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Governance of Cross-Organisational Digital Innovation in the Public Sector

Steven Nõmmik

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Steven Nõmmik

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Avaliku sektori organisatsioonide koostöö digitaalse innovatsiooni juhtimisel

STEVEN NÕMMIK

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List of publications

The list of author's publications, on the basis of which the thesis has been prepared:

I Verhoest, K., Callens, C., Klijn, E.-H., Brogaard, L., García-Rayado, J., **Nõmmik, S**. (2024). "Designing Cross-Sector Collaboration to Foster Technological Innovation: Empirical Insights from eHealth Partnerships in Five Countries." *Public Administration Review*, 1–18. https://doi.org/10.1111/puar.13785 (ETIS category 1.1)

II Breaugh, J., Rackwitz, M., Hammerschmid, G., **Nõmmik, S.**, Bello, B., Boon, J., Van Doninck, D., Downe, J., Randma-Liiv, T. (2023). "Deconstructing complexity: A comparative study of government collaboration in national digital platforms and smart city networks in Europe." *Public Policy and Administration*, 1–22. https://doi.org/10.1177/09520767231169401 (ETIS category 1.1)

III **Nõmmik, S**. (2024). "Cross-organisational collaboration management of digital innovation in the public sector – the case of the Estonian Employment Register" *NISPAcee Journal of Public Administration and Policy, 17(1),* 1–27. https://doi.org/10.2478/nispa-2024-0007 (ETIS category 1.1)

IV Callens, C., Verhoest, K., Klijn, E.-H., **Nõmmik, S.**, Pina, V., Brogaard, L. (2023). "How service users envision their engagement in processes of collaborative innovation: A Q-methodological study on user involvement in eHealth collaborations." *Public Policy and Administration*, 1–25. https://doi.org/10.1177/09520767231170298 (ETIS category 1.1)

V Breaugh, J., **Nõmmik, S**. (2024). "The coordination of digital government platforms: the role of administrative tradition and collaboration history." *In:* Verhoest, K., Hammerschmid, G., Rykkja, L., Klijn, E.-H. (*eds.*) *Collaborating for Digital Transformation How Internal and External Collaboration Can Contribute to Innovate Public Service Delivery.* Edward Elgar, 81–102. https://doi.org/10.4337/9781803923895 (ETIS category 3.1)

Author's contribution to the publications

Contribution to the papers in this thesis are:

I In **Article I,** the author of the thesis contributed by data collection and conducting the analysis of the Estonian cases. This included assigning values for the different conditions as well as writing a qualitative background overview on the cases for conducting the fsQCA. The author also contributed to the revision of the manuscript during the submission process.

II In **Article II**, the author contributed to the development of the theoretical framework and to the analysis of the empirical data. The author participated in the design and writing of the framework (contributing primarily to sections on complexities as well as the contextual role of digitalisation). The author also conducted interviews for the Estonian cases and contributed to the writing of the final draft regarding the empirical results.

III **Article III** is a solo-authored work, with the author being responsible for designing the study, writing the analytical framework, collecting the empirical data (documents and conducting the interviews), performing the data analysis, and writing up the paper.

IV In **Article IV**, the author of the thesis contributed to the initial design of the Q-sort, conducted the data collection for the Estonian cases, and contributed with the analysis of the Estonian cases. The author also contributed to finalising the Q-set during the initial design of the data collection process. In addition, the author participated in the final writing process and helped revise the manuscript during the submission process.

V In **Article V**, the author of the thesis was in equal co-authorship with the lead author of the publication. The author co-wrote the theoretical framework (writing the sections regarding collaboration history and collaborative process challenges) and participated in the data collection, analysis, and writing an overview of the results. The author furthermore contributed with edits to the manuscript during the revision process.

1 Focus and aim

Digital innovations have been an important mainstay of the public sector for decades, with technologies utilised to improve the effectiveness, responsiveness, and transparency of public policy and administration (Choi & Chandler, 2020; Dunleavy & Margetts, 2023). Public administration has reached a stage where it is difficult to imagine functions and processes that do not involve the use of some form of digital technology. This includes different information systems, mobile applications, open data, social media, data analytics, and most recently, artificial intelligence (AI) solutions, all of which have been deeply embedded into the daily working environment of the public sector. However, the introduction of technologies into the public sector has been far from a straightforward success story, with past decades providing a myriad of examples of low performance outcomes, unintended consequences, and even downright failures (Choi & Chandler, 2020; Kempeneer & Heylen, 2023; O'Neil, 2016). Whilst some of the failures have to do with overoptimistic expectations (as is currently seen to some extent with AI), the main challenges tend to originate from the integration of new technologies with established administrative structures and processes. This has called attention to the complex interactions that digital technologies have with the actors, social processes, networks, and institutions that influence the potential directions for digital innovation (Bailey & Barley, 2020; Pollitt, 2011).

