those persons with ideas and willingness to bring them forward can be found in both groups.

The ability to contribute to common good or higher level objectives beyond the own organization relates primarily to the internal actors within public administration and often lead to the discussion of target setting and KPI:s. As concluded by one actor in the ecosystem, "*innovation is a person business*", we need to give space for innovators to find the opportunities, develop the ideas further, and try them out in a limited way. A target setting framework that does not promote work that goes beyond the interests of the own organization will radically limit the number of ideas that could result in new and better services or operations; "*I was thinking that how many ministries have in the formal target scorecards a KPI on how*

much they collaborate? That it would be one of the measures of good performance. That you follow what happens and take initiatives for collaboration with other ministries and organizations? This should be in the targets of every unit in the ministry". An expected counterargument could be that these cross-organizational ambitions are taken care of centrally within government level portfolio management and investment decisions, but it is important to recognize the difference in scope and level between these two. A cross-organizational openness and targets that support cross-boundary collaboration in development will generate and develop the ideas that later might end up in government level portfolios. The portfolio management approach does not generate customer- or service driven innovations.

The KPI:s can be seen as the formalization of target setting and there is a tendency to focus on the financial reporting both as operational KPI:s ("*I am expected to produce purely financial reporting. If I am unable to do that they will some replace me with someone who is able"*) and in development initiatives ("*We are still very much in a situation where each initiative is evaluated against its direct financial ROI"*). The value of financial KPI:s in running the operations or keeping the project on track are not questioned, but they should be complemented with other KPI:s that better reflect the opportunity of digitalization. And when speaking of opportunities for combinatorial digital innovation, the informants reflect over the lack of incentives for co-operation. The views on what kind of incentives would be needed and how the operative and development project KPI:s should be modified are rather vague, but there is a sentiment that the existing is not enough.

A final topic that relates to the motivational structures is about the balance between enforcement and encouragement. The opinions do differ within the ecosystem, with some actors telling how "*enforcement is the only way to get people to use those common tools"* whereas others express the views that *"change does not happen by force, but there should be motivation, time and money"*. The second point of view is by another actor described as "*You cannot force other actors unless they see the value in participating in common activities*". Rather than trying to decide which approach would be more correct, this analysis has looked at the context of the comments and tried to identify situation when enforcement might be needed and other contextual situation where motivation, support and encouragement would be better suited. One of the actors summarises this tension after using both arguments herself, that *"enforcement would be more about ensuring the framework and motivational aspect about keeping all channels open for innovation".* The conclusion is that enforcement would be most appropriate in the context of shared solutions and reuse of common assets. The benefits of establishing a

shared digital infrastructure in public administration builds on achieving the planned leverage but the transfer to those solutions might mean additional complexity and costs for the individual agencies. This means that there has been tensions in the past with agencies trying to avoid the use and stay with established internal solutions. Also, the feeling that the shared solution might be inferior to the internal solution has previously resulted in resistance, but the comments in favour of enforcement build on the importance of alignment and use of common platform to enable further digital innovation.

Collaboration

The structural arrangements influence ecosystem collaboration, which is considered an important element of digital innovation. In the grounded analysis, we find that the actors highlight two aspects of collaboration in the current ecosystem context; the need for and current lack of collaboration and the role and type of shared vision to guide the collaboration.

The lack of collaboration is seen as a major barrier for change in the ecosystem. The new contextual situation and the complexity of the challenges would require working together to find the best responses, but there is a tendency to prefer intra-organizational response models. Some informants are more frustrated over this and claim that there is no will to work together, whereas others recognize the challenges of achieving the balance between internal and external objectives. As a result of this lack of collaboration, the actions taken are fragmented, which is reflected in comments such that "*Everything is so fragmented. We should thing more broadly and holistically. We do think from the customer point of view, but in a fragmented way within each sector. What we need to do is to put the customer in the middle and accept that there are many organizations associated*". This tendency to focus on organizational-internal solutions is obviously not consequent across all situations, and some actors do add that there are a number of cross-organizational forums, but the problem is that they often include more talk than action; *"well, we have different forums where you can get together and complain about how bad things are but they do not have any decision power so in average it is a waste of time"*, "*what I said before that the usual suspects meet each other and that discussion does not create very much new"*. The empirical data does therefore not support that new collaboration forums would solve the cross-boundary issues, but a more structural change in the actual implementation model will be needed to support digital innovation. While recognizing that the issue to a significant part is cultural, a division into well-coordinated and centrally supported digital assets and evolutionary customer centric initiatives, as presented in categories 2 and 3, could reduce the interdependencies that make cross-organizational development so difficult.

Time dimension:

The final sub-category is about the maturity differences and short vs. long-term perspective that are both needed.

The informants explain that the response to digitalization needs a short-term perspective as there is the need for experimentation and iterative progress where you learn and adjust based on doings, but also because "*we have to live with the fact that our 'customers' want to see the benefits right away".* Stakeholders expect to see benefits realized in reasonable time. On the other hand, actors have to work with a long-term perspective of "*opening up the future for more opportunities"* and "*establishing a platform that provide capabilities, effectiveness and responsiveness for future needs that are not yet known*". Most informants agree that the impact of digitalization need to be considered as a long-term trend and the responses should be aligned with that, but it is not always easy in the pressure to produce results and "*in the short political cycles. A government period of 4 years can be too short to create lasting change in this rigid world, but we should build the foundation for the next period*". These experiences support the views presented in the third category that the implementation model needs to be more gradual with learnings along the implementation process, decisions done when needed and important options for the future held open as long as possible.

When considering digital development in the whole ecosystem, the time dimension is further complicated by the different maturity level of participating organizations. Ecosystem level progress is constrained by the different needs and abilities of organizations with quite different maturity in this respect.

4.2.5. Category 5: Culture and attitudes

A fifth and final category is describing the aspects of organizational culture and attitudes that influence the ability to draw on digital opportunities. In the analysis, the empirical data related to culture and attitudes has been categorized into a) more general views on what kind of culture would be needed in a digital era, b) the personal traits that have been stressed as important in the context and c) the collective attitudes that would increase the ability to respond.

Table 17 : Culture and attitudes

Sub-category	***Corresponding Open Codes***
General attitudes and views	• Positive and negatives views • "Digital first-" and "Once only"-principle
Personal traits	• Risk taking

	• Leadership
Collective attitudes	• Increased mental readiness • Isolation and Not Invented Here • Defending achieved benefits

Generic attitudes and views:

The generic attitudes towards digitalization include both positive view in relation to the current situation and future opportunities of the case ecosystem as well as negative views of how there is not much new happening. These opposite views can be due to different positions and experiences in the ecosystem, but from the context of how these comments are expressed it is possible to see that they also relate to different aspects of digitalization. The negative aspects often relate to the lack of change in how digitalization initiatives are managed and the overall governance. These views are captured in quotes such as "*They have done digitalization for a longer time, and for them it is pretty much automation. Not very much new in it.*" and "*I am a bit worried about how the new key initiatives are managed. There is 100m€ and it sounds like the governance is rather 'traditional'"*. There is a feeling that despite the policy level talks about digitalization and experimentation, there has been little change in the way programs are implemented – "*I do not see very much new"* and *"I am a bit disappointed compared to the hype one year ago. Seems that inertia is too big to get the wheels turning"*. Relating this finding to the other emerging categories of this grounded analysis, it would mean that the new requirements and opportunities of contextual change are not reflected in the way ecosystem actors respond. A mode of operation, where stepwise progress towards holistic customer-centric solutions are achieved by building on existing digital structures, has not yet been realized. And this makes it difficult to overcome the challenges of the traditional program implementation model. This view is contrasted with the opinions that many new approaches are tried in the ecosystem, but the conclusion could be that there currently is distributed experimentation in new ways of taking advantage of digitalization, but when it comes to more "serious" implementation programs, they are forced into the formal mode that is prevailing form a monolithic era. This indicates that the answer to realising the potential would be in how governance structures constrain new ways of working. This finding will be elaborated in more details in the section of discussion and conclusions.

The positive views by actors more often relate to the maturing attitudes and competences that has the potential to produce good results in a longer time frame. As concluded by a distributed

government actor: "*There are very many good things that has happened and is happening. Encouragement would be the way to go forward.* […] *And there is lots of know-how in Finland".* The other positive comments also listed progress areas and stressed that it is not too late to get to the next level. There is a maturity in thinking and the opportunities are broadly accepted, there are competences that can be built on and they are used in small scale experimentation on how things can be done differently, but there is a threshold to overcome before we can expect to see results in a broader scale "*We are mature to do things differently, but the whole apparatus is not there yet. But we can see the change happening"*.

A final aspect that was stressed in relation to generic attitudes, was the need for principles or slogans that has helped leaders to gain buy-in in administration and beyond. The two most commonly mentioned are the Digital First-principle, that challenge the previously dominant thought that public services has to be available to everyone in the same universal way and gives "authorization" for new-thinking, and the Once Only-principle, which makes people realize that working together is not a choice but a necessity and you must have trust in other organizations that have a role in producing the end-customer service. The Digital First principle goes hand-in-hand with the growing awareness captured under the code *mental maturity*, and the Once Only principle is a describing as situation that could be seen as the outcome of increased focus on data and other fundamental elements that can be reused for a high number of services. These two overarching principles have been particularly useful in opening up the attitudes towards more holistic digitalization.

The Once Only-principle, which was considered to be a success factor in many countries, is essentially incorporated in the Government program 2015 and established as a guiding principle for digitalization as *"We will ask for new data only once*". Against that fact, it is somewhat surprising that it was not very much emphasised by case ecosystem actors other (although they stressed the importance of data) but more by the international reference actors.

Personal traits:

A starting point for this research has been that the actors are instrumental in achieving the change potential that is afforded by changes in digital structures. As a consequence, it would be logical to ask what kind of personal traits are required to successfully act upon the opportunities. Mindful about the limitations of this study, we are able to show indication of two personal characteristics that would support actors in navigating the opportunities; the acceptance of risks in exploring new opportunities and a leadership role in crossing boundaries.

Traditionally, public administration has been considered to be risk averse compared to private the sector (Bernier & Hafsi, 2007; Matthews et al., 2009; Osborne & Brown, 2011). This study is not trying to establish whether this is the case or not, but it indicates that the actors that are more at ease with risks would be better positioned to take advantage of new opportunities. The empirical data tell about "*no culture of risk taking*", "*unconscious search for security*" and *"the cautiousness of public officials*", but at the same time show that experimentation and drawing on new opportunities has required actors *"to take risks with taxpayers' money"* and *"you have to follow the law, of course, but also be ready to take risks and find new approaches in public sourcing".* The need for risk taking is exemplified by one actor in distributed government who explained his role with wordings that resembled that of an entrepreneur. When asked if he would describe himself as an internal entrepreneur, he answered that he has not used the term, but that is exactly what he is doing; putting himself at stake in promoting new ways of working. The views that organizational culture is being risk-averse are by some actors explained by the high level of scrutiny in public sector initiatives. A public service that suffers of poor data quality, for instance, is likely to get a lot more negative publicity than a similar private service. Finally, there are some specific structures that makes risk taking less appealing in the public sector. The two main constraints are public procurement legislation and lack of incentives. Even if there is experimentation related to innovative sourcing, such as embedding hackathon events in the sourcing process, the legislation still provides a framework for how development services are acquired, and it often guides the actor to source against more pre-defined solutions than gradual step-wise progress with the flexibility to either tap into existing platforms or carve out parts of the solution to become shared assets, when considered feasible during the implementation.

The leadership aspect of how actors respond to digitalization was discussed in particular with government actors. There seem to be a recognition both in central government and in distributed government that, as the context and challenges are changing, so must the leadership. Leaders that are willing to take a boundary-crossing role both internally in the organization, e.g. vis-à-vis other units, and externally, partnering with other actors, would be positioning themselves as leaders in digitalization. The nature of the role would, however, change and take on more of an impartial builder of trust and less of a pure decision maker. Leaders need to accept that "*there is no objectively best solution, accept their ignorance and be open to drive objectives beyond their own agency or unit".* Leading the way towards a transparent and open approach with joint development would be very important to break old habits of isolation, as one of the common

challenges that everyone suffers from is the fragmented development and "*not invented here*" culture that quite a few actors referred to.

Collective attitudes:

The empirical data shows a growing mental maturity in regard to digitalization and the desire to do things in new ways. This is sometimes limited by other structures (e.g. financial, resourcing or legal barriers or self-created obstacles), but just as often actors in the case ecosystem tell that the new ways of working are constrained by negative attitudes towards working together. Some attitudes that make collaboration and holistic development difficult include the not invented here syndrome, lack of incentives in the formal target setting system, and stakeholders that have an interest in defending status quo.

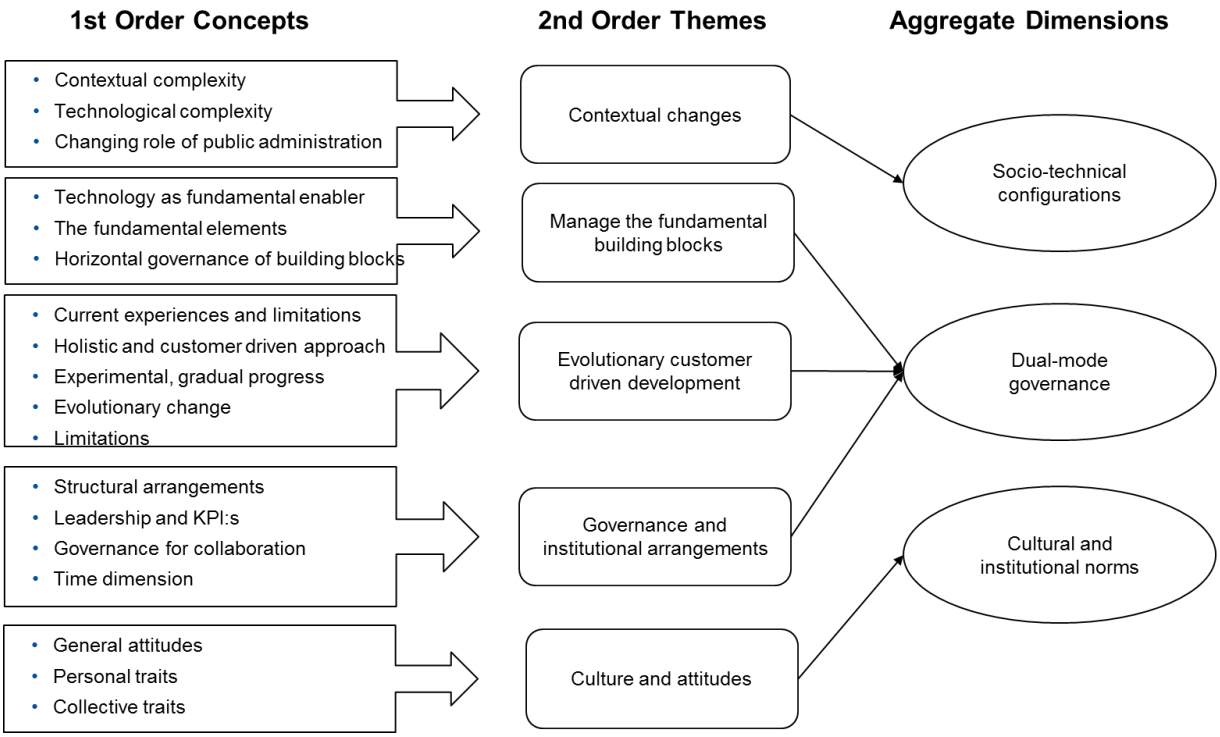
There is an interesting contradiction in the findings of increased maturity in the perception of digitalization and the fragmented and isolated approach to how digitalization opportunities are addressed. Data indicates that this might be related to the temporal aspect of reasoning. The future projective view is showing a maturity in how organizations look ahead and see that digitalization will enable broad, holistic response to complex challenges, but the experiential and situational-evaluatory perspectives focus on the past and current challenges related to cross-organizational development and concludes that it will be easier to focus on internal development.

Changing attitudes and organizational culture is tough, which is reflected in a comment by a non-government actor "*I'm a bit cynical, because I have noticed that it has been difficult selling that idea*" no quick fixes are to be expected in this area. It does not, however, have to mean that benefits of digitalization could not be achieved. First of all, it is a long-term game, as quoted by one non-government actor "*no-one of us will be around to see the outcome"* and secondly, arrangements can be made to support the use of shared digital assets without having to build the kind of large multi-stakeholder implementation initiatives which are found to be slow and cumbersome for participating actors. A way to address the challenges related to cross-organizational development would be to establish a dual governance mechanism that provides different logics of managing the fundamental elements and promoting evolutionary customer-centric development, as explained in categories 2, 3 and 4. This dual governance logic emerging from the empirical case data would reduce the negative impact of actors unwilling to work together as there would be a gradual change towards more modular and combinatorial development as opposed to monolithic initiatives where all stakeholders negotiate requirements.