One of the main issues affecting the understanding of the design and implementation of digital technologies in public administration has been connected to the limited integration of e-government research with broader public administration debates (Bannister & Connolly, 2020; Dunleavy & Margetts, 2023; Gil-Garcia et al., 2017; Pollitt, 2011). Rather than looking to build and synthesise existing knowledge, the respective research communities remain quite detached from one another. This leads to underestimating the relationship between technical and social factors in integrating new digital technologies with existing routines and practices (Pollitt, 2011). Crucially for public administration discourse, it has resulted in oversimplifying the role of structures, actors, and processes central to the public sector, thus providing limited insight into the complex interdependencies present when enacting new digital technologies (Bannister & Connolly, 2020). As a result, the effects of the social and institutional factors on enacted technologies have been understudied (e.g., see Fountain, 2001; Kempeneer & Heylen, 2023). These factors have become all the more salient as digital innovations have increasingly adopted intra-organisational arrangements to adapt to the complex social challenges (Dunleavy & Margetts, 2023).

While multi-actor arrangements have received significant attention within public administration research, the study of digital innovation has adopted multi-actor perspectives only to a limited extent (Gasco-Hernandez et al., 2022; Wouters et al., 2023). Next to hierarchical and market-based approaches, cross-organisational arrangements through different collaborative and network settings are increasingly seen as key in addressing the pressing challenges in policy-making and service delivery (Hartley et al., 2013; Torfing, 2019). Through multi-lateral formats, the collaborative processes open themselves up to diverse organisational responses, which become a catalyst for change (Qvist, 2017; Torfing et al., 2020). The diversity in organisational backgrounds brings forth new information and knowledge to improve mutual learning as well as develops trust and joint commitment for mobilising and implementing digital solutions (Mergel et al., 2019; Raadschelders & Whetsell, 2018; Torfing, 2019). However,

it is important to highlight that engaging in multi-actor arrangements can result in both under-collaboration due to coordination failure as well as collaborative excess due to overestimating interdependencies (Elston et al., 2023). This is affected both by the characteristics of the actors within the multi-actor arrangements, the chosen network management strategies as well as the surrounding institutional context, which affect the possible modes of collaboration and network settings (Chen et al., 2019; Elston et al., 2023; Randma-Liiv, 2023; Weerakkody et al., 2016). The different mixtures of organisational and institutional factors in managing the design and enactment of digital solutions require more research to better comprehend the combinations conducive to digital innovation in the public sector.

Therefore, the aim of the thesis is to provide new conceptual and empirical insights into the governance of cross-organisational digital innovation processes in the public sector. Theoretically, the thesis has adopted a network governance perspective for the study of digital initiatives. Through network perspectives, the thesis is able to contribute to the study the different multi-actor approaches for digital innovation by addressing the role of actor characteristics, network management as well as the institutional context. The publications forming this thesis address the following research questions related to the governance of digital innovation initiatives in cross-organisational settings:

- *How do actor characteristics impact the governance of cross-organisational digital initiatives?* (**Article I; II; III** and **V**)
- *How does network management impact the governance of cross-organisational digital initiatives?* (**Articles I; II; III; IV** and **V**)
- *How does institutional context impact the governance of cross-organisational digital initiatives?* (**Article II; III**; **V**)
- *Which configurations of cross-organisational governance are conducive to enacting digital innovation?* (**Article I; II; III** and **IV**)

Empirically, the thesis is based on a mix of single and multiple case study research design. To better understand the role of the different factors, the empirical study included different units of analysis (from studying single networks to multiple connected networks) as well as different analytical frames (from analysing actor roles to studying network management).

Article I, co-authored with Prof. Koen Verhoest, Dr. Chesney Callens, Prof. Erik Hans Klijn, Prof. Lena Brogaard, and Dr. Jaime García-Rayado, analyses the role of partnership design in technological innovation. The empirical part of the article is based on a comparison of 19 eHealth partnerships across five European countries. The findings stress the importance of partnership design in shaping technological sophistication. Contrary to prominent ideas in collaborative innovation theory, the findings from the cases indicate that small, centralised, and homogeneous partnerships tended to be most successful at achieving technological innovation. This was spurred on by the high levels of interpersonal trust amongst participants, which made it possible to reduce the complexities present in technologically sophisticated initiatives. Furthermore, the interpersonal trust between the actors enabled taking a contingent approach with the roles for the lead actors, who managed the complexities through a varying set of roles.

Article II, co-authored with Dr. Jessica Breaugh Bossdorf, Dr. Maike Rackwitz, Prof. Gerhard Hammerschmid, Dr. Benedetta Bello, Prof. Jan Boon, Dries Van Doninck, Prof. James Downe, and Prof. Tiina Randma-Liiv, focuses on complexity theory in collaborative digital environments. The empirical part is based on a cross-case analysis of eight digital

projects from four European countries. The results indicate that digitalisation plays a role in furthering the interrelatedness of the different types of complexities (substantive, strategic, institutional). As a result, digital projects aiming to reduce the complexities present within the administrative structures experience a temporary increase in tensions, necessitating management interventions to mitigate the pressure. Furthermore, the findings highlight that digital projects are rarely the source of significant reforms, as the established institutional context tends to steer new digital initiatives towards complementing existing logic rather than result in transformations.

Article III is a solo-authored article that analyses the role of system context, collaborative process challenges, and management interventions. The empirical part of the paper takes a holistic approach and focuses on the single case of the Estonian Employment Register. The article emphasises the importance of coordinating actors in adopting contingent roles based on the challenges and needs of the actors. The development of technological solutions can result in unexpected potentialities, which requires a shift in the composition of actors and their individual roles. The paper furthermore calls attention to the advantages of conducive environments, where previously established reputation and technological capacities are crucial for articulating an overall vision and potential value. This made technologically less capable agencies more open to new technological initiatives. Lastly, the paper outlines the challenges in adjusting to the new operational and technical logic, leading to incompatibilities with common semantic understanding and technical interoperability.

Article IV, co-authored with Dr. Chesney Callens, Prof. Koen Verhoest, Prof. Erik Hans Klijn, Prof. Vicente Pina, Prof. Lena Brogaard, looks at user perceptions regarding their roles in public-private collaborations for digital initiatives. The analysis of the empirical data resulted in three specific user profiles. Users who perceive themselves as external to the governance structures were motivated primarily by the desire towards more functional final outputs of technological initiatives. Users who saw themselves as an internal part of the governance structure were motivated primarily by the opportunity to contribute to outputs through participation. The paper outlined the importance of output legitimacy for all user profiles. Furthermore, the empirical results did not indicate profiles linked to either self-organising or user-innovating roles, which are prominent in collaborative innovation literature.

Article V, co-authored with Dr. Jessica Breaugh Bossdorf, focused on the role of administrative tradition and pre-existing relationships in shaping the collaborative process challenges and the management measures for cross-organisational collaborative digital initiatives. The empirical findings pointed to a certain behavioural clustering linked with administrative traditions, with pragmatism, legal culture, level of formality and hierarchy present across administrative traditions. Administrative traditions can be tied to power imbalances and complexities present in collaboration, whilst strong pre-existing relationships can be linked with the mitigation of perceived challenges. This is most contrasted with the cases from the Continental and Scandinavian traditions, with political challenges more relevant for the former and technical challenges for the latter. The paper highlights how digital initiatives must adopt different management measures and governance structures to address the impact of the surrounding context.

The thesis contributes to existing public administration and e-government literature by systematically incorporating a network governance perspective into digital innovation processes that increasingly take place in cross-organisational settings. The introduction of a network approach provides a different perspective on the study of the interactions

between the technical, organisational, and institutional dimensions of digital innovation. This is crucial for public administrations where the complex interactions between actors, networks, institutions and the enacted digital technology are instrumental for steering digital innovation. While the connections between the technical, organisational, and institutional dimensions have been noted in literature beforehand (for example, see Kempeneer & Heylen, 2023; Bannister & Connolly, 2020; Gasco-Hernandez et al., 2022, Wouters et al., 2023), they have been explored to a limited extent from a network governance perspective. The study of the dynamics of actor characteristics, network management, and institutional context as the key factors shaping digital innovation will further our understanding of the interaction between the technical, organisational, and institutional elements of e-government (Bannister & Connolly, 2020). Furthermore, the thesis contributes to our understanding regarding the relevant conditions for capitalising on the advantages of collaborative governance for digital innovation (Torfing, 2019).