4.2.6. Summarizing ecosystem level findings

The five categories emerging from the inductive analysis emphasize different aspects the phenomenon at the level of ecosystem. These findings can be combined into a data structure of first order concepts presented in the voice of the informant, second order themes presented in theoretically relevant terms and aggregate dimensions to explain the phenomenon in a conceptual manner (Gioia et al., 2012) as shown in Figure 14.

Figure 14 : Data structure of ecosystem level analysis



The visualization in Figure 14 shows how the ecosystem level analysis has proceeded from raw data to first order concepts and further to theoretical themes and aggregate dimensions. The five categories that emerged from the axial coding have been aggregated into three structural areas that play an important role as drivers, enablers and constraints in distributed change that is enables by digital generativity and become enacted by actors in the ecosystem.

The first aggregate dimension, which responds directly to the experiences and views of the first axial category, shows how the context of public service delivery is changing due to both societal drivers and technological development. There is an increased societal and technical complexity in the structures that calls for new approaches and ways of responding to digital opportunities. Wicked problems makes the old models obsolete but there are not yet established alternatives that would replace them. The context is changing regardless of what any single actor decides to do in response to digitalization and there is a sense among actors that the roles and even the

institutional identities of many public organizations will change. The important question for the future will be more about the capacity to learn, act and react together in response to the emerging opportunities (or threats), than the ability to "predict, plan and prepare" by specifying and building digital solutions that will be able to solve upcoming problems.

The aggregate dimension that draws on these actor perceptions and narratives has been named *Socio-technical configurations* as it relates to the overall contextual change that sets the scene. The socio-technical reality is a key driver for change with the wicked and interdependent societal challenges, the technical installed based that both enables and constrains change and the its continuously evolving nature due to other actors taking action to drive their objectives. In line with the theoretical framing and the cyclical model of enactment, the socio-technical structures becomes reconfigured through the response taken by actors in the ecosystem (rfr. to definition of digitalization). The socio-technical configurations is a structural domain that resonates with the literature on Digital Government proposing a more holistic approach digital opportunities in the context of Public Administration. The emphasis is on a holistic approach that looks at broader systems rather than incrementally adding digital technology as point-solutions (OECD, 2014, Dunleavy et al., 2006; Fishenden & Thomas, 2014). This shift of perspective from detailed and exact (implementation of specified solutions) to holistic and fuzzy (enabling for an unknown future) is expected to be a major challenge that requires strong leadership capacities.

The second aggregate dimension combines three axial categories into an explanation of how distributed reconfiguration can be enabled and coordinated. It explicates a number of current constraints that makes it difficult to realize the generative potential and provides suggestions for how to organize both operations of digital assets and change through digital initiatives and link the two processes that run with very different logics. The dimension has been named *Dual-mode digital governance* and it describes the structures that define and guide digital change in the system. The first of the three second order themes included, the *fundamental building blocks*, essentially describes how the potential for distributed change draws on digital artifacts, their characteristics and the generative affordance that they provide. This potential, which was discussed in the literature review section 2.2, was recognized by many actors in the ecosystem although described with other terms and metaphors. In the empirical analysis we have seen how actors recognize the importance of these elements, which elements they find to be most important and how they would put more emphasis on the governance of these elements to promote agility, distributed response and digital innovation.

The second order theme of *evolutionary change* describes past and current challenges in digital initiatives as well as the experiences and proposals related to how customer driven digitalization should be organized and implemented. Realizing digital opportunities is indeed drawing on technological affordances, but as enactment is dependent on goal-oriented actors the ecosystem should allow for distributed, gradual and experimental development that draw on the fundamental elements in producing incremental steps towards holistic changes. This opportunity is not well-reflected in the current implementation model and increased central control would further constrain both the motivation of actors and the innovation capacity in the ecosystem. The proposal to shift to customer driven digitalization is reflected in the political agenda, but that is not alone enough to change development models from isolated initiatives to distributed but coordinated development.

The third axial category contributing to this aggregate dimension, *governance and institutional arrangements,* contributes with experiences and suggestions on how to organize and govern to release the potential of fundamental digital assets while at the same time enabling a more responsive and experimental approach to digital opportunities. An idea of dual governance that address the potential and constraints described in the two previous categories emerges. Constraints in current governance model include "hard" structural constraints, such as budgetary and legal factors, as well as soft constraints, such as leadership, incentives and drivers for collaboration.

A conclusion of the second aggregate dimension is that the characteristics of digital artifacts matter in the response to new structural opportunities, but the current model of how digital initiatives are implemented and governed is not optimal for producing the expected outcomes. This second dimension aligns theoretically with the literature on digital artifacts, digital infrastructure and digital generativity (e.g. Tilson et al., 2010; Zittrain, 2008). It does, however, extend from these domains with the suggestion that there need to be a dual-mode governance in order to effectively make use of the generative affordance. A governance model that separates identification, design, implementation, maintenance, promotion and support of digital assets from the different logic required to make use of them in a customer-driven, iterative and responsive way. The findings resonate with generic change management literature that favor evolution over design (Van de Ven et Poole, 1995) and brings to mind the concept of brickolage (:::?), but there is also interesting similarities to the more specific literature on digital innovation. The way that a dual-mode governance would coordinate development initiatives with fundamental building blocks, while allowing for problems and solutions to meet, is in line

with the proposed theorizing logics of digital innovation with affordances, sensemaking and orchestrations rather than specific design, stage gate development and control mechanisms (Nambisan et al., 2017).

The last of the aggregate dimensions, which has been named *cultural and institutional norms*, explains how the ability and motivation of distributed actors is a necessary ingredient of generativity enactment. The name relates to invisible structures that rises from organizational culture and institutional legitimacy. Ability and motivation is of course also related to the incentives and formal decision making model, but those aspects are covered in the 2nd order theme of Governance and Institutional arrangements. Without actors that want to make use of digital opportunities and thereby contribute to distributed change, it does not matter if there is the digital maturity in the administration or a governance that enables distributed change. It is important to remember that the affordance is relational to the actor, which means that there will not be a central response to the same opportunity even if there would be the will and capacity in central government. The central government would just not see the opportunity! This means that the only way that generativity enactment can occur is through the agency of distributed actors and centralized governance can enable and support this process by promoting a culture that supports engagement, collaboration, experimentation and innovation. The first order concepts of this dimensions rely on personal and collective traits that the study suggests to promote distributed response to digital opportunities in the ecosystem. Based on the empirical data, there is an emphasis on the need for collaboration towards shared interests and overcoming the isolation that most actors see as a major obstacle to broader use of digital opportunities. The aggregate dimension aligns with existing literature on innovation in the way it highlights the potential for innovation in broad and heterogeneous systems and the necessity of individual ability and motivation working to drive ideas that can produce new innovative solutions (Schumpeter, 1934; Ahuja, 2008). Applying the definition of Open Innovation as "*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries*" (Bogers et al., 2017: p. 17) connects this ability and motivation back to the previous aggregate dimension on how system governance must allow flows across organizations, but in a purposeful way that enables actors in the ecosystem to make use of the assets.

Together these aggregate dimensions suggests that;

> *The contextual change, with increasing complexity in societal challenges faced as well as technologies in use, call for new approaches that separate fundamental digital assets*

from the digital change initiatives. The governance model for fundamental elements should differ from the governance of digital initiatives, as an attempt to support all digitalization efforts with only one governance model will result in either too much centralized control, which will constrain innovation and actor motivation, or a too fragmented model for the fundamental elements, which will constrain leverage of digital assets. The value of such dual-mode governance will, however, be realized only if there is the ability and motivation of actors throughout the ecosystem to take initiatives and drive experimentation, change and innovation in a distributed manner.

With this condensed storyline we conclude the ecosystem level analysis and lifts the perspective back to our research questions and how the two rounds of analysis have answered them.

4.3. SUMMARY OF DATA ANALYSIS AND FINDINGS

The research was designed to answer the following two research questions:

Question 1: "How are digital opportunities and challenges in a public service ecosystem perceived by the actors and how do the perceptions that underpin their response differ or align across actors and actor groups?"

Question 2: "How are individual responses to digitalization enabled or constrained in the ecosystem and how can ecosystem governance be organized to support digital generativity?"

As the research questions are at two different levels, taking an interest in the interplay between actor level agency and the ecosystem level governance and constraints, the analysis was also conducted in two rounds and at different levels.

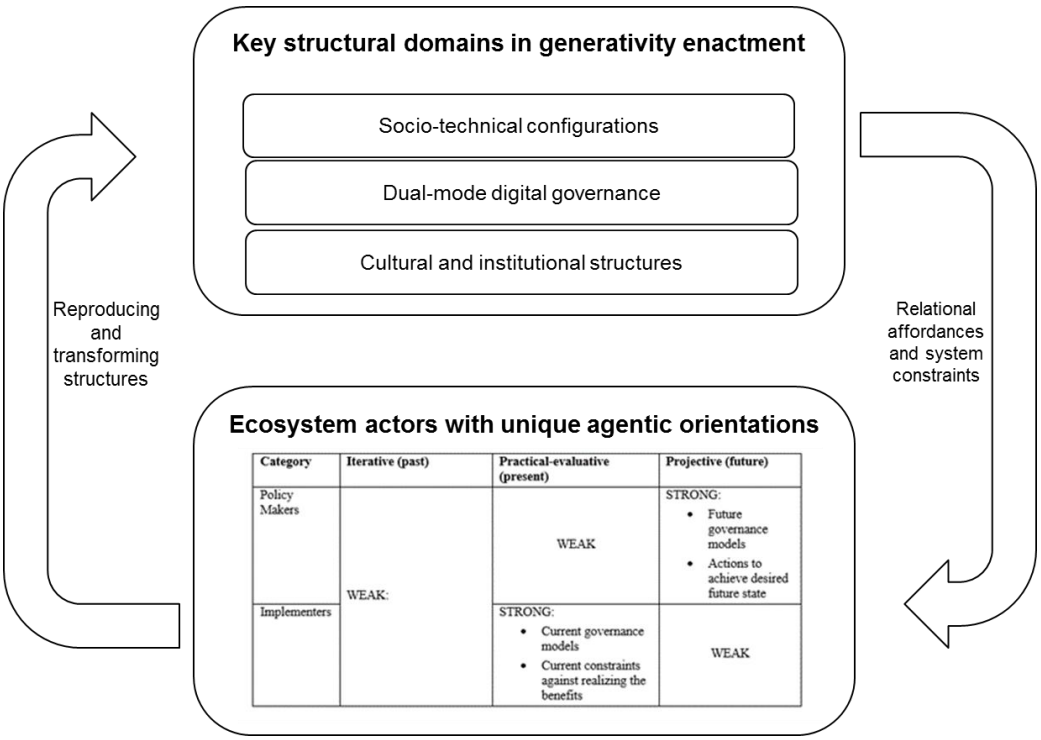
The actor level analysis shows how actors draw on unique agentic orientations in their response to ecosystem digitalization. Understanding these differences is important as generativity of digital structures is treated as a relational affordance that depends on the perceptions, situation, goals, ability and motivators of actors. The analysis also shows how the differences between government actors and non-government actors are less apparent than the differences between actor categories of *policy makers* and *implementers*. Actors involved with policy making, regulation and ecosystem governance have a more future-oriented orientation whereas those actors that are directly involved with digital change initiatives, i.e. the distributed government actors and the non-government actors, draw more on their current situation and the constraints that they are facing. Further, the individual level analysis reveals areas of alignment across all

actor groups, such as the increased need for agility and responsiveness to make use of the new digital opportunities and the need for cultural change to break the tradition of isolated doing and make way for a more collaborative modus operandi where actors can learn and adjust together. Finally, the individual level analysis helps in explaining a number of tensions by putting seemingly conflicting statements into a temporal perspective. The tension of flexibility versus control, the tension of evolution and disruption and the tension between business- or technology-driven digitalization are explored through the empirical data with the conclusion that none of the three issues is an either-or question, but instead the various views are relevant in different temporal or contextual situations.

The ecosystem level analysis complements the individual level findings with a synthetized description of digital change dynamics in the ecosystem, which have been formed by super-imposing the experiences and views of individual actors. It shows that increased complexity and changing roles in public administration is calling for new responses to digital opportunities. A system with increased focus on fundamental digital elements, a development model that allows for more incremental progress in pursuing holistic digital government, and an ecosystem governance that separates but coordinates the two is suggested to promote the enactment of digital generativity. This will, however, require a culture of collaboration with ability and motivation of actors to work together and learn together.

Applying these outcomes of the analysis to the theoretical framing presented in Section 3 (Figure 5) provides a model for generativity enactment in the case ecosystem as presented in Figure 15.

Figure 15 : Enactment of digital generativity in the case ecosystem



The model combines the analytical framing with the findings of the two rounds of analysis. According to the theoretical framing of affordance theory and human agency, the generativity would become enacted through an interplay between digital structures and social action. The digital structure provides affordances to actors, who respond to these in accordance with their agentic orientations. The actors are, however, also constrained by structures, both the way digital structures are formed and other structural areas such as the current socio-technical configurations, the governance model for change and the cultural and institutional norms. This gives the manoeuvring room for actors to respond. These were the three structural domains found to be of special importance for the generativity enactment. The socio-technical configurations determine the current context and way of working and also acts as a driver for change. The inefficiencies in current configuration is a trigger for actors to reflect on opportunities. A dual-mode digital governance, i.e. the structures that guide digital change is suggested as a model that would support distributed digital change. Few ecosystem has such a governance model and in practice we see that the current governance is constraining actors. Finally, we have the cultural and institutional norms, i.e. the soft structures that determine actor motivation and legitimacy to actively strive for change. All three of these structures can be perceived differently by actors, and actors have different means and powers to act upon their perceptions, which means that neither affordances nor constraints are the same to all actors.

There are, however, also patterns in the differences and some areas of alignment across actors and actor groups that also will influence responses.

In the domain of social action, we have seen that each actor has a unique mix of past experiences, current challenges and future goals, which means that the structural domains provides different relational affordances to them. The two categories of *policy makers* and *implementers* emerge as having different agentic orientations in the response to digital opportunities in the ecosystem. The implementers, with their practical-evaluation orientation and focus on governance issues and constraints, are concerned about operational challenges posed by current socio-technical configurations in their context and the way that current governance constrains their actions. They are not primarily concerned about the digital building blocks as they provide less direct value and the current governance model is not providing very much incentives to use or contribute to them. This easily leads to the dominant model of isolated digital initiatives directly linked to the socio-technical structures, neglecting the opportunities that the fundamental digital elements would offer.

The policy makers, with their projective orientation and a focus on governance and actions, are more interested in holistic digitalization and efficient use of a shared digital infrastructure. They emphasize the long-term value and opportunities afforded by fundamental digital building blocks and relate the discussion on future governance and actions to how these shared building blocks could be leveraged. The socio-technical structures are important as they provide the public value, but the need for a holistic approach is recognized and the emphasis is on "doing and learning together" rather than isolated digital initiatives. The actions, partly taken and partly reflected upon, often relate to governance and institutional arrangements that would support such a holistic approach that simultaneously leverages the building blocks and allows for distributed agency. The dual-mode governance that emerges as a central dimension from the ecosystem level analysis is, however, not explicitly expressed but individual actors reflect on individual sub-questions of governance, support and control.

Based on these perceptions and orientations, the actors decide about actions. Within the manoeuvring space that is left between the affordances and the constraints, actors choose their route of either doing nothing, enforcing current structures or driving change in the structures.

With this conclusion, which is based on the two-level analysis of empirical data, we move back to the literature on generativity and digital innovation to discuss the findings against existing literature and the gaps that the study set out to explore.

5. DISCUSSION AGAINST EXISTING LITERATURE

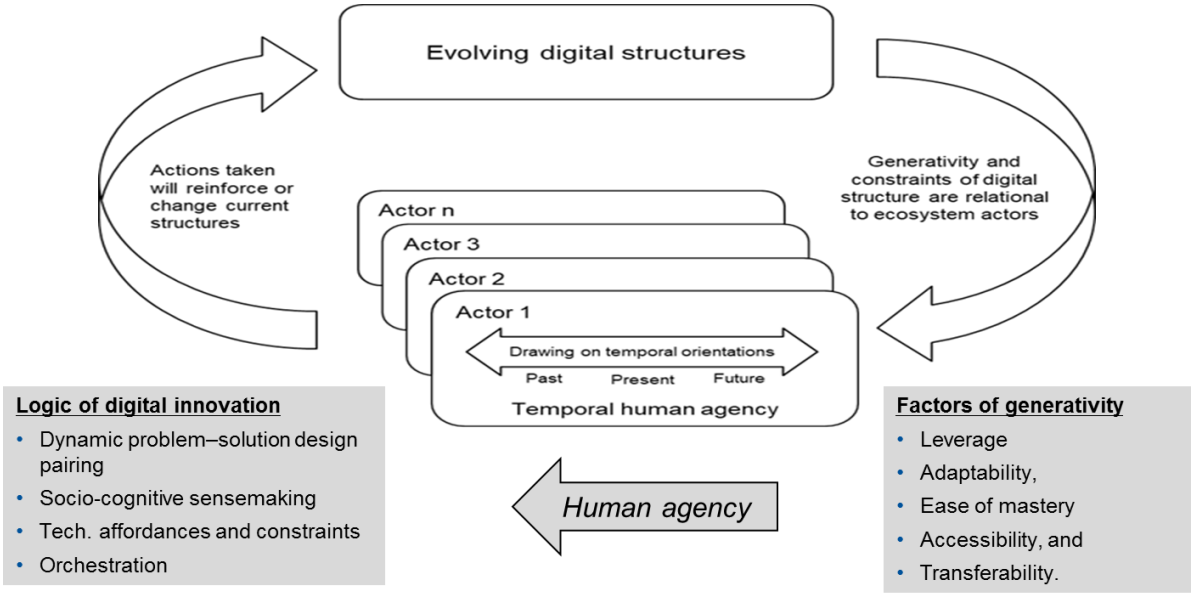
The previous section presented the findings of individual level and ecosystem level analysis. This section compare the findings to two areas of literature, i.e. the foundational works on generativity by Zittrain (2006; 2008) and the most recent conceptualization of digital innovation (Nambisan et al., 2017).