The thesis shows the role of actor characteristics, network management, and institutional context in shaping and steering digital innovation. First, the thesis highlights the relevance of a combination of low levels of diversity and high levels of trust for inducing digital innovation. The empirical cases reflect that mutual learning built on trust-based relations can encourage digital innovation when utilised for a limited set of ideas, where actors can comprehensively test the functionalities of the digital technology through trial-and-error (**Article I**; **III**). Secondly, the thesis also discusses the importance of the choice of network management approaches from the design of the coordination measures as well as leadership roles in shaping the enactment of digital technologies (**Article I**; **II**; **IV**). The multi-actor arrangements need to simultaneously nurture positive dynamics, i.e., mutual learning and trust-building, while limiting negative dynamics, i.e., substantive and strategic challenges, which puts significant pressure on the actors involved to find compromises. The thesis argues that homogeneous venues where lead organisations adopt a central role through command and control are best able to capitalise on the potential of digital innovation (**Article I**). Homogeneous venues are built on stronger ties, which are important for encouraging a more risk-accepting environment and openness to learning from errors (**Article III**). The asymmetric position of the lead actor enables cross-organisational initiatives to maintain overall focus and bypass collaborative deadlocks (**Article I**; **V**). Lastly, the findings indicate that the cross-organisational initiatives are able to maintain legitimacy and acceptance by narrowing the overall vision and framing the digital initiative through output legitimacy (**Article III**; **IV**). By having clear, achievable goals and exploring the promising functionalities of the technologies, digital initiatives can maintain the commitment of partners as well as intended end-users (**Article III; IV**).

The rest of the introduction is structured as follows. First, the analytical framework for the thesis is provided. Second, the research methodology is described. Third, the primary findings from the thesis are highlighted. Finally, the main discussion points and potential research avenues are examined.

2 Analytical framework

Public administrations have experienced increasing calls for engagement in different forms of collaborations to adapt to both citizen expectation and complex environments (Elston et al., 2023). This is no different for digital innovation initiatives, as digital solutions are increasingly crossing organisational, sectoral, and territorial boundaries (Wouters et al., 2023). Collaborations vary significantly, with multi-actor arrangements differing in various characteristics – from the background of the engaged actors and strategies for managing the collaborations to the goal of the networks (Gil-Garcia et al., 2019). Through cross-organisational venues, the enactment of technologies is facilitated by a complex dynamic of institutional and organisational factors. This includes the engaged actors themselves (e.g., organisational biases, conflict with organisational skills and priorities, limited resources and technological capacities), the engaged networks (e.g., responsiveness of the governance structures, issues with agreeing upon a mutual language, established digital infrastructure) and the surrounding institutional context (e.g., incompatibilities with the legal framework, compatibility with values within the policy field, overlapping mandates between networks) (Bailey & Barley, 2020; Vial, 2019; Wirtz et al., 2019). The thesis aims to capture the complex interplay between the institutional and organisational factors by focusing on the following three theoretical building blocks.

1) *Actor characteristics.* Actors adopt specific behaviours and strategies for cross-organisational digital initiatives, shaping the opportunities for enacting new digital initiatives (Kattel et al., 2020; Fountain, 2001). This thesis focuses on the role of available resources, capacities of individual actors as well as the priorities of actors. The choice of the factors was guided by the aim to cover both the limitations, e.g., cognitive and material, and the strategic interests that affect the positions the actors are able and willing to undertake (Klijn & Koppenjan, 2016; Bailey & Barley, 2020). For operationalisation, the analytical framework has combined perspectives from network governance, complexity and e-government research (Chen & Lee, 2018; Cordella & Tempini, 2015; Klijn & Koppenjan, 2016; Picazo-Vela et al., 2018; Wouters et al., 2023).
2) *Network management*. Whilst actor characteristics shape the behaviour of individual actors, network management strategies ultimately shape the venues for capitalising on the resources and capacities made available (Trondal, 2023; Wouters et al., 2023). The thesis covers strategies from the perspective of structure- and process-based factors. This includes the design of the governance structure, the role of the lead actor, the challenges to the collaborative process, and management interventions. To illustrate the factors, existing literature on network governance, collaborative innovation, collaborative governance, e-government and boundary spanning has provided insight into the dynamics relevant for nurturing and limiting cross-organisational exchanges (Bailey & Barley, 2020; Klijn & Koppenjan, 2016; Provan & Kenis, 2007; Quick & Feldman, 2014; Torfing et al., 2020).
3) *Institutional context*. Although actor characteristics and network management are crucial for enacting digital technologies, these occur within established institutional contexts. Established routines and practices are essential for regulating the behaviour of actors, with divergences resulting in further resistance (Elston et al., 2023; Randma-Liiv, 2023; Klijn & Koppenjan, 2016).