In the analysis, we first saw how individual actors differ in their agentic orientations in relation to the challenges and opportunities that emerge with growing and maturing digital structures. The ecosystem level analysis brought these different experiences and reasoning to an ecosystem level view on generativity enactment. From the two rounds of analysis, the model shown in Figure 15 emerged to describe the enactment of digital generativity in the case ecosystem. Three distinct structural domains, socio-technical configurations, governance system and cultural norms, provide affordances and constraints to ecosystem actors that draw on their agentic orientations in response. Through the responses they re-enforce or modify the structures in many ways. Some actors might add to the building blocks, others may reconfigure the socio-technical processes, and others still might change the governance model. Any such response that induces change in the structural domains will obviously affect the affordances and constraints, and the cycle repeats.

Generativity and digital innovation are in existing literature proposed to be outcomes that follow from the specific characteristics of a growing digital infrastructure (Yoo 2010, Zittrain, 2006; 2008; Haneseth and Lyytinen, 2010; Tilson et al., 2010) and the goal-oriented actors that respond to opportunities in their unique context (Majchrzak and Markus 2012; Markus and Silver 2008; Emirbayer and Mische, 1999). The argument is that digital structures provides a relational potential to actors who, in accordance with the self-efficacy theory (Bandura, 2000), can enact it to their benefit. This would materialize as distributed digital innovation, which by *carrying out of new combinations of digital and physical components can create novel products* (Yoo, 2010) and *change market offerings, business processes or models through the use of digital technology* (Nambisan et al., 2017).

This line of argumentation puts human agency, which has been the focus and foreground of this study, as a link between the relational affordance of structural generativity and the outcome of digital innovation. Below we will discuss the empirical findings against the five factors of generativity proposed by Zittrain (2008) and the four theoretical logics of digital innovation proposed by Nambisan et al. (2017) as presented in Figure 16 below.

Figure 16 : Human agency can enact generativity factors to produce digital innovation



The findings presented in previous section suggest that a dual-mode governance would enable distributed actors to respond to opportunities in ways that leverage the fundamental digital building blocks while allowing for customer-driven reconfiguration of socio-technical structures. Intuitively the factors of generativity by Zittrain (2008) would seem to provide guidance for the governance of digital assets and the theorizing logics by Nambisan et al. (2017) might provide advice for how to govern digital initiatives. This will discussed in more details below.

5.1. GENERATIVITY

This study does not explicitly focus on digital structures and the generative characteristics, but it foregrounds the actors to increase our understanding of how human agency is instrumental in the enactment process. The objective of the discussion in this section is to link the empirical findings related to enactment to the existing conceptualization of generativity. This will provide both additional details and empirical validation to the current generativity factors that are largely conceptual. Generativity factors that are supported by the empirical study and its inductive ecosystem level analysis can be consider strengthened by the study and areas where existing literature is in conflict with be findings can be identified for further exploration.

The discussion builds on the literature on digital infrastructure (Hanseth and Lyytinen, 2010; Tilson et al., 2010; Henfridsson and Bygstad, 2013) and especially the foundational works on digital generativity by Zittrain (2006, 2008) where five generativity factors have been proposed

(Zittrain, 2008: p. 71). In the discussion we rely on the definition that was presented in Chapter 2.1.3, describing generativity as "*a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences"* (Zittrain, 2008: p. 70) and use the five factors that are proposed to add to a system's generativity as a reference for empirical data and findings.

5.1.1. Unfiltered contributions from broad and varied audiences

In the generativity literature there is an implicit reference to human agency with the reference to actor *contributions* as part of the generativity definition (Zittrain, 2008: p. 70) and the subsequent statement that *"Participation is the input to generativity and innovation is the outcome*" (Zittrain, 2008: p. 90). This aspect of human agency is, however, not taken to the centre of Zittrain's research, nor in further research on digital generativity. Instead, Zittrain focuses on the material elements and digital characteristics that provide the generative affordance. To find the theoretical underpinning for human agency as instrumental in the enactment process, we have to look at more generic research on technology in organizations (Majchrzak and Markus 2012; Markus and Silver 2008; Volkoff and Strong 2013; Strong et al., 2014) and apply it to the context of digital generativity.

Based on the individual level analysis we can confirm that each ecosystem actor approach digital opportunities with unique agentic orientations, which means that they will drive different opportunities and contribute to the ecosystem in ways that cannot be pre-planned by any central actor. This influences the digital generativity as each contribution is adding to the structural affordance that is available for other actors. Looking at it in another way means that if contributions are limited to what is prescribed or approved by a central actor, there will be only a small part of the potential realized as the central actor sees only a share of the opportunities due to different agentic orientations. To realize the full potential requires contributions from broad and varied audiences. Contributions that make sense to these actors due to theirs past, their present circumstances and their goals for the future.

Another question is whether these contributions should be *unfiltered*, as is proposed in the definition (Zittrain, 2008). The findings suggest that the distributed contributions should be supported, coordinated and guided to promote efficiency in the ecosystem as a whole. Experimentation might be unfiltered, but the governance of fundamental digital elements should according to findings promote existing assets and guide digital initiatives in the use of them instead of allowing each initiative to develop own parallel solutions. This would not only be costly but also reduce the leverage of each asset, i.e. reduce the generativity as the system

become fragmented. This is the most relevant finding that would be in contrast to the generativity definition and its basic premises. It is, however, only partly contradictory as it clearly seen in the findings that it is crucial to have flexibility and ability for broad and various actors to experiment and contribute without central approval. This is reflected in the actor experiences and further stressed by the fifth category emerging in the ecosystem analysis. The problem is the word *unfiltered* is a bit too strong as part of the definition and could be reconsidered.

The actors are also constrained in their abilities to contribute to the ecosystem and make use of digital opportunities. According to the affordance theory, enactment depends not only on actor perceptions and objectives but also on the actor's ability to make use of the possibilities that the environment provides and system constraints (Leonardi, 2011; Volkoff and Strong 2013; Zammuto et al. 2007). The ecosystem level analysis describes change dynamics and constraints of the case ecosystem. These experiences and constraints that actors tell about can be compared to the generativity factors proposed in literature. Zittrain (2008: p. 71-73) proposes that generativity is dependent on how well a system or technology leverages a set of tasks, how it can be adapted to a range of tasks, how easily new contributors can master it, how accessible it is to those willing and able to use and build upon it, and how transferable any changes in the system are to others - including and perhaps especially non-experts.

In fact, to have a detailed comparison between empirical case situation and the proposed generativity factors, the interview transcripts were coded against these five categories with the following outcome.

5.1.2. Leverage

Leverage refers to how broadly the system or individual component provide benefits to its participating actors (Zittrain, 2008). A benefits of being part of an ecosystem, rather than working alone, is to avoid reinventing the wheel, have access to tools, resources and data collected by others, and the ability to use services and support processes external to own organization. A broader use of resources increases their leverage. Leverage can take different meanings depending on the context, but as it in this context is used rather literally, we rely on the Oxford dictionary definition of leverage as *"use (something) to maximum advantage"*. This means that digital assets and resources are highly leveraged if they can be used for a broad range of purposes by a variety of actors, and this leverage makes the system more generative.

Actions and initiatives within the broad definition of digitalization contribute differently to the leverage of digital structures. For example, an IS application that is developed to solve a very

specific problem can provide a good solution for organization that implement it but might be of little value for others in the ecosystem. On the contrary, digital assets designed to become common platform functionality can provide value for many ecosystem actors, even if they do not solve any specific issue on its own. According to the definition, the latter has a higher leverage in the ecosystem.

Finally, it is worth clarifying the use of the term leverage in relation to digital innovation. Leverage is often discussed in relation to innovation diffusion (e.g. Nambisan and Sawhney, 2011), but in the context of this study, we focus on how a good direct leverage of digital structures and assets would support generative change and thereby enable innovation. The further leverage achieved through diffusion of innovative outcomes is not contested, but that is not covered in this discussion.

The empirical data gravitates to three aspects of leverage, which would be of relevance when discussing the generativity of digital structures; the notion of basic building blocks or fundamental elements, the drivers and constraints related to increasing the leverage, and the governance to enable and promote shared use for maximum advantage.

The first on these three, the view that digitalization builds on basic building blocks, which can be combined into different configurations, is often touched upon already in the discussion on what distinguishes digitalization from the previous era of ICT-enabled organizational development. Several informants reflect on the recent past as a first wave of digitalization, which has produced a high number of digital artefacts and assets in the quest for process automation and efficiency. Informants tell about the steady progress of producing digital assets that could be leveraged for future solutions not yet known, such as "*We need to go back to the services and what we call the decomposition of services. To smaller scale services*", "*The typical ones are; base registers, interoperability and standards, digital identification system, information storage and management system like data centre mgmt. and cloud computing, shared services in different areas*", "*One thing we saw was a very well structured level of base registers"* and "*Always when we start building something new, we would complement this [digital asset] portfolio, which together with existing assets would provide additional value*". This trend seems to be partly due to the pure volume of assets being produced, i.e. "*The common assets have enabled combinatorial solutions in many areas"*, partly due to increased pressure to take this into account in design choices, i.e. "*The financial crisis constraints on the public service is an interesting driver to stop administration to reinvent the wheel but work together on the common tools, functionality and services"*, and partly a general maturity and awareness

about the opportunity, i.e. "*Not very much has changes in regards to tooling. On the contrary, we have realized that we can do much more with existing tools without buying anything new at all.*" These basic building blocks, or fundamental elements as they were called by some actors, would be the basis for more profound transformation in the "second wave of digitalization", that is yet to come. The notion of basic building blocks that is a key element emerging out of the inductive analysis aligns nicely with the generativity factor of leverage because the objective with building blocks would be to stay at a more generic level than traditional information system design, and can therefore be used to maximum benefit within the ecosystem. There is, however, a concern that the term is used to broadly to describe all digital development that is done. Not all artifacts that are called digital building blocks will have the potential for leverage. The potential will be dependent on how they are designed, implemented and managed and this would be important to recognize and account for. A generic capability, which is implemented within an isolated application and managed by one agency whose prime concern is only to fulfil their own mission, will not have the same potential for leverage as the same capability if it is designed to evolve as platform functionality and implemented as flexible services with well-managed interfaces.

The drivers for increased leverage of system resources and assets are in the interviews often discussed in relation to contextual changes and challenges in the ecosystem, such as financial austerity, need for responsiveness, "wicked problems" and increased user expectations. The drivers are recognized as partly context and policy dependent, but at least the pressure caused by the financial crisis in 2008-2009 and the need to follow a "once only" principle in data acquisition are generic drivers for consolidation and leverage of existing resources. This trend is ongoing, and is increasing the leverage of existing and new building blocks, but there is a limit to what assets and resources can be leveraged across the ecosystem. The more specific a digital artefact is to a particular need; the less leverage is to be expected. This is illustrated in examples where actors have run into problems when trying to establish common solutions such as application processing across agencies. Only generic building blocks can be efficiently leveraged across the ecosystems, as the organizational routines are unique even in organizations that might seem similar at first glance. A further constraint, which is more institutional and cultural, is the willingness to collaborate across agencies and a feeling that most agencies prefer to build their own building blocks even if it would mean that they "reinvent the wheel". This challenge gave reason to reflect on motivation vs. enforcement and the leadership and measurement challenges related to increasing the leverage of resources and assets.

As there is a broad recognition of the value that increased leverage can provide and there are drivers that would motivate actors to take this direction, the governance system would need to overcome the constraints and barriers. The first governance guideline, which can be derived from the empirical data is that there should be two distinct models of governance in the ecosystem. It is important to recognize the differences between how to govern the building blocks that should be leveraged as broadly as possibility and how to govern the configurations that provide optimal support for the core operations of various actors. The leverage of common building blocks requires a much more open and centralized approach, which provides procedures and resources for identification, cooperation, support and promotion, and this is today weak in the case ecosystem; "*I do not see anyone who would actively do that today"*. The logic of this governance would be more similar to asset portfolio management than traditional application management - *"a portfolio of national digital assets"*. On the other hand, this centralized logic would not be appropriate for governance of digital initiatives and enabling digital innovation from a user perspective.

Recognizing this dual need of governance is a key aspect of promoting leverage of digital assets and the empirical data indicates that it would be central in order to realize the ecosystem benefits of digitalization. It is interesting as one of the initial questions for this study was whether organizational response to digitalization is better to centralize digital development or allow for distributed innovation. This finding indicates that both are needed; a centralized approach can increase asset and resource leverage although it would add constraints for customer-driven digital initiatives and innovation.

These findings confirm that the leverage factor of digital generativity depends on the awareness, drivers and motivators as well as governance model. The findings further indicate that current model for managing digital initiative is not ensuring future leverage of the outcome but development is mostly done in the traditional isolated way. The leverage is limited by low incentives for collaboration across silos and a governance model, which lacks roles and responsibilities for identification, promotion and support for assets that could be leveraged more broadly in the ecosystem.

5.1.3. Accessibility

Accessibility is a pre-requisite for achieving broad leverage and a fair assumption would be that no uncoordinated, distributed change can happen if there is no access to assets and resources. This section will present the need for and limitations of accessibility based on the empirical material and discuss how accessibility relates to generativity of digital structures. Following a

generic definition of accessibility as "*The quality of being easy to obtain or use*" by Oxford Dictionary, the case study analyses how actors in the ecosystem see accessibility as a factor in their response to digitalization.

The need to promote access in order to achieve digitalization benefits is broadly recognized among the actors in the case ecosystem. References to previous phases of technological development, such as removing telecom regulation, link increased openness and accessibility to economic progress and societal benefits are presented: "*We can compare to the history of telecom industry; it used to be monopoly business with isolated companies in well-bounded regions and no competition. When this monopoly was broken, the industry started to grow and develop"*. Accessibility across agencies and towards private companies is seen as crucial in order to keep up with development and contextual changes and launch innovative services; *"In order to stay afloat in this change, the only option is to tap into collaborative development"* and *"And we need to remember that much of the competences are in the private sector; we need to ensure seamless collaboration and allow them to contribute"*.

The first aspect of how accessibility is promoted is the strong emphasis on Open Data initiatives. Open data has been in the forefront of digitalization in the context of public administration (Janssen et al., 2012; Zuiderwijk and Janssen, 2014), and this study shows that there is a broad agreement in the case ecosystem about its importance. The value of open data initiatives is emphasized and several informants suggest that access to digital data is indeed the "fuel of the digital economy" with views such as "*There is a major difference between the information economy and the data economy*" and "*They see that the own closed ecosystem does not produce enough new thinking into development pipeline, so why not open up the interfaces?"* The increased accessibility achieved through Open Data is also seen as one of the best ways to break a silo architecture, e.g. "*Open data is a very significant issue, because it is one of the best ways to break silos*", which is often stated as the number one constraint for digital innovation (Bannister and Connelly 2012; De Bri et al., 2010). The term Open Data is, however, only reflecting part of the accessibility requirements. As many informants point out, the broad use of and distributed contribution to Open Data requires access in machine readable format and interfaces, which are well designed and well supported. Along with the increasing maturity of Open Data initiatives, the emphasis has shifted to interface management (sometimes called Open API), rather than being limited to raw data access. The interface is crucial as it defines how data usage is constrained (what you can access and what not) and what kind of service levels are promised. If there is no interface and no guaranteed service levels, the data

might be good for experiments but requires further formalization for operational use. Informants also highlight the overhead cost that well supported interfaces and guaranteed service levels generate. The shift towards data-driven society or data driven administration requires increased emphasis on data ownership, data stewardship, etc. and individual organizations are unlikely to take the additional cost of supporting assets only because they could eventually be useful for others. Many of these questions are still unsolved in the case ecosystem, and this limits the accessibility and reflected in quotes such as *"The challenges are really on the administrative side; legal framework, security, and maybe also the interpretation of data security", "Putting data security in the right perspective is a central challenge. Security people tend to say _no_ to everything, but risk assessments have to be done by the right people", "Data privacy needs to be respected and governments should make sure and guarantee that it's respected"* and *"But why would they open up data for others. [….] They sell it and get some small revenues. Not impossible, but requires some efforts"* or "*This has been interpreted that we as X are breaking the law if we provide them with some data over an interface and this is unbelievable, because it means that we cannot have standard interfaces, but need to customize every interface."*

In addition to the rather well-known trajectory of Open Data initiatives, some newer initiatives to increase accessibility were presented by informants. The study reveals interest in several initiatives that address cross-organizational access such as experimentation with boundary resources, hackathon events and innovative sourcing, including *"As an example that things can be done differently is the open hackathon, that we conducted in connection with the public tendering"*, "*The resulting service is so much better than the public traffic information services […]. This shows the value of providing real time data"* and "*However, it is important to remember that the objective of boundary resources is not to build walls, but to lower the barrier for use*". Along with the increased access to data in machine readable format, many public agencies have organized hackathons either in connection to upcoming sourcing bids or as independent innovation initiatives and the results have been promising. The fact that an individual developer, in a couple of days, can produce prototypes that outperform the outcomes of established development teams has raised the awareness of the innovation potential that lies in increased accessibility. Even though hackathons today are something that can be categorized as experimental and out of the ordinary routines, the good results indicate that some of the learnings should be brought into future modes of development; *"Today, when developers*

without degree can produce all kinds of heterogeneous services in a weekend when they just get access to data, we must realise that this is where we should put more efforts".