The thesis analyses the institutional context through the factors of prior digital developments, actor embeddedness, and established interaction dynamics at the system level. By combining insights from studies on administrative traditions, public management reforms, network governance and e-government, the thesis delineates the context to understand its impact for cross-organisational digital innovation (Cordella & Tempini, 2015; Di Giulio & Vecchi, 2023; Fountain, 2001; Kattel et al., 2020; Klijn & Koppenjan, 2016; Peters, 2021; Vial, 2019).

Actor characteristics, *network management*, and the *institutional context* shape the design and implementation of digital innovation. This includes both the interpretation of the functionalities of the digital solution as well as their integration into existing work processes (Mergel et al., 2019; Fountain, 2001; Kempeneer & Heylen, 2023). The overall theoretical approach is summarised in Figure 1.

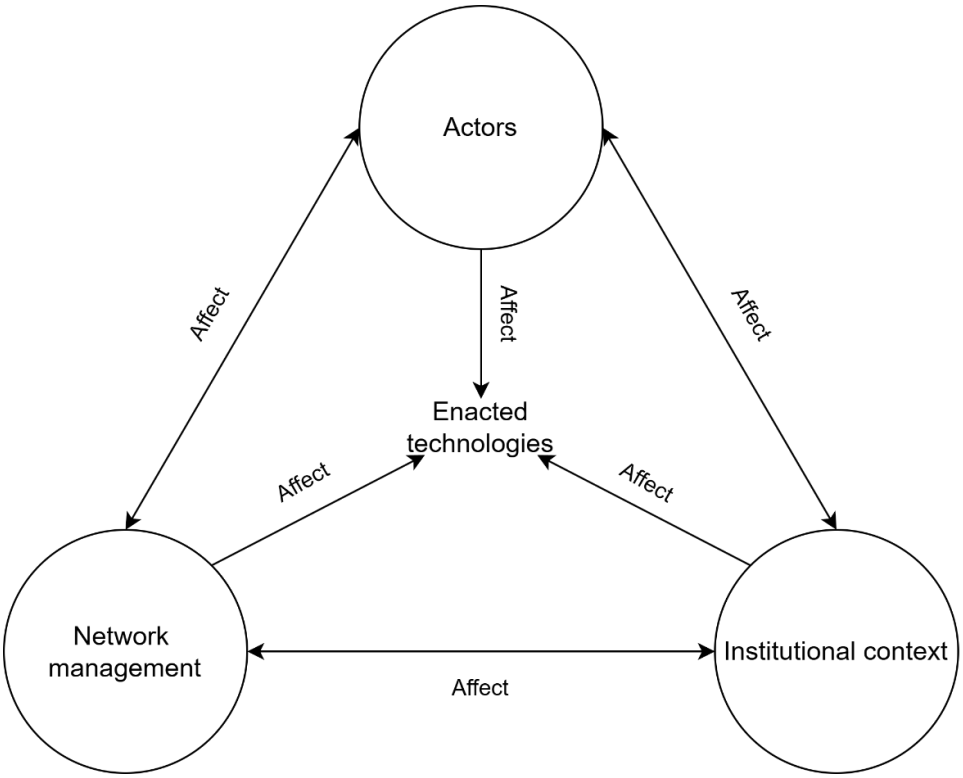

***Figure 1**: Cross-organisational governance of digital innovation*
Source: Author, based on theoretical framework

2.1 Actor characteristics

Digital innovation has potential to change structures and processes, resulting in a change of relationships amongst public actors, government-to-citizen and government-to-business dimensions (Gasco-Hernandez et al., 2022). The process of change is strongly dependent on the actors present and engaged with digital innovation – from their ability to mobilise relevant resources and the capacity to engage in actions to the priorities they foresee in relation to their own goals (Fountain, 2001; Picazo-Vela et al., 2018). Actors in this