Technical accessibility is, however, not enough. Experiences tell that the technical accessibility needs to be complemented with attractiveness to use the data that is accessible; *"An issue that has bothered me is the lack of transparency. A lot of digital development is done in old "committee mode", which is not attractive for the real innovators"*. There is a reluctance to participate in the public initiatives among some private sector actors, and this lack of attractiveness is a barrier to generativity. Legal restrictions are also raised in relation to access, often indicating that increased openness would be against data security or privacy regulations, but several of the actors also state that many of these restrictions are self-created and might be based more on interpretations of the law instead of the letter of law; *"This has been interpreted that we as X are breaking the law if we provide them with some data*", "*We have a lot of legislation, increasing all the time I would say, that define how services should be delivered instead of what should be done*" and *"Nobody denies that there would be a real need to ensure data security and privacy, which sets some limits to how far openness and accessibility can be extended, but the decisions to limit access are sometimes taken easily and by wrong persons and for the wrong reasons*".

The emphasis on openness and accessibility is not only driven by digitalization, but is supported by policy initiatives related to Open Government (OECD, 2014/2015) and this is pointed out by some of the actors; *"Hand in hand with digital government we have the open government movement, which means that interactions with citizens are deepened"*. This means that a shift from citizen centred to citizen driven public policy making, where the administration is no longer creating services *for* its customers, but together *with* its customers and it makes a radical change in thinking as well as in the identity of public administration. This is reflected in statements such as "*... it is a shift from citizen centred to citizen driven public policy making", "We are no longer creating services for our customers, but together with our customers"* and *"It sounds like a small difference, but it is really a revolutionary change in thinking and identity of the public administration"*. This shift will build on accessibility and is expected to produce unexpected outcomes; "*I'm very sure that NASA did not expect Google Earth to be launched when they released their material for public use*".

Improving access is expected to increase leverage, and together they add to the generative potential of the system. The discussion above shows that accessibility is a much broader topic than Open Data, which has already evolved quite well in many constitutions. The ability and

motivation to make use of digital assets is according to the affordance and human agency perspective also dependent on actor ability and motivation to engage in ecosystem development and this brings us to the next of Zittrain's factors contributing to system generativity.

5.1.4. Ease of mastery

Ease of mastery is a measure of how understandable the system is and how much effort is needed to learn how it can be accessed, leveraged, transferred and / or adapted for new purposes. In the context of digital structures in a service ecosystem, the ease of mastery includes many dimensions; technical aspects, governance procedures as well as broader institutional and cultural dynamics that must be understood in order to be able to tap into the value potential that the system provides.

The empirical analysis in the case ecosystem shows that there is an inherent tension between the concept of ease of mastery and very nature of digital structures in an ecosystem. Most discussions with informants stress the increasing complexity that cross-organizational digital structures generate with a high number of interfaces, connections and interdependencies even if the modularity of the system would be well managed. Several informants touch upon the subject with view such as "*There will be more and more connections and more and more dependencies", "Building on top of existing components, instead of launching a new project, is difficult*" and "*As an example we can think about a process, which starts from an accounting firm X, using a software Y by SaaS provider Z, and connects to us through a service, which actually is run by company W*". On the other hand, people are becoming better equipped to manage and cope with this complexity; "*On the other hand, the confidence in own abilities was poorer before and the usability and ability to solve problem situations is improved now", "It has become everyday business, the user experience and opportunities for innovation is easier to spot in your daily work*" and *"People change; today they are more competent and capable".*

Mastery of a distributed system's capabilities advances through collaboration, communication and learning together, reflected in "*In this time we must do together and learn together; this could be a summary of the whole discussion*", which means that the limited dialogue today that is expressed by several actors is a barrier to "master" available assets. Achieving responsiveness in an unpredictable environment, where both challenges and the expertise needed to solve the challenges are distributed, will require collaboration, learning from each other and learning with each other. The experiences expressed by informants, that there is a limited willingness or ability to work together across sectors, indicates that it will be difficult to achieve the needed level of "mastery" of the system components that would be accessible and available for leverage

just by working together; "*It is a struggle but the "once only"-principle has made it easier to understand the logic"*. System level support is required to make it easier to leverage assets, i.e. someone "*motivating the private sector to participate and develop. Saying "Look what we have here. If you join the efforts, you can use all this…"* We need activation.

Ease of mastery leads to the "ease of contribution". Understanding available components and interfaces also makes it possible to contribute. This is in line with the characteristics of open innovation and user innovation and suggests that asset owners should let others make use of available assets, allow them to learn how to master them and thereby eventually contribute with improvements, extensions and new compatible assets. This suggests that attracting new actors to the ecosystem is beneficial for the existing actors, but the culture and ways of working are today not attractive to some of the most innovative companies. Many actors elaborate on this attractiveness aspect with views such as "*Some companies do not participate in any public initiatives because the find it so distressing. […] Because of previous experiences they have decided not to be involved, and for good reasons", "Individuals are important for innovation", "need to attract contributors",* and *"private sector will contribute if it is attractive*".

The case study findings indicate that the ease of mastery relates both to the complexity of the system and the organization and support for working together and learning from each other and with each other. A good understanding of how system resources can be accessed, used and modified for your own needs is a pre-requisite for generative change of the system, but there will also be significant differences in how adaptable the system is in itself and this is the fourth aspect of the generativity to be analysed and discussed.

5.1.5. Adaptability

Adaptability relates to how malleable the resources are for application in many and varied contexts (Zittrain, 2008). As digital development is proposed to be holistic and continuous rather than well-bounded projects with specified fixed outcomes (OECD, 2014a), the adaptability plays an increasingly important role and should over time increase the leverage of the system, i.e. it broaden the set of tasks that can benefit from the system. The downside is that it high adaptability might increase the complexity of the system and thereby lower the general ease of mastery for other actors and newcomers.

System adaptability, which in this study follows the Oxford Dictionary definition as "*The quality of being able to adjust to new conditions",* builds on the characteristics of digital artifacts and structures explained in section 2, with properties such as being editable and reprogrammable. In practice, the adaptability is, however, limited in many ways through design

and implementation choices. Empirically, we find that case informants relate adaptability to technical issues as well as governance structures.

Some of the case informants recognize the special technical characters of digital structures when discussing their experiences and stress the importance of technology in addition to the business drivers, which normally are held at the forefront when discussing digitalization. Statements like *"We need to give room for technology in the discussion. The business issue is obvious, but you cannot achieve results without understanding the technology", "This is important; how to keep agility and do proper enterprise architecture at the same time", "Especially the mobile, cloud, social media, big data etc. Processing power increase…", "I have described it as technology being the engine of change; it has a lot of horse power, but we need to get into the driver's seat", "We have now realized how much more we can achieve with the existing technology", and "Digital innovation capabilities are in the end determined 'under the hood'"* show that some actors acknowledge the technical characteristics of digital artifacts, but this is a minority of all actors interviewed. Most informants discuss adaptability as a response to changing context, discussing the challenges or paradigm change in administration, or the constraints against adaptability, such as legal, budgetary and institutional barriers, but not the enabling characteristics of digital structures.

The paradigm shift with based on contextual change and technological change highlights a need for increased responsiveness and the structures are not today supporting it very well. It is well recognized that multi-year programs with monolithic structures are poorly suited for these needs, or "*the paradigm change in public administration is that all our structures, organizations, leadership models, culture, processes etc. are built for a manageable world. A world where you can either design or prepare for what will come. Neither one of these approaches will work in the future*"

There is a tendency to respond to change through the existing budgetary, legal and institutional structures. The traditional way of thinking of public administration as an old factory, which produces the same services and benefits as universal for all citizens is, however, outdated and the development model, which has been used to produce the "production infrastructure and automation" for that factory need to change as well. These views are presented as *"Today it's not the one who knows most that will win, but the one that is quick to learn new", "I feel that things are changing so fast that you cannot even build for a year, because the environment and opportunities have already changed in that time"* and *"The traditional way of thinking in public*

administration is like an old factory; it produces same services and benefits as universal for all citizens."

The problem is that, in addition to technical legacy, there is a number of non-technical structures, which constrain the adaptability. Some of these constraints are self-created, such as too detailed legislation describing how public services shall be produced, instead of the level of public service that needs to be offered. Other comments related to how adaptability is constrained are *"I've been wondering if it is an unconscious act to secure your position. […] if the law specifies how things have to be done, it is easy to abide to the law by doing exactly so", "The structure of administration is not supporting agile response. The budgeting model is promoting large initiatives and on top of this we have the risk adversity of public officials", "My fear in such a scenario is that if you start to have highly interconnected systems, any changes to standards or specifications would freeze the entire system", "Then we have this phenomenon that we create our own problems, Hiring large IT-companies or buying something (maybe from a monopoly supplier) and then we are stuck"* and *"Selecting a solution should not generate a lock-in situation. Not to solution nor to supplier…"*

There is also a concern that the legislation is not keeping up with the speed that context and technology is changing, which means that the regulation that was well motivated before becomes outdated and barrier for further development *"This means that suddenly our good intentions and regulation has become a barrier for better services. A change in the environment can make rules and laws obsolete quite quickly"*. Apart from legislative constraints, there is a concern about the flexibility of budgeting. The budgeting mechanisms in public administration favors well-scoped and clearly defined initiatives, where an appointed organization gets funding to develop a solution to identified needs. Several informants find that the margin of movement within budget is so small, that it is not possible to respond to new needs during the budgetary cycle even if the amounts needed would be much smaller than the initiatives funded. This challenge with budgeting inflexibility becomes still more difficult to overcome if the opportunity to respond to new requirements would include cross-organizational cooperation.

As a response to overcome these challenges, informants propose a dual mode in development projects. Almost half of the informants use the term step-wise progress or synonyms, which shows the awareness of how success requires both long-term thinking and ability to see and respond to changing requirements and learn as you go. These views are driving comments such as *"The time span need to be rather long if we want to achieve real change, but there should be steps for every year and this is what should bring agility. Looking far ahead in this world is*

really difficult", "The target should be set so far into the future that it is not possible to see the path how you can get there as a whole. Instead you have to break it down from the objective based on good guesses. Which routes could take us there?", "The future will be more about 'grabbing opportunities' and continuously "opening up" the future so that new opportunities will appear", "Every year we should review that we do the right things as the world around us is changing. So reflecting on the environment needs to be present all the time" and *"The development needs to be step-wise. Nobody can do that kind of mega-projects, it will not work".*

These experiences indicate a duality in development model and governance structure. There will be a need for project based development, which will have defined objectives and KPI:s that relate to how the objectives have been achieved, but there should also be an "intelligence" that links the needs and initiatives together, make sure that the initiatives make use of and feed into the common platform, and make sure that the strategic options, which are most important in order to achieve the long term vision, are decided strategically and not limited only to the most cost efficient implementation of a single project.

Adaptability of digital technologies is a well-studied but paradoxical topic. Based on the fundamental characteristics presented in the literature review, all digital structures have the potential to be adaptable, but still structures over time often become inflexible and constrain change rather than facilitate it (Fishenden and Thompson, 2013; Orlikowski, 2000). Finding the balance in the change and control paradox is a peril task, but the analysis in previous subsection suggests that a governance structure, which separates the fundamental elements to a digital platform, on which customer-driven services can be developed and implemented in a more distributed, experimental and agile mode. This could make the difference between adaptable and non-adaptable digital structures. The views and experiences of actors support the view that the "old model" of running initiatives, i.e. packaging all the requirements into one project and designing, sourcing and implementing a solution that corresponds to the requirements is not viable when going further into the digital era. In the context of digitalization, adaptability is a system level requirement, often expressed as agility or responsiveness by policy makers and CIO:s, which cannot effectively be achieved by looking only at individual initiatives. This is why the platform driven approach would be so important, because it separates the platform change rhythm from the service life-cycles. Together they provide system level responsiveness as the platform can evolve independently of the service operations and the services can evolve independently of underlying platform.

This proposed separation of platform capabilities from user-driven development is also expected to enhance the transferability of system components, which is the fifth and last of the generativity factors.

5.1.6. Transferability

The aspect of transferability describes the ability to exchange components among system actors and in and out of the system. Transfer is defined in Oxford dictionary as the act of *moving (or sometimes copying) something from one place to another*, which in the context of digital structures means that e.g. assets, artifacts or procedures that have been found successful can be copied to other parts of the system, which would result in increased leverage. One of the first findings of the analysis is indeed that there is a close link between, and also a high similarity in the way actors feel about, leverage and transferability.

As transferability refers to moving or copying something from one place to another, it will be helpful to divide the concept into two distinct situations; inflow transfer and outflow transfer. Outflow transfer, would be a situation where assets, artifacts or routines are diffused to other parts of the system or to other systems, and inflow transfer would be a situation where external components are introduced either as new components or replacing existing. The outflow transferability reflects the common objective of digitalization in public administration, where good experiences and solutions should be captured, assigned ownership and diffused (Valtiokonttori, 2016). The case study, however, shows that there are limited incentives to promote diffusion in the current de-centralized system. As there are few incentives for contribution to the common good, new innovations tend to stay local. Most informants agree that the capture and promotion of transferable assets and procedures would have to be centrally supported, whereas the reuse logic would come more naturally through scarcity of resources and actors realizing the benefit of tapping into existing infrastructure.

The transferability of something that has been proven successful in other parts of the system or outside of the system is dependent on ability and motivation and the empirical data emphasis a lack of motivation. This is seen in comments such as "*The horizontal cooperation is so difficult, because people are responsible to their own superiors and the incentive system promotes that you only focus on the objectives of your own unit", "I wonder if there are any target related to how much cooperation there is with other units"* and *"Well, even if we speak about digitalization, there is a strong human aspect. It means that there will be incentive systems and such that acts as barriers for change".*

The challenge related to increasing dependencies and complexity in the system has been discussed before and the inflow transferability should be a possible remedy to that, as it enables replacement of system components that are becoming obsolete or pose a risk of increasing the rigidity, but the informants were not very specific on this topic in the case study. This might be because experiences are still limited, but several discussions on the lock-in, dependencies, technical understanding and architecture issues indirectly touch upon the issue.

In the case study there is a clear indication that the basic structures of the administration do not favour transferability of good practices, resources or assets. The higher you discuss in the organization, the clearer the view becomes about how the administration "*is designed top-down and based on silos"* where *"everyone wants to do their own thing and that reinforces the silos".* All groups of informants recognize the challenge for transferability that such a silo culture creates, which makes the discussion of what can be done to break the silos, such as the related architectural, resourcing and governance issues, even more interesting. The topic of silos is a long-standing topic in the discussion and literature on public administration (and other large organizations as well) (DeBri and Bannister, 2010; Bannister and Connolly, 2012), and as mentioned by several informants it is "by design". In theory, digital platforms would be able to effectively break silos, but as several actors in the case ecosystem pointed out, it is not only a technical issue, but very much an issue of governance, resourcing and KPI:s.

The first issue of how the transferability challenges can be overcome would be to focus on the type of assets that realistically can be transferred from one actor to another. As actor experiences indicate, that the more organization specific an asset is, the less likely it will be that it can be transferred as such to other actors in the ecosystem; *"there were some quite incredible discussions about how they wanted to include, if not XML-schemas, data content specification anyway into the law".*

This has been realized in initiatives that by first glance might seem generic, such as case management or task workflow support in different agencies *"the workflow solution that was expected be common did not really transfer"*. As with the case of leverage, the question of transferability comes back to granularity and modularity *"We need to go back to the services and what we call the decomposition of services. To smaller scale services. […] if we start to go back to the more fundamental elements, then they start to be common and people will understand it*".

But not even these granular assets, with the potential for broad leverage will be flowing to other parts of the ecosystem without intentional efforts. There is a broad agreement among actors that

there is not enough resources to support this as we hear that *"There is nobody who would actively promote the common services and opportunities", "Someone should know the common services; where they are developed and how they could be used elsewhere", "People do not know about them. We should be able to see where we have opportunities for reuse and ability to move and use best resources"* and *"Results will not come through enforcement alone. You need to have time and money"*.

As incentive structures lead organizations to focus primarily on their own objectives, they will not willingly take on support tasks related to the use of shared assets by other organizations.

This empirical analysis shows that there are several structural and cultural barriers against transferability as well as technical and architectural barriers. The former group was more dominant when discussing actor experiences. The cultural barriers also seem to be very similar for the transferability as for leverage, which means that actions to overcome these could significantly impact the potential for generative change and innovation.

5.1.7. Summary of findings in relation to generativity literature

This section has extended the empirical analysis of sections 4.1 and 4.2 with a literature driven discussion of how the empirical findings align with the definition and the five generativity factors (Zittrain, 2008).

The concept of generativity is supported by the empirical study almost as defined. The importance of contributions by broad and varied audiences is stressed by the ecosystem actors, the ability to participate and contribute is crucial and the initiatives should come from the distributed actors as they perceive opportunities based on their agentic orientations. The only contradicting element is the proposal that these contributions should be unfiltered. The empirical findings instead suggests that they should be coordinated as part of the dual-mode governance model.

Reviewing actor perceptions and experiences against the generativity factors, we find that all five factors of generativity are supported as relevant in promoting generativity. The actors do not always use the same terms in their reflections but the round of coding actor narratives to these five factors show that there is ample support for these factors. Enhancing the factors should thereby increase system generativity and thereby provide potential for digital innovation. The fact that it indeed do produce digital innovation is not confirmed by the study.

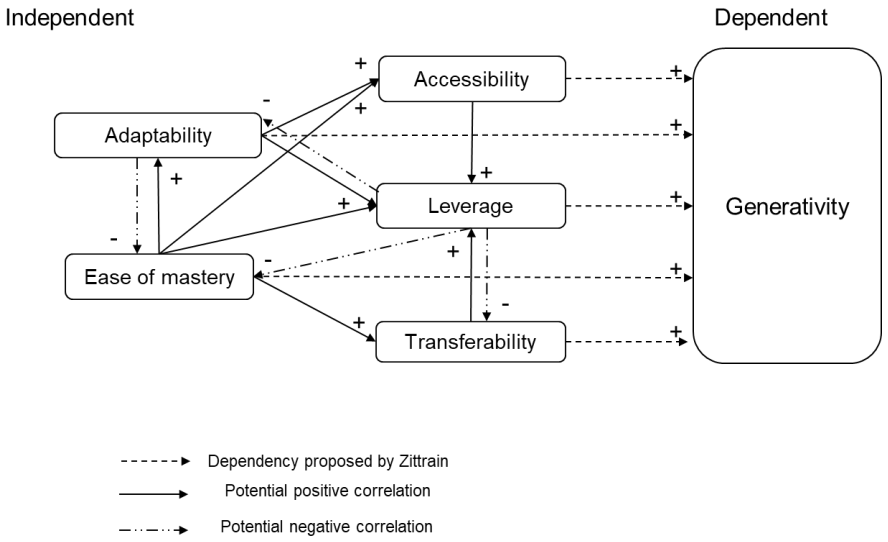
At the start of this section an intuitive idea was presented that these generativity factors would be useful as guidance for establishing governance for the fundamental building blocks. As the

empirical data provides support for these factors, we can deduct that a governance model that promotes high leverage of digital building blocks, ensures the accessibility, secures adaptability for new situations, provides guidance for transferability and support to achieve ease of mastery, would indeed be desirable. One of the building blocks mentioned repeatedly by informants can act as an example of this. The National Service Bus service (In Finnish: Kansallinen Palveluväylä) is a key element of shared digital infrastructure in the case ecosystem. Increasing the *leverage* of the Service Bus would increase the number of actors that are connected to the same data exchange system and increase the value to all according to the network effect. Making it *easily accessible* to new actors further increases the user base and as a consequence the leverage. *Adaptability* will be needed as an increasing user base will bring new requirements and scalability needs. If it is not adaptable the limit will be reached and additional actors that could be leveraging the same solution will have to find other alternatives or develop an own solution for similar purpose. The *ease of mastery* will also influence the leverage as a complicated system that is difficult to understand and take into use will have both a direct impact on leverage and an indirect as the support organization will be overloaded and that would become a constraining factor. The *transferability* of the solution could provide leverage in other ecosystems as has been seen in this case where the solutions used in Estonia and Finland have a common history. This example, which is an existing and very important component of the digital infrastructure, shows how leverage actually appear as a factor that links to the four other factors. Leverage refers to how broadly an asset is being used and according to the logics of networked systems, an increase in the number of connected parties will provide value to all actors in the system.

These signs of interdependencies between the generativity factors are not covered in previous literature. Zittrain propose that the factors are reinforcing each other (Zittrain, 2008), but comparing the findings to the factors indicate that leverage actually would be in a more central position than the other four. The empirical data suggests that the four other factors promote a higher leverage which further increase generativity. One could speculate that an increased leverage could reduce at least *ease of mastery* and *adaptability*, potentially also *accessibility* and *transferability* but these correlations cannot be seen from the empirical data. These interdependencies have not been previously studied and this would be an opportunity for further studies that would focus specifically on this interdependence between factors. Based on this study, a hypothetical model of the factors influencing system generativity can be created for further analysis and verification. In the discussion above, we showed how the five aspects that

were suggested by Zittrain to influence generativity are supported by the empirical case study, and suggested that there might be dependencies or correlations between the factors as shown in Figure 17.

Figure 17. Potential interdependencies between generativity factors



The suggested dependencies would put leverage in the focus as all other factors are assumed to influence positively on the leverage, but an increased leverage could influence negatively on the adaptability, transferability and ease of mastery. This concern associated with a too high leverage was captured in the interviews by some of the actors as "*my fear in such a scenario is that if you start to have highly interconnected systems, any change of standards could freeze the whole system"* and *"Ironically the complexity is partly due to digitalization, which is not proposed to solve the problem"*.

Putting this opportunity for further research aside, the discussion above has shown that these factors could be used in the case ecosystem when considering the dual governance model proposed based on the analysis. An approach that promotes broad leverage of fundamental digital building blocks should be designed in a way that balances leverage with a good level of adaptability, accessibility, transferability and ease of mastery. Such a governance model would promote generativity and agility in digital initiatives.

5.2. DIGITAL INNOVATION

"Participation is the input to generativity and innovation is the outcome" was the conclusion of Zittrain in his foundational research (2008: p. 90). Although the link between digital generativity and innovation has not been explored extensively, there are other more recent contributions in literature on digital innovation with similar suggestions. One of the most significant of these is Nambisan et al. (2017), who question our current assumptions about boundaries and agency for innovation as well as the relationship between innovation process and outcome, propose new theorizing logics for digital innovation, and suggest new research avenues for scholars in the area. This section will discuss the empirical findings of the study especially in relation to the proposed theorizing logics.

The objective of Nambisan et al. is to promote innovation theory that "*incorporate the variability, materiality, emergence, and richness of the sociotechnical phenomenon called digital innovation*" (Nambisan et al., 2017: p. 224). First of all it is striking that they position digital innovation as a sociotechnical phenomenon, which puts it very close to the definition of digitalization as sociotechnical reconfiguration based on digital structures that keep growing due to digitization (Yoo, 2010). The aim to include variability, materiality, emergence and richness further strengthen the links to digital generativity as it aligns with the *contributions from broad and varied audiences*, which is part of generativity definition (Zittrain, 2008), and the emergence is in line with the aspect of *producing unanticipated change*, also part of the definition.

Nambisan et al. (2017) use a broad conceptualization of innovation that links research on intra-organizational innovation management with research on digital products, platforms, ecosystems, and infrastructure. The article proposes that new theorizing logics will be needed as current assumptions related to how innovations form / evolve, how actors should organize for innovation and how the nature of innovation and organization of innovation interact, are becoming challenged along with digitalization. As a response they propose that increased focus on *Dynamic problem–solution design pairing, Socio-cognitive sensemaking, Technological affordances and constraints,* and *Orchestration of activities*. The findings of this empirical study support these conceptual claims with the explication of actor reasoning and the emerging ecosystem level categories.

This proposed approach, which provides a new conceptualization of digital innovation, alignes with the findings of this study. The theorizing logics might provide elements for a more

dynamic and responsive governance of digital initiatives that make use of digital building blocks.

5.2.1. Dynamic problem–solution design pairing

Some of the most central outcomes of this study match the proposed logic of dynamic problem–solution design pairing. Based on the actor experiences, the analysis suggests a dual mode of governance that promotes broad leverage of fundamental digital elements but allows for experimentation, agility and freedom in customer-driven digital initiatives. The digital elements would be managed independently of the problems that drive initiatives and used in solution design in a dynamic manner.

The individual level analysis shows a broad agreement on the need for increased responsiveness, but also a tension in how much there should be control vs freedom of change and a recognized need for cultural change and new approaches. The actors related to past experiences and current challenges in elaboration of how solutions are designed and implemented and many have come to the conclusion that traditional "*first design it and then build it*"-approach is inadequate in a digital ecosystem. Actors reflect on these challenges with views such as "*describe the contrast between the potential and the traditional implementation and governance model"*, "*doing as before will not bring different results, no matter how hard you try*" and *"we still have 'waterfall-funding'. We speak about digitalization and agility, but the funding is from the old world*".

The ecosystem level analysis proposes that the need for better responsiveness can be achieved by a better control of available digital assets and more dynamic use of them in responding to the problems that appear and change at an increasing rate. The fundamental digital elements provide solution components that are managed independently of customer-driven change initiatives but can be used in various combinations dynamically, i.e. new components can be added, existing ones can be modified or replaced and outdated assets are retired without the classical one-time transition from a legacy solution to a "modern", which over time becomes the new legacy.

The core category of the inductive analysis propose that the governance model and institutional arrangements would be key to achieve such dynamic responsiveness. Separation of fundamental digital assets to a different governance model seems to be the way to break free from traditional models of designing, sourcing, implementing and operating digital solutions in the public administration. The same trend might be valid for other sectors as well,

but the impact of public sourcing legislation makes it even harder to achieve dynamic evolution of solutions unless it is systematically built into the system and governance model.

In the study, there are many actor experiences and views that point to this direction, but a couple of quotes that capture this dynamic are "*if you go back to the fundamental elements […] you can leave the re-aggregation to the people"* and "*I believe that we could generate a whole lot of innovations just by understanding the available digital assets"*.

Interestingly, the dynamic problem / solution design pairing seems close to the Garbage Can theory, which was introduced in the context of public administration already in the 1970s. Cohen, Ohlsen and March (1972) proposed that problems, solutions, participants and decision making opportunities flow in and out of a garbage can and the choice of which problems that get attached to solutions is largely due to chance. Add to this the perspective of affordance and human agency and it is not any more purely by chance, but the matching would be based on the ability and motivation of goal-oriented actors to enact affordances.

5.2.2. Socio-cognitive sensemaking

The theorizing logic of socio-cognitive sensemaking is actually built-in into the research design as part of the affordance and human agency perspective. Affordances are relational to actors and can be enacted based on the perceptions, ability and motivation to make use of them (Majchrzak and Markus 2012; Markus and Silver 2008). Temporal human agency positions itself as a broad perspective that is more complete than the individual theories that have been used to explain human agency, making sense of possible trajectories through narrative construction being one of them (Emirbayer and Mische, 1998).

Sensemaking theory is presented as the process through which people understand issues or events that are novel, ambiguous, confusing or in some other way violate expectations and has been related to organizational change, learning and creativity and innovation (Mailtlis and Christianson, 2014). It turns complex circumstances into a situation that can be comprehended explicitly in words and serves as a springboard to action. It is the interplay of interpretation and action (Weick et al., 2005). These mechanisms that sensemaking theory explain are very much in line with the context of this study and the challenges that actors face in the ecosystem. The situation is changing with increased contextual and technological complexity, new opportunities and a growing awareness that new approaches and models are needed, but no clarity about what they would be and how they should act.

The findings support the proposition by Nambisan et al. (2017) that sensemaking would be important in the response to structural opportunities as and support digital innovation. Apart from being aligned with the theories used, this is also reflected by the emphasis on doing and learning together and iterative change with continuous adjustments along the route, which are emphasized in the narratives. All actor groups in the individual level analysis express a need for a culture that is more collaborative and more iterative. This proposed direction is in line with the areas of strategic, projective and collaborative sensemaking (Weick et al., 2005; Maitlis and Christianson, 2014).

The ecosystem level analysis shows that the typical way of running development initiatives is a legacy from the time when there was not as mature digital structure as today, which is reflected in the following actor statement; "*Everything comes from the desk of the project manager, hoping that it some day will meet the needs of the citizen. This is totally wrong! Or it used to be right when it was the only way but not any more…"*. Today initiatives that do not use the potential for collective sensemaking are losing in flexibility to learn as you go, make use of what becomes available and make adjustments to keep on track in a rapidly changing environment.

Sensemaking literature explains the dynamics between individuals and collective sensemaking in broader systems, which is based on communication and collaboration (Weick et al., 2005). The interplay between individual actors and ecosystem dynamics is a key element of this study and actors express many related views on how innovation is people business and there is a need to attract and motivate enthusiastic individuals while at the same time *"the only way to stay on top of change will be to tap into the joint development"*. The strong criticism against isolation and not-invented-here syndrome is not good for collective sensemaking.

5.2.3. Technology affordances and constraints

The third theorizing logic of digital innovation is also part of the research design and theoretical framing of the study. Technological affordances and constraints are in literature proposed to have an instrumental role in appropriation of information systems (Leonardi, 2011; Majchrzak and Markus, 2012), and Nambisan et al. (2017) claims that they have an instrumental role in the digital innovation process. The reasoning why I chose the affordance theory as a lens for the empirical study is much similar to how Nambisan et al. argue in the article on their importance (2017) as they link the relational potential for action to specific features of technology. They single out customer innovation, combinatorial nature of software and modular

platforms as affordances that would be valuable for digital innovation and stress that the value of affordance perspective is that it links the technology and its features with the use context.

The findings of the individual level analysis show how the actors have unique agentic orientations towards the phenomenon, which confirms that the affordances, which are proposed to be relational to actors' perceptions and the basis for action, will provide different opportunities for innovation to the different actors. As the analysis reveals how actors see digital affordances in relation to current situation and future goals and tell about the constraints that hinder them from making use of the affordances, the study provides support that the logic of affordance and constraints is indeed relevant in further research on digital innovation. The individual level analysis also shows that the constraints are perceived differently between actors in the "policy makers" category and among "implementers". The distributed government and non-government actors explain how constraints related to budgeting model, legislation and public sourcing form barriers to desired change and new approaches and, as action according to human agency theory is dependent on perceived affordances and constraints, these will limit the innovation capacity of the system. Some of the descriptive quotes visualizing these aspects of digital change dynamics are "*we speak a lot about the business aspect of digitalization, but we should remember that there would not change of business if digital technology would not have enabled it"* on the affordance and "*now we are at the core of it and there will be huge challenge to put the changes into practice*", about the constraints.

The ecosystem level analysis provides more detail on how the affordances provide opportunities for distributed and combinatorial digital innovation and how the constrains work against it. The structural affordance for change is related to the growing maturity of digital structures and the increasing volume of basic digital elements that can be used as parts of a broad variety of solutions. The most fundamental of these is the access to digital data. Open Data has been one of the key focus areas in public sector digitalization and still is. Due to the digital characteristics the Open Data affords new services and more effective ways of working to the actors in the system compared to every one collecting and managing their own datasets. "*Data is the fuel of the digital economy"* has been a mantra for some time, but in the context of public services there are specific drivers that push towards shared basic registers and a "once only"-principle. The shared digital platform that builds up from open data and other common digital assets provides new opportunities to everyone in the ecosystem. Still, in a relational manner dependent on perception, ability and motivation and within what is possible considering the system constraints.

5.2.4. Orchestration

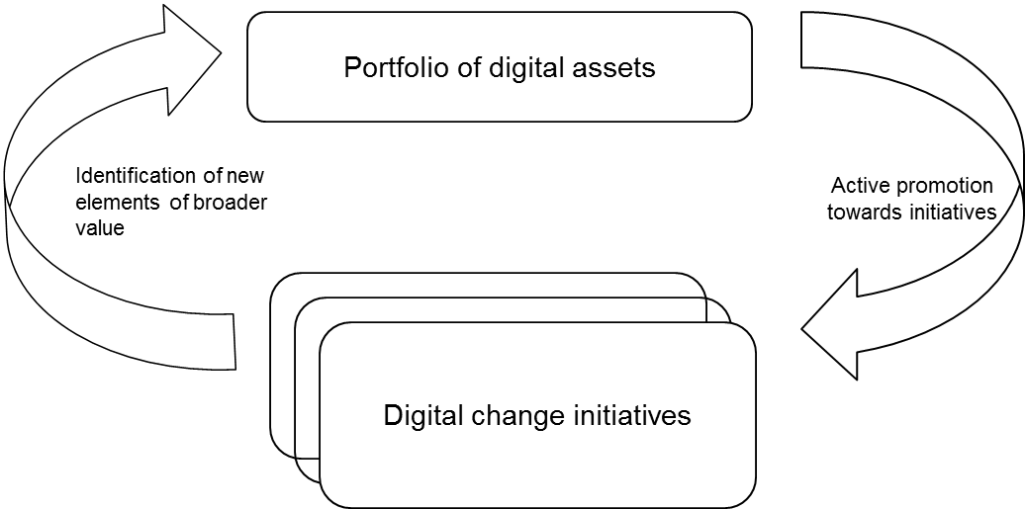
Orchestration as an ingredient in digital innovation is central in the findings of this study. The analysis at ecosystem level produces an integrated narrative on the digital change dynamics that emphasizes a governance that allows for distributed change while coordinating and supporting broad leverage of digital assets. A governance that builds on coordination and orchestration to a higher degree than today.

Orchestration is in the article by Nambisan et al. (2017) proposed as a response to the increasingly distributed innovation as there is a need coordinate the loosely connected crowds of contributors. Unlike digitalization, orchestration can be done by specific actors in the ecosystem, which can see new problems enter the stage and *match them with available or new solutions or help brokering solutions generated by contributors to plausible problems or opportunities* (Nambisan et al., 2017: p. 230). This kind of brokering was seen as important in the case ecosystem as actors though that "*we talk about broad digitalization and innovation, etc. etc. but no one coordinates"* and "*there is no one picking up these solutions and push them forward".*

The individual level analysis produces insight in a few areas where actor views diverge and a certain tension is visible in the perceptions and opinions. These tensions, including the views related to freedom versus control, evolution versus disruption and business versus technology, can be motivated and explained due to different temporal factors and other situational differences, but will indeed call for orchestration in the system to take into account the different needs and views.

The ecosystem level analysis suggest that the way to do it is to promote a cultural change towards increased collaboration, active portfolio management and promotion of digital assets and project portfolio governance that support and direct initiatives towards shared goals and identifies elements that could be separated from the initiative into the portfolio of digital assets. Actors feel that "*this kind of support is needed in order to require that actors use shared components"* and *"someone has to harvest these assets, which have been done and are available".* This would create a cycle that supports growth of the digital asset portfolio, i.e. the shared digital infrastructure, and effective use of the elements as indicated in Figure 17 below.

Figure 18 : The orchestration across the fundamental elements and digital initiatives



5.2.5. Summary of findings in relation to digital innovation literature

The new logic for digital innovation (Nambisan et al.; 2017) suggests that one must take into account the individuals, i.e. what the system affords to the actors and their sensemaking, but also the systemic aspect of dynamic problem / solution design pairing and orchestration. This might sound familiar to the reader as it follows the same two-layer logic as the design of this study. The generativity is a structural affordance that is enacted through human agency and understanding the dynamics requires an interest in both the individual and the system.

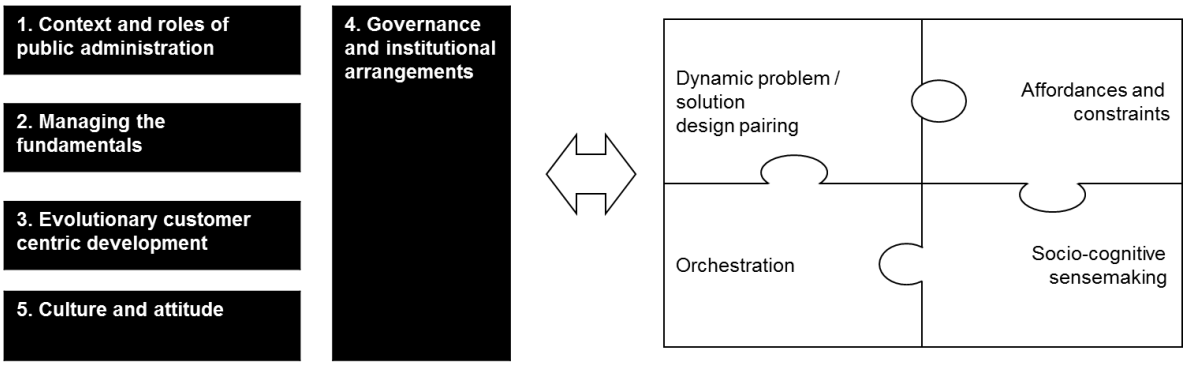
The individual level findings confirm the role of actors by showing the uniqueness of agentic orientations, which means that each actor will see unique opportunities to drive their objectives, to make use of previous contributions and to innovate through sociotechnical reconfigurations. The theorizing logic has a direct connection to the theoretical framing of this study in the affordance theory, but also the sensemaking aspect is inherent in the temporal human agency as it posits that actors respond in line with the perceptions of the phenomenon that is a mix of drawing on past experiences, evaluating current situation and projecting to goals. Much similar to sensemaking literature, which also has a temporal aspect (Weick, 2005; Maitlis and Christianson, 2014).

The affordance and sensemaking should according to Nambisan et al. (2017) be supported by the system design, i.e. ensure orchestration so that dynamic problem / solution can support enactment of what is afforded by the system instead of being constrained by other factors. This is reflected in the core category of governance and institutional arrangements that emerged from the ecosystem analysis. It is also interesting to see the difference between Nambisan et al. and Zittrain in this respect. As discussed in previous sub-section, the literature on generativity

propose that generative digital change and innovation happen through *unfiltered* contributions whereas these theorizing logics for digital innovation propose that the activities shall be *coordinated*. The empirical data provides better support for the latter. The ability to experiment and contribute without having everything centrally approved is central in both approaches, but the coordination or orchestration would be required to achieve holistic results and efficiency across actors.

The dual-mode governance that separate fundamental digital assets from digital change initiatives, matches the dynamics problem / solution pairing and orchestration as shown in Figure 19 below.

Figure 19 : The empirical findings align with new theorizing logics of digital innovation



A conclusion of this discussion is that the proposed theorizing logics provides structure to several elements of innovation literature that intuitively was found interesting in relation to the research problem. The strong alignment between findings and the proposed theorizing logics of Nambisan et al., suggests that ecosystem actors could benefits from digital structures through digital innovation rather than top-down designed digital change initiatives. It also supports the suggestion by the authors to proceed with additional research in this direction.

The idea that generativity and the proposed innovation outcome could be a way to develop alternative response models to ecosystem level digitalization was raised during the early stages of this research. It draws on the broad definition of digitalization. Digitalization is not good or bad - it just happens. Nor does the definition support the idea that some actors would take the lead and direct digitalization to a beneficial outcome for the whole ecosystem, but is instead positioned as a mechanism of continuous inflow of new digital assets and reconfiguration of sociotechnical structures to make the most of these in response to rapidly changing challenges. This means that the dominant development model, which assumes a relatively stable environment, is challenged and distributed and combinatorial digital innovation rise as an interesting alternative. Innovation is by definition a concept of producing new value through

combinations and the existing literature discussed in section 2.3 provides some advice to actors on how they can increase the innovation capacity. Some of the innovation theories in use seems to be well suited for use in digital context, such as open innovation, customer innovation and service innovation, but they are a bit fragmented and there is also room for more specific innovation theory on digital innovation.

The fact that there is a strong match between emergent findings related to *governance and institutional arrangements* and the *orchestration and dynamic problem/solution pairing* is interesting. A dual governance model, which would provide a more centralized and controlled governance for fundamental elements and more freedom for innovation in the solution space, resonates well with the logic of dynamic problem / solution pairing. The fundamental elements can be part solutions to a broad variety of problems when combined in different ways and the institutional arrangements and governance should provide the needed orchestration. This brings to mind the proposed integration of random variation and creative synthesis as a path to better innovation capabilities (Jiyao et al., 2015). Both generativity literature and empirical findings support the view that random variation increases the innovation capability in the ecosystem, i.e. a broader set of digital assets that can be used and combined by distributed actors increase generativity. But at the same time the findings clearly suggests that success depends on the coordinating and integration mechanisms and the ability to work together and learn together. The creative synthesis builds on collective attention, enacting ideas and building on similarities (Harvey, 2014), which this study shows to be relevant parts of the actor reasoning. The strong criticism against a too fragmented ecosystem, where actors work in isolation and have a not-invented-here attitude, does not support collective attention towards new opportunities that become possible due to increased volume and variation of structural elements. It is also very much against the idea of an affirmative process of building on and integrating ideas (Harvey, 2014). The need for better actor ability and motivation to experiment and drive distributed change is emphasized and this clearly would be a way to enact ideas. Also the pillar of building on similarities is reflected in the analysis findings where actors build on past experiences and use them as maneuvering repertoires and for deliberation. The findings, however, show that there is a void in communicating and promoting similarities that would link back to the collective attention.

The study supports the view that is not a question of either or, but a question of how these two models combine. Using both models together, innovation through random variation and the creative synthesis, is by Jiyao et al., compared to the use of goal-oriented brainstorming (2015).

The broad and varied contribution is an important part of the value creating process, but so is the creative synthesis model that directs the outcome towards the shared goals of the participants. This is an interesting conclusion that could act as guidance to one of the initial managerial question of whether a centralized intelligent design will produce better response to digitalization or if it would be better to let actors freely find the best ways to navigate opportunities and interfere as little as possible. Both the findings and the comparison to literature on digital innovation suggests that best results can be achieved when both models work in sync.

6. CONCLUSIONS

This section will discuss the contributions to academic literature and managerial practice, present a set of practitioner propositions and suggestions for further research and conclude the thesis with some final remarks by the author.

6.1. ACADEMIC CONTRIBUTIONS

Addressing the topic of how actors enact the generative affordance of digital structures in a public service ecosystem, this study primarily contributes to IS literature on digital infrastructure and generativity. The findings show how actors draw on unique agentic orientations in their response to structural opportunities and the ecosystem level analysis identify structures that play a role in the enactment process. These and other findings extend the current literature from the structural opportunity towards the interplay between structure and action. In addition, the findings also contribute to the growing stream of digital innovation research and to the literature on digital government.

6.1.1. Information System literature

The contribution to IS literature adds to the existing literature on digital infrastructure (Zittrain, 2006, 2008; Tilson et al, 2010, Hanseth & Lyytinen, 2010; Henfridsson and Bygstad, 2013) and its generativity (Tilson et al, 2010, Yoo et al., 2012, Zittrain, 2006, 2008; Eck et. Al 2015). This literature explains how digital materiality, the specific characteristics of digital artefacts provide a structural affordance for generative change. The structural side of digitalization well-covered by these and some other IS scholars but is insufficient as basis for organizational response. It is not enough to know that there is a potential, but practitioners would like to know how they should respond to make use of it. This requires, according to literature on technology in organizations and as change enablers, studies that explore both structural affordances and constraints and the human agency that overcome constraints in enacting the affordance. As it has been established that digital structures provide an affordance for generative change, we extend our analysis to the social actions that enact the affordance to produce socio-technical reconfigurations. Through two rounds of analysis, the first drawing on the theories of relational affordance and temporal human agency and the second being an inductive ecosystem level analysis of experiences, views and constraints related to the enactment, the study explicates several aspects of the interplay between structural affordance and the agency of actors in the ecosystem.

Specific contributions related to how agentic orientations influence the enactment are:

- The analysis shows how actors in the ecosystem use agentic orientations vis-à-vis the digitalization opportunities and a two-dimensional model based on temporal orientation and content orientation is produced to explicate the uniqueness and compare profiles across actors and actor groups.
- The study shows a difference in agentic orientations between implementing actors, including the distributed government and non-government actors, and policy actors, covering the central government and international reference groups of actors.
- The actor level analysis also reveals five areas of actor alignment, including insights on how some of the classical tensions in perceptions about digitalization can be explained with a temporal perspective.

As the response to relational affordances depends on the agentic orientation of actors we can conclude that these ecosystem actors will respond differently to digital opportunities. Situations that appear as major opportunities to some actors might pass unseen by other actors and as a consequence full realization of digital opportunities mean that all actors should have the ability and motivation to act upon opportunities that are appealing to them. Centralized decision making on digital investments will according to these findings never be able realize the full potential.

However, as ecosystem success depends on the alignment of actors, actions and flows in the system (Adner, 2017) the differences and areas of alignment are also important in order to understand the generativity enactment. The differences, both at the individual level and across actor categories, can according to Emirbayer and Mische (1998) be explained based on the different past experiences, current challenges and future goals of actors in the ecosystem. The fact that there are differences was expected based on the theoretical framing, but prior to the study it could not be predicted what differences would be found and between whom they would be. It could actually have been expected that there would be rather clear differences between the orientation of non-government actors and government actors, but it turned out that a bigger difference is between policy makers and implementers. The way that implementers draw more on current situation and the constraints that they are facing in the implementation initiatives and policy makers look more towards the future and how to modify the governance system, is logical in retrospect and contributes to the understanding of enactment dynamics.

The tensions identified in actor perceptions are elaborated through the temporal lens and the findings show that conflicting views can be explained by acknowledging the temporal

dimension. Applying this perspective shows surprising alignment in paradoxes such as the question of evolution vs. disruptive change or whether digitalization should be treated as a technology driven change or business opportunity. The way that actor orientations align in these tensions is also an interesting opportunity for further research. The tension of change and control is known in the literature on digital infrastructure (Tilson et al., 2010; Hanseth & Lyytinen, 2010, Ciborra, 2000) and digital innovation (Svahn et al., 2017) and both rounds of analysis contributes to the understanding of this paradox. The temporal human agency perspective aligns seemingly conflicting views as mentioned before and the ecosystem level findings suggests that a relief to this tension could be achieved through a dual-mode governance. A governance that separates but links fundamental digital assets, which needs to be more controlled, and the digital change and reconfiguration, where more change is allowed. These findings resonate nicely with generally accepted views of equal importance of material structures, i.e. the fundamental digital assets such as data assets and shared technology components, and the social actions, i.e. the practices of digital change initiatives that would allow for distributed change and innovation.

The inductive ecosystem level analysis of empirical data, with decomposition of data, conceptual labelling and creation of conceptually relevant categories, contributes to our understanding of digitalization and enactment of generativity at a system level. The analysis produces five emerging categories that are relevant in understand the phenomenon at the level of the ecosystem. The five emerging categories are further elaborated to three aggregate dimensions, which explains how not only the digital structures but also three other structural domains are crucial in the enactment of generativity.

Specific contributions based on the ecosystem level analysis are:

- The ecosystem level analysis confirms the initial actor level finding that more responsiveness will be needed in the ecosystem. It provides additional detail to underlying reasons for this agility requirement based on contextual drivers, it explicates current constraints related to responsiveness and it covers informant propositions for how it could be achieved.
- The findings suggest that a dual-mode of governance of digitalization in the ecosystem would support actors in making use of the generative affordances better than the monolithic governance that is dominant today. The fundamental digital assets need to be governed in a different way than the collaborative and iterative development of

digital services, and the current governance that does not clearly separate these is a barrier for generativity enactment.

- The synthetizing ecosystem level analysis produces five emerging categories, which explain the key aspects of the phenomenon as experienced by the actors. Together with the actor level analysis these explanations are used to form a conceptual model of generativity enactment in the case ecosystem.
- The findings emphasizes the importance of appropriate culture, ability and motivation to contribute to distributed development, innovation and ecosystem success. This category explicates much of the non-tangible sentiments experienced in the field work with a claim that ecosystem level benefits of digitalization cannot be achieved without a culture of collaboration complemented with individual ability and motivation to participate, engage and contribute. This needs to be emphasized because it aligns with all the theories that the research draws on; generativity, affordance theory, human agency as well as innovation management literature.

Each of the emerging categories are relevant in their own, but the suggested dual-mode governance is the contribution that would call for special attention. It not only links much of the emergent findings to each other, but it also connects to the five generativity factors of a system (Zittrain, 2008) and two of the proposed theorizing logics of digital innovation, i.e. the problem solution pairing and orchestration (Nambisan et al., 2017).

6.1.2. Digital innovation

The discussion of empirical outcome against literature on generativity and digital innovation supports and provides additional details to existing literature and prevailing conceptualizations of digital generativity. It also strengthens the recent propositions for new theorizing logics for digital innovation by showing that they are feasible and relevant in an empirical setting.

Generativity was selected as a key element for the theoretical framing based on how it resonated with definition of digitalization as socio-technical reconfigurations. Confronting the five conceptual factors that are claimed to increase digital generativity in a system to the findings of the study confirms that all five factors would be relevant in this case ecosystem and the empirical data support the claim that they would increase generativity potential (not the enactment thought):

- The empirical case study confirms that digital generativity can be a fruitful path as alternative approach to realizing ecosystem level benefits of digitalization. This would

put focus on distributed and combinatorial innovation instead of the traditional approach of defining a problem, specifying a solution, and implementing a solution in a sequence.

- All five factors of generativity (Zittrain, 2008) are supported by the empirical data. The data further suggests that there would be interdependencies between the factors and that Leverage would be a central factor.
- The study identifies a drawback with the definition of generativity in relation to the word *unfiltered*. The broad and varied contributions that produce generative change should according to the findings not be unfiltered but *coordinated*.

The generativity is according to literature a step to digital innovation, which is why these contributions are covered under the topic of digital innovation. The study also contributes with empirical material to test the recently proposed conceptualization and theorizing logics of digital innovation (Nambisan et al., 2017).

- Confronting the theorizing logic against the findings of this case study does not show any contradictions. Instead the conceptualization and four theorizing logics, i.e. dynamic problem – solution design pairing, socio-cognitive sensemaking, affordances and constraints, and orchestrations, align extremely well with the study. The theoretical framing of the study, which was designed independently of these theorizing logics, has similar duality in the way it addresses both actor level agency and ecosystem level structures and constraints. The actor level lens aligns with socio-cognitive sensemaking and affordances and constraints and the ecosystem level findings match the other two, i.e. the dynamic problem – solution design pairing and orchestration.

Although the study did not set out to show a direct link between generativity and digital innovation, the findings support the view that digital innovation can be enhanced through an increased focus on proposed generativity factors. The empirical data shows how generative change will be increasingly important to cope with contextual complexity. Increased responsiveness and agility will be needed and the unique agentic orientations suggest that the actor who realizes an opportunity should have the ability to push for needed socio-technical reconfiguration, i.e. the kind of distributed and recombinant digital innovation that is proposed by Nambisan et al. (2017). This provides support for the generativity claim that "*participation is the input to generativity and innovation is the outcome"* by Zittrain (2008: p. 90).

6.1.3. Digital government literature

Finally, the research also contributes to literature on digitalization in public administration. The study adheres to the call to shift focus from individual problems and specific e-Government solutions, such as online public services, to a more holistic view on digital government and public reform enabled by digital technologies (OECD, 2014). Several maturity models have been proposed to explain how ICT is used in public administration (Lee, 2010; Janowski, 2015; Di Maio & Howard, 2017), but there are few empirical studies describing the higher maturity stages that would enable or support such a shift from eGovernment to Digital Government. This research provides empirical material from a case study in the context of public administration that takes such a holistic approach

The framing of generative affordance and human agency is a novel theoretical approach in this domain and follows the research proposals that studies on e-Government and Digital Government should make use of more generic theories from IS-literature and technology studies (Bekker, 2012). The findings show how dominant stage-gate models for digital development and governance are poorly suited for the reformative digital ambition, and this study provide an alternative approach. It contributes to the literature on Digital Government with an empirical case study that has a solid theoretical framing from IS literature but is clearly beyond the previous paradigm of e-Government, and provides empirical material about experiences, challenges and governance aspects related to such a major change of perspective.

Specific contributions in the field of Digital Government are:

- The difference in agentic orientations between “policy makers” and “implementers” is a direct contribution to the literature of digital government.
- The five categories and three aggregated dimensions emerging from the ecosystem level analysis reflect key areas to address in order to support the enactment of generative affordance
- The central dimension of dual-mode governance suggests that separation of governance for fundamental digital elements from the digital initiatives would increase agility and distributed change in a public service ecosystem.

In summary, the study contributes to the understanding of how generative affordance can be enacted in this particular context of a public service ecosystem. It does not produce detailed prescriptive advice on how actors shall respond, but contributes to a better understanding of the phenomenon that each actor can use to support decision making in his or her particular situation and goals. A suggestion that there would be a “one-best-way” of responding seems unrealistic

anyway as the framing claims that affordances are relational and actors will respond based on their agentic orientations. This is why the study takes an interest in actor perceptions and experiences as foundational for understanding consequent actions and the interplay between the structures in the ecosystem. Differences in agentic orientations, constraining factors and the need for cultural change might have been intuitively known to practitioners who keep telling about the struggle to make use of digital opportunities, but they have so far not been covered in academic literature. Now let's turn our attention back to the practitioners and discuss what there is in these findings that could be applicable in the case ecosystem and potentially beyond.

6.2. MANAGERIAL CONTRIBUTIONS AND PROPOSITIONS

In addition to the academic contributions, the study also contributes to practitioners in the case ecosystem and potentially to a broader community of practitioners in public service ecosystems with a similar digital maturity. The case study contributes to the understanding of how the potential for distributed change and innovation, i.e. the generative affordance, could be an important factor in the response to digital opportunities that open up due to evolving digital structures. The study shows how the unique agentic orientations of ecosystem actors influence distributed responses throughout the ecosystem, how the actions are constrained by other structural factors and how a separation of fundamental digital elements from customer-driven iterative change would support responsiveness and agility in the ecosystem. Based on these insights, five managerial propositions are derived to support actors in taking the research findings into practical use in future policy making, ecosystem governance and digital development.

The findings contribute to government policy making in a time when many national and regional governments are shifting focus from individual e-Government initiatives to a more holistic use of digital data and technologies with reformative ambitions. International organizations like the EU, OECD and UN are aligned in their policy analysis and recommendations on trends and directions that governments should take (OECD, 2014; United Nations, 2014; European Commission, 2013) and this study contributes to our understanding of how digital generativity could support these ambitions. It explores and explains the role of generativity in ecosystem response to digitalization and especially the enactment of generativity, which is important for practitioners but less covered in existing literature.

The first managerial conclusion is related to the initial concern that the "old model" of ICT development is less than optimal for broader digitalization in an ecosystem context. A problem-

driven and sequential approach to digital development might have been the only option in the past, but new ambitions to support truly customer-driven and holistic reformative change and new opportunities due to growing and maturing digital structures call for other alternatives. The findings suggests that distributed digital innovation based on the generative affordance of digital structures would be such an alternative. For practitioners this would require an open attitude towards change and acceptance that "the way we have always done it" might not be the only way or even the best way when the contextual situation changes.

Another practitioner contribution is the proposed dual-mode governance, which would separate digital assets from digital initiatives. This will enable proper coordination and orchestration in the area of fundamental digital elements, which according to both findings and literature is a requirement for digital innovation, while at the same time enabling responsiveness to opportunities and changing needs in the operations and service development. Each of the five emerging categories in ecosystem level analysis will provide practitioner guidance for advancing such a dual mode governance. The first category *Contextual changes and roles of public administration* explains why changes will be needed, the next three categories propose a governance setup and describe constraints that have to be addressed, and the last category suggests cultural aspects that would have to support the change to realize the benefits.

A third area of special practitioner interest are the constraints that have been identified in the analysis. These constraints can be categorized as hard constraints and soft constraints. The hard constraints relate to rigid financial management processes, legal restrictions and the limitations that public sourcing legislation might place on experimentation, collaboration, reuse and agility in the response to new opportunities. These are often rather well know and commonly referred to, but sometimes they might also be used as excuses for not having to change the current practices. Practitioners should look critically into each of the hard constraints in order to separate the perceived constraints from the objective ones as we know from human agency theory that perceived reality drives the actions. Distributed digital change is according to the findings also constrained by several institutional and cultural factors. Actors in the ecosystem often prefer to work on their own and several actors involved in the study indicated that there is a "not-invented-here" mentality, which is diminishing the opportunity to achieve cross-sectoral digital benefits. There are several reasons for this, including but not limited to the complexity of traditional multi-stakeholder initiatives. The findings highlight the importance of ability and motivation of individual actors to participate and contribute but even more so the need to join forces, tap into joint development and learn by doing together. The cultural traits

that are described in the last category of ecosystem level analysis provides arguments to drive change in this area. Empirical data shows that attitudes are slowly changing as new people are entering the ecosystem with less legacy from the "old model", but directed actions would also be needed as well to speed up this change.

Next area of practitioner value is the description of how each actor respond to changing context in unique ways depending on their past experiences, the current situation and future goals, i.e. the role of human agency on perceptions and actions. There is no such thing as a shared vision that would align all actions towards ecosystem success, but it would nevertheless be important to communicate direction and create opportunities for collective sensemaking around opportunities and threats to facilitate understanding and alignment. These agentic orientations are central in the academic contributions, but they are also interesting and important for practitioners. Acknowledging the differences in actor orientations and realising that views that seem conflicting might be explained with a temporal dimension will make it easier to understand each other and overcome cultural differences and organizational boundaries. Recognizing the temporal orientations of actors, with the influence of past, present and future, helps to understand how actors understand digitalization and why they communicate or respond in certain ways.

Continuing on the topic of conflicting views and tensions, the study also provides insight that clarify some of the tensions that are common in practitioner discussions on how to respond to digital opportunities. These include such issues as whether digitalization should be seen as a continuation of the decades of ICT-enabled organizational development or as a disruptive force, if it would make more sense to take a business development approach or focus on the technology drivers in digitalization, and if the benefits would be better realized with a centralized or decentral model. The temporal view taken in the analysis shows that these issues are not necessarily conflicting, but might be explained by temporal differences. For example, actors with a predominantly iterative temporal orientation, i.e. relying on past experiences, are more likely to see digitalization as a continuation whereas those with a projective orientation are more likely to describe it as transformative and speak about how it enable radically new service and operational models.

Finally, it is worth stressing the findings related to how the orientations differ between the two actor categories, the *policy makers* and the *implementers*. This can be of interest for those setting the agenda for digitalization and need to alight actors and actions in the ecosystem. It could have been expected that there would be a difference between government actors and non-

government actors, but this other difference that emerged out of the analysis might be even more significant for future decisions. The actors in a policy making role need to take into account that distributed government actors and the non-government actors involved in implementation tend to draw more on current challenges and past experiences than on projections for the future. If the future benefits are over-emphasized the other actors in the ecosystem might feel that the policy makers are "up in the clouds" and do not understand the reality of those "that have to do the job".

These managerial contributions provide guidance for practitioner in the ecosystem. In order to make it easier to take action based on the findings of this study, five managerial propositions have been formulated based on the findings.

> *Proposition 1: The unique perceptions and orientations of ecosystem actors can be a challenge for ecosystem alignment, but they are also foundational for distributed digital innovation and should not be supressed.*

The findings shows how each actors draws on a unique mix of agentic orientations in their reasoning and subsequent actions. The two and a half years of policy guidance, discussion and directed communication since the government programme was launched in 2015 has not created a shared vision and aligned response to digital opportunities in the ecosystem. Instead, the study confirms what affordance and human agency theories suggest, i.e. that each individual actor is forming his or her perception of opportunities based on previous experiences, current situation and goals for the future. This comes, however, with some benefits in addition to the challenges for that they pose for ecosystem alignment. The major benefit is that an increased variation in perspectives according to literature on both open and digital innovation will increase the innovation capacity in the system. People see different opportunities in the same structural changes, which can be enacted through either collaboration or distributed action.

As individual actors have unique agentic orientations, the analysis also reveals areas where orientations are similar and different across actors and actor groups. Two categories, the *policy makers* and the *implementers* emerge when comparing the individual profiles and this finding can be used to support alignment, communication and collaboration in the ecosystem.

> *Proposition 2: Recognizing the differences in agentic orientations between policy makers and implementers can be used to improve communication and collaboration across actor groups.*

The actors who are actively involved in digital change initiatives draw more of current constraints and this should be acknowledged when communicating the policies and future plans. On the other hand, implementers might need to lift their focus from current constraints and acknowledge that things are slowly changing (as also indicated by the findings). An increased awareness on both sides that actors relate to the phenomenon differently could up for better collaboration and more effective governance.

The inductive analysis used produced a synthesized description of ecosystem level mechanisms based on the individual views and experiences. Five categories centred around the core category of a governance and institutional arrangements emerged from the analysis. The analysis suggests a dual governance model, which secures a stable digital infrastructure consisting of shared digital assets and a distributed and iterative digital development model that makes use of these assets in producing customer-driven value.

> *Proposition 3: A dual governance model, which systematically separates the governance of fundamental digital elements from the governance of digital initiatives, would improve ecosystem responsiveness and innovation capacity*

Many elements of the digital infrastructure are already governed separately with the explicit objective to support broad leverage, but this is not the case across the ecosystem. Most initiatives still develop assets that would have value to a broader audience but due to the isolated and fragmented development become embedded into the solution. This limits at least the leverage, accessibility, adaptability and transferability of assets, which all are proposed to increase the generativity of a system. The research findings stress that the logic of fundamental digital assets and the evolutionary customer-driven change are too far from each other to be supported with one-size-fits-all governance. Trying to do so would limit the capacity for distributed digital innovation.

The empirical findings are well aligned with the literature on generativity and digital innovation. Comparing the empirical findings to the generativity literature and the five generativity factors shows that the factors are supported but the defining feature that contributions should be unfiltered is not.

> *Proposition 4: Increasing the accessibility, ease of mastery, adaptability, leverage and transferability of digital assets will increase the capacity for generative change in the ecosystem, but there also need to be systematic coordination / orchestration.*

The concept of digital generativity is very interesting in relation to the ambition to move from individual e-Government initiatives to the holistic and reformative approach and the findings support the proposed generativity factors. It is, however, according to the findings important to introduce coordination in the governance to support a balance between flexibility and motivation to respond to opportunities and experiment with new approaches and having ecosystem level coordination.

The fifth emergent category of the ecosystem level analysis continues on this matter of motivation and ability. The findings suggests that there is a rather severe mismatch between current isolated culture and fragmented ways of working and the requirements for generative change. As digital generativity is treated as a relational affordance that becomes enacted by goal-oriented actors, it follows that no change will happen unless the actors have ability and motivation to drive change.

> *Proposition 5: A culture, which combines ability and motivation of individual actors with collaboration and an attitude of doing and learning together will be a key ingredient in reaching the potential ecosystem.*

The case study provides much evidence on the limitations of current culture and the need to promote a different attitude towards working together and learning together. This comes from the very nature of the contextual changes and increased complexity.

These propositions should be applicable in the case ecosystem, they can be considered for public service ecosystems with similar digital maturity and could be used for inspiration in other contextual situation where generativity of digital infrastructure is explored as an alternative approach to digitalization.

6.3. Suggestions for further research

The results of this study shows how distributed human agency is an important factor in generativity enactment and explicates structural factors that influence the enactment process. With this, it follows a research agenda to focus on digital infrastructure and its generativity as proposed by scholars such as Ciborra (2000), Tilson et al. (2010) and Yoo (2013). This research path has still not received the attention that it would deserve, despite the major impact that digitalization has on organizational life. The study foregrounds ecosystem actors in the enactment process, which was identified as a major gap in existing literature, and the findings indicate that there is much more to learn about the interplay between digital structure and actor

level agency and how this affects digital innovation through enactment of generative affordance.

The first suggestion for further research would therefore be to continue and intensify the work around digital structures and generativity as an alternative approach to the traditional top-down and sequential design-implement-operate model. Any research that increase our understanding of this approach to distributed digital change will be useful as the empirical studies in the area are few.

The model that represents generativity enactment emerged from an inductive analysis and can be considered valid only in this ecosystem. It does not claim to have external validity, but further research will be needed to test and extend the model with appropriate validity assumptions. This could be done as a comparative multicountry study or in a chosen vertical such as health care, which were proposed in the pilot interviews. An interesting focus area for further research would be the suggested dual governance in respect to the paradox of change and control (Tilson et al., 2010). The paradox has been empirically studied in literature related to digital platforms (Eaton et al., 2015) and digital infrastructure (Henfridsson and Bygstad, 2010), but none of them propose a model that could provide guidance on how to overcome the paradox. The model proposed in this study, with separation of fundamental digital assets and distributed customer-driven digital initiatives, and the dual governance to hold them together, might prove valuable as a response to this paradox but that needs to be studied further.

The comparison of empirical data against generativity literature shows that findings are in line with the five factors, which are proposed to produce generativity in a system (Zittrain, 2008). There are, however, weak indications that there might be more to discover in the relations between factors. Leverage seems to be more central than the other four factors and additional research could be undertaken to investigate these dependencies. This observation could be important and a study that focus on the five factors of generativity in a digital ecosystem could provide new insight on how these factors relate to each other. The factors were initially proposed more than ten years ago and the situation in digital ecosystems is radically different now, which means that there are new opportunities to take the construct to a more mature empirical setting.

Another area for further research would be to establish a more explicit link between the digital affordance and the outcome of digital innovation. The existing literature implicitly suggest the connection, but there is still a fair amount of terrain to cover in this relation. This study takes one step in the direction with the focus on the enactment rather than the structural affordance,

but the connection is still only indirect. The study focus on the actors and findings align with the generativity factors as well as with proposed theoretical logics of digital innovation, but the study does not show how structural generativity factors result in innovation. This should be investigated in studies that focus on both generativity factors and the level of innovation outcome.

In the research design phase several theories were considered as potentially relevant in exploring the research problem. Out of these, some are still relevant in the light of the findings. The theory on institutionalism (DiMaggio and Powell, 1983) is well-accepted and previously found to be especially relevant in the context of public administration. The findings stress the cultural and institutional norms as one of the structural areas that influence generativity enactment and more detailed studies on the institutional play could expand this initial finding. Sensemaking (Weick, 2005; Maitlis and Christianson, 2014) is one of the perspectives that Emirbayer and Mische (1998) refers to in the elaboration of why temporal human agency is of importance. As perceived affordances are key to the individual response there is definitely an element of sense-making and the perspective becomes even more central with socio-cognitive sensemaking as a component of the proposed theorizing logic for digital innovation. Dedicated studies on how the sensemaking process, individual and collaborative, drive the enactment of generative affordance in the ecosystem could further improve our understanding of the individual level process. The organizational routines (Pentland et al., 2012; Feldman and Pentland, 2003) are proposed to explain both persistence and change in organizations and this was considered as potential perspectives for the field study. The performative and ostensive routines seems to have potential to explain some of the research problem of how to achieve the needed change in the ecosystem, while at the same time keeping the stability that also is needed. It still seems like a valid theory to complement the understanding of distributed digital innovation in an ecosystem and some scholars could find interesting research path there. In the end, the arguments that digital generativity, through relational affordance and temporal human agency, could lead to distributed change and innovation seemed to be the most promising path and was chosen for this study, but the other theories still offer a multitude of opportunities for further research.

Finally, an increased focus on the value creation process would be an interesting avenue of further research. The Service-Dominant Logic (SDL) proposed by Vargo and Lusch (2016) is already linked to digital innovation (Lusch and Nambisan, 2015) and is intuitively resonates with the concept of digital generativity and contemporary trends of digital platforms and multi-

sided markets. The key pillar of SDL that value is created in use, when resources become integrated, and is defined by the customer, could support the understanding of how fundamental digital elements produce value in various configurations. Digital structures and solutions can according to the SDL perspective not be built top down to provide value, which would be considered goods-dominant logic where value is defined by the producer, but should instead be seen as resources that can be integrated and combined with other resources to produce value. This difference between goods-dominant logic and service dominant logic resonates well with the difference between individual e-Government initiatives, where the solution is specified before implementation, and holistic digital government where value is created through integration of existing and new data sources, platform components and other digital elements.

6.4. Final remarks

This case study research in a public service ecosystem has shown how temporal human agency can be helpful in understanding the interplay between structural generativity, individual actors and ecosystem level change. The two rounds of analysis, first at the level of individual actors and then at the level of the ecosystem, do not provide one simple answer to challenges that actors face in determining response to changing digital structures, but the findings do emphasize some important aspects to consider and the managerial propositions derived from the results can be useful as practitioner guidance. First and foremost, the findings show the need to strengthen a one-size-fits-all governance to a dual model that recognizes the different logic of fundamental digital elements vis-à-vis the customer-driven digital initiatives. Second, the case study shows how current ways of working constrain distributed change and limit responsiveness in the ecosystem. Third, there is broad agreement habits of isolated action and formalism is not motivating innovative actors to experiment, take action and drive change. Acknowledging the fact that there is untapped potential in generative digital affordance is a start. Realizing the potential would, however, require a readiness for change. A readiness to allow for distributed actors to act on their agentic orientations, to remove current constraints, to apply appropriate (dual) governance and to strengthen the cultural traits of "*being in the same boat*" and "*doing together, learning together*". Over time, distributed but coordinated change could produce the reformative impact that is called for in digital government visions, but has been so difficult to achieve with traditional approaches.

The way that the study ended up with these conclusions draws significantly on literature in ecology. Not only is the concept of ecosystem borrowed from ecology to management research, but also the theoretical framing of relational affordances theory originates from ecology

(Gibson, 1979). This was not a conscious choice when launching the research, although evolutionary change (Van de Ven and Poole, 1995) was considered at the beginning as a theory that might be compatible with digital generativity. Instead it has been more of a gradual process through the many choices done along the path. The research problem of how the rapidly growing digital structures open up for new opportunities led me to the thought that an ecosystem level approach is more revealing than focusing on an individual organization or initiative. And some steps later, the literature on technology in organizations brought me the theory of affordance, which made sense with its non-deterministic logic.

In retrospect it is, however, interesting to see how central the parallels with ecological ecosystems have become. Comparing a digital ecosystem to ecological ecosystems can be a way to promote new insights because both have a high degree of complexity and interdependency (Mintzberg et al., 2009). A change in one factor, such as growing population of a certain organism, will influence many other populations in ways that are not always trivial to predict. Interdependency can be a bliss as it can create a self-regulating systems, but it can also be a curse as it might be the cause of wicked problems, which are extremely difficult to even define, not to speak about solving them. The ongoing progress of digitalization has been, and still is, creating such a complex and interdependent system where a change in one part will influence other parts of the system. The more we respond to grand societal challenges with integrated digital solutions, the more interdependencies are created and the result will be increasing complexity. The hope would be that we also can promote the aspect of self-regulating system, and the switch from centralized design of digital response to distributed actors who respond independently to affordances could support such development. This is another reason why it would important to explore alternative models for ecosystem level digitalization.

The concept of ecosystems has been used in management literature for some time and with the rise of new digital business models it has seen another surge of interest. Contemporary trends has brought increasing attention to ecosystems in public administration as well. Actors in the case ecosystem speak about ecosystem impact and involvement as a natural extension to their organizational development. Areas such as Open Government, Open Data, Civic Tech, Data-Driven Innovation, etc. are driving this interest in ecosystems among policy makers, but ecosystems comes with fundamental change that would be important to understand. In an ecosystem there is no single actor that can control every aspect of the system. Instead, distributed agency will become increasingly important and research on digital infrastructure,

generativity and digital innovation can provide tools for understanding this change as it relates to digitalization. Tilson et al. (2010) raised the importance of digital infrastructure almost ten years ago with an article that referred to it as *the missing IS research agenda*. Now, with the rise of digital ecosystems and a new ambition level for digital government as holistic customer-driven reform, it seems that this approach is ready to take a more central role in the public administration.

That would mean a shift from isolated digital change initiatives and centrally envisioned and funded change to distributed, but coordinated, evolutionary change. One of the questions posed at the beginning of the research was whether a centralized approach to public sector digitalization would be better or worse than a decentralized. There was then and are still arguments for both views. One might say that centralization is needed as digitalization builds on compatibility, standardization and reuse, but at the same time the ambition to be truly customer-driven, responsive and make use of the emerging opportunities to produce citizen value, indicates that a distributed approach would be better. The findings of this research propose that both are needed, but combined in a dual-mode governance that separates digital infrastructure assets into a centrally coordinated government platform and allows for distributed change and innovation at the edges of public administration and the service ecosystems. This would be in line with the rise of data-driven government and the goal of increased digital innovation in the interface of public and private actors. Decentralized action on top of a centrally coordinated platform would be a way to achieve increase responsiveness by leveraging both the distributed wisdom and the evolving digital structures. In general, rapid technological change seems to give the advantage to distributed systems over a centralized model, which would have difficulties to keep up with the pace. These concerns are in the study expressed by informants both within the case and by international policy experts who see similar challenges across many constitutions.

These have been some final reflections on the topic. However, in line with the interpretivist research design, the thesis tells a story of how the phenomenon is seen from within the ecosystem. It makes interpretations of individual experiences and use them to build ecosystem level synthesis, but the situation keep changing and as we adhere to the belief that technology is non-deterministic the final outcome will only be known over time. Therefore, I leave the final word to two of the informants who touched upon this topic with statements that; *"we are living in interesting times and there seems to be a paradigm change in how public sector operate"* and *"a realization that none of us will live to see the final outcome of this development"*.

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APPENDIX A: DEFINITIONS

Digitization	"the process of converting analog signals into a digital form and ultimately into binary digits (bits)"	Tilson et al., 2010, p. 749
Digitalization	“encoding of analogue information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of the product and services”	Yoo, 2012, p. 5
Digital artifact	“manmade objects and tools that have a digital representation of information or are used to create, store, transmit or consume such digital information"	For the purpose of this study
Digital platform	“Extensible framework that addresses a family of generic functionalities meeting the needs of heterogeneous user communities platform-controlling actor and third-party actors”	Eck et al., 2015, p. 9
Digital infrastructure	“the shared, unbounded, heterogeneous, open, and evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their user, operations, and design communities”	Hanseth and Lyytinen, 2010, p. 4
Digital structures	The recursive infrastructure that is formed by digital artifacts, platforms, and infrastructure.	For the purpose of this study
Generativity	“a system’s capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences”	Zittrain, 2008, p. 70
Affordance	“the possibilities for goal-oriented action afforded to specific user groups by technical objects”	Markus and Silver 2008, p 622
Human agency	“Human agency is typically defined as the ability to form and realize one's goals”	Leonardi 2011, p. 147
Temporal human agency	“The temporally constructed engagement by actors of different structural environments—the temporal-relational contexts of action—which, through the interplay of habit, imagination, and judgment, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situations”.	Emirbayer and Mische, 1999, p. 970
Digital Innovation	“The creation of (and consequent change in) market offerings, business processes or models that result from the use of digital technology”.	Nambisan et al., forthcoming, p. 5
Digital Government	“the use of digital technologies, as an integrated part of governments’ modernization strategies, to create public value.”	OECD, 2014, p. 6
e-Government	“the use by governments of information and communication technologies (ICTs), and particularly the Internet, as a tool to achieve better government”	OECD, 2014, p. 6

APPENDIX B: CONTACT LETTER

Lähettäjä: NN [mailto:n.n@n.com]

Lähetetty: 5. tammikuuta 2017 17:34

Vastaanottaja: NN

Aihe: Digitaalinen innovaatio julkisten palveluiden ekosysteemissä

Arvoisa NN,

YY ehdotuksesta lähestyn sinua haastattelupyynnöllä aiheesta *digitaalinen innovaatio julkisten palveluiden ekosysteemissä*.

Olemme yhdessä YY:m ja muiden VM:n digitalisaation avainhenkilöiden kanssa pohtineet, miten digitalisaatio muuttaa toimijoiden rooleja ekosysteemissä ja miten keskushallinto parhaiten tukisi digitaalisten innovaatioiden syntymistä ja toteuttamista. Tavoitteena on menestyvä julkisten palveluiden ekosysteemi digi-ajassa, ja väitöskirjani kysymyksenasettelu on tehty tätä tavoitetta vasten.

Tutkimuksen lähtökohtana on ristiriita, missä:

a. Digitalisaation suurin potentiaali muodostuu siitä, miten olemassa olevia ja uusia digitaalisia ratkaisuja yhdistämällä mahdollistetaan uusia palveluita ja toimintatapoja
b. Perinteisesti toimintaansa kehittävän yksikön helpoin polku on kuitenkin ollut että minimoidaan sidosryhmät, joiden tarpeet otetaan huomioon, ja tehdään ratkaisu, joka täyttää omat ja omien asiakkaiden tarpeet.
c. Keskitetty ohjaus puolestaan suosii isoja, pitkälle määritettyjä hankkeita. Tämä rajoittaa variaatioiden ja kokeilujen määrää, ja heikentää sitä kautta koko ekosysteemin innovaatiokykyä.

Ihannetilanteessa jokainen digitalisaatioon investoitu euro tuottaisi sekä välittömiä hyötyjä toteuttavalle yksikölle, että entistä paremman yhteisen alustan tulevia tarpeita varten. Tämä vaatii uudentyyppistä ajattelutapaa ja hallintamallia. Nyt suoritettavalla tutkimuksen haastattelukierroksella kerätään sekä julkisten että yksityisten toimijoiden kokemuksia ja näkemyksiä tästä. Näistä näkemyksistä muodostetaan kokonaiskuva ja ehdotuksia, jotka luovutetaan keväällä VM:n digitalisaatiotiimille.

Toivon, että sinulla olisi mahdollisuus osallistua tähän tutkimukseen ja myös sitä kautta olla mukana edistämässä julkishallinnon digitalisaatiotyötä. Haastattelu voidaan tarvittaessa suorittaa puhelimitse ja siihen olisi hyvä varata noin 45 minuuttia.

Ystävällisin terveisin,

- NN

APPENDIX C: INTERVIEW GUIDE

Introduction: Relate to my previous role and past involvement in the ecosystem to build sense of shared interests.

Introduce problem: We speak about digitalization everywhere, including the government program, but there is not really a very clear consensus about what it actually means, how it should be turned to beneficial outcomes and how actions should be coordinated.

Introduce opportunity: Theoretically, digital data and technologies [extreme homogenization / standardization of data, re-programmability of technology, marginal cost of reproduction, editable nature, etc.] enable new and better "configurations" in the ecosystem. However, as we know, the reality is more complex, and there are many reasons why change does not happen.

Objective of the research: The motivation for this study is to explore how the opportunities that emerge with growing and maturing digital structures could be turned to beneficial outcomes in the ecosystem. The assumption is that full benefits of digitalization cannot be achieved in isolated initiatives but on the other hand, putting too much in a single initiative has not proven effective either (too many stakeholders, difficulties we have seen with broad reforms).

Practicalities: Discuss confidentiality and ask approval for recording.

Theme 1: How do you see the difference between the digitalization we speak about today compared to the long history of "ICT enabled development"? Now we say that it is transformative, but it is not always clear what is different compared to 10 - 15 years ago. How do you see the difference? In your opinion, what does these digital changes in the organization and in the environment / ecosystem enable? What objectives are supported and how can organizations make use this new situation?

Theme 2: What actions have been taken / is taken / are desired to make use of the new opportunities? What are you doing and what are others doing?

Theme 3: As we discussed, there are drivers enabling new ways of working, but also we know that there are also many constraints. Any comments on those? Which they are and how we can overcome the barriers?

Theme 4: How should Public Administration be organized in order to make this happen? Do you have any comments to which aspects should be governed / controlled / supported by the central government and in which areas would it be important not to centralize / control in order to allow for distributed innovation?

APPENDIX F: OUTCOME OF OPEN CODING

Agile	Ecosystem	Negative views
Ambiguity of term	Experimentation	New development approaches needed
Architecture	Financial crisis as a driver	Not invented here
Attracting innovators	Flexibility of resources	Once only
Authorization and authentication	Formal processes	Platform logic
Automation and cost efficiency	Foundation of digital innovation	Political and financial drivers
Barriers	Fragmentation and need for coordination	Positive view and opportunities
Budgeting	Globalization	Privacy
Centralization vs decentralization	Gradual change in initiatives	Programs
Check and verify continuously	Hard structures	Promotion of common services
Common services	Holistic approach - conflicts	Reporting
Competences and learning	Implementing challenges	Resource management
Competition	Importance of key persons	Resources
Complexity	Incentives	Risk taking
Consumerization	Increase in complexity	Role of public admin
Continuation on ICT dev	Industries changing	Roles and responsibilities
Control	Innovation logic	Security
Customer centric approach	Isolation and NIH	Service delivery
Data as key asset	Joining forces	Service layer
Decomposition and reaggregation	KPIs	Shared vision
Defending achieved benefits	Leadership	Silos
Difference ICT and digitalization	Legal frame	Sourcing
Different maturity	Long term thinking	Tech aspect of digitalization
Digital asset portfolio	Long term views	Term digitalization
Digital evolution	Managing dependencies	Top-down vs bottom up
Digital first and once only	Mental maturity	Transparency
Digital PA vs digital economy	Mobil devices	Work roles
Direct ROI	Monolithic initiatives	
	More talk than action	
	Motivation vs. enforced use	
	Multi-stakeholder issues	
	Need for new approaches	

APPENDIX G: OUTCOME OF AXIAL CODING

Contextual change and roles of public administration

Sub-category	***Corresponding Open Codes***
The contextual drivers	• Increasing complexity and interdependencies • Breaking boundaries • Political and financial drivers
Increasing technological complexity	• Continuation on ICT development • The ambiguity of term digitalization • Impact of consumerization and mobile devices • The digital transformation
Changing role of public administration	• Roles and responsibilities • Role of public administration • Digital public administration vs. digital economy

Managing the fundamentals

Sub-category	***Corresponding Open Codes***
Technology as fundamental enabler	• Technology aspect of digitalization • Building the foundations for digital innovation • Architecture • Decomposition and re-aggregation
The fundamental elements	• Data as key asset • Platform logic • Service layer
Cross-boundary governance of digital building blocks	• Promotion of common services • Digital asset portfolio

Evolutionary customer centric development

Sub-category	***Corresponding Open Codes***
Current experiences and limitations	• Monolithic initiatives • Automation and cost efficiency • Implementation challenges • New development approaches needed

Holistic and customer driven approach	• Customer driven approach • Holistic development
Experimental, gradual progress	• Gradual change in initiatives • Experimentation • Check and verify continuously
Evolutionary change	• Innovation logic • Digital evolution • Agile • Decomposition and re-aggregation
Limitations	• Security and privacy

Governance and institutional arrangements

Sub-category	***Corresponding Open Codes***
Structural arrangements	• Hard structures (public sourcing, legal frame, budgetary frame) • Resource management • Centralization vs. decentralization • Formal vs. informal processes • Transparency
Leadership and KPI:s	• Attracting innovators • KPI:s and incentives • Motivation vs. enforced
Governance for collaboration	• Joining forces • Shared vision
Time dimension	• Different maturity • Long term thinking

Culture and attitude

Sub-category	***Corresponding Open Codes***
General attitudes and views	• Positive and negatives views • "Digital first-" and "Once only"-principle
Personal traits	• Risk taking • Leadership

Collective attitudes	• Increased mental readiness • Isolation and Not Invented Here • Defending achieved benefits

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