context refers to the different types of organisations (e.g., public, private, and societal) engaged within the multi-actor initiative. Public actors include both the national (e.g., ministries and agencies) and the local (e.g., municipal authorities and local agencies) levels in a variety of roles. Public actors can have a role in establishing a broader strategic approach through their role in designing and adopting legislation, regulations, and strategies (Ashaye & Irani, 2019). However, they also adopt more active roles within digital innovation initiatives, where they can be in leading and supporting actor roles (Breznitz & Ornston, 2013; Gasco-Hernandez et al., 2022). Furthermore, public actors can also be in the position of end-users and recipients, as they procure the desired digital solutions (Juell-Skielse et al., 2017). While private organisations have often been conceptualised through their role as IT-developers, they can also initiate digital innovation initiatives and be engaged as intended end-users (Janssen et al., 2020; Juell-Skielse et al., 2017; Wouters et al., 2023). Digital innovation initiatives in the public sector also involve other non-governmental organisations – from citizen representative organisations to different interest groups and professional associations (Juell-Skielse, 2017; Loeffler & Bovaird, 2016). By being involved in a multi-actor initiative, the actor imparts their own meaning to the digital solution, thus shaping the design and enactment of digital technologies (Bailey & Barley 2020). The meaning-making is derived from the actors' capacities and priorities (e.g., values and goals) (Bailey & Barley, 2020; Wouters et al., 2023). The thesis focused on the following actor characteristics: a) *committed resources*; b) *collaborative capacity*; c) *technological capacity*; d) *priorities of actors*.

As organisations become engaged in multi-actor initiatives, they also *commit resources* to the collaboration. By *committing resources*, actors foster further interconnections with one another within the collaborative project and establish the basis for new interactions (Chen et al., 2019; Gasco-Hernandez et al., 2022). This includes *resources* like knowledge, tangible resources, social capital, and reputation. Knowledge refers to an understanding of the problem that the actors possess (Bailey & Barley, 2020). Knowledge and knowledge creation is based on a combination of individual, organisational, societal, and professional sources (Raadschelders & Whetsell, 2018). Knowledge can contribute towards more informed decision-making, but it can also foster biases within organisations, limiting the applicability of digital solutions (Bailey & Barley, 2020; Raadschelders & Whetsell, 2018; Torfing, 2019). Tangible resources can be identified by their verifiable properties and ownership, and them being quantifiable (Grant, 2002). This mainly includes time and money (in both direct and indirect contributions through personnel and processes), but can also include existing digital infrastructure (e.g., platforms) that the actors are willing to contribute (Sullivan & Skelcher, 2002; Gasco-Hernandez et al., 2022). Through their prior history in interactions and the development of relationships, actors possess a reputation (Nahapiet, 2008). Reputation serves as a proxy indicator of an organisation regarding the actions they may carry out and the perceived chances of success (Bardach, 1998). The existence of a positive or strong reputation provides other actors with confidence regarding the integrity of the process, chances of success, and legitimacy of the outcomes, thus affecting their own commitment (Ansell & Gash, 2012). Lack of a reputation results in a more incremental development of interactions due to a critical stance on success (Bryson et al., 2006). Previous successes in digital initiatives shape the perceptions of stakeholders regarding future initiatives (Kattel et al., 2020).

Although actors commit resources to the multi-actor initiative, their extent and utilisation within the collaboration is also shaped by the *collaborative capacity* of the

engaged actors (Jakobsen & Thrane, 2016). Multi-actor digital innovation initiatives require actors to understand the potential of the functionalities of the digital technology for intra-organisational processes (Bullock et al., 2020). *Collaborative capacity* refers to the ability to process relevant information for the purposes of transfer, to translate it into a universally understood language, to transfer it in a manner understandable to the other actors, as well as the ability to reciprocate (Quick & Feldman, 2014; Perry-Smith & Mannucci, 2017). The choices towards transboundary exchanges originate in the analysis and evaluation of the potential actors (Bryson et al., 2015). Through *collaborative capacity*, actors are able to improve the collaborative process and better assess the potential value from the multi-actor arrangement (Gasco-Hernandez et al., 2022). This can lead to further contributions from the organisations involved as they see more value in cross-organisational exchanges. Furthermore, *collaborative capacity* improves the impact of the committed resources as well (Jakobsen & Thrane, 2016). By improving the ability for cross-organisational exchanges, actors can better steer the committed resources towards the different processes in the design and implementation of the technology.

As different actors are engaged in the digital innovation process, their contributions to the initiation, design, and enactment phases are also impacted by the *technological capacity* they possess (Wouters et al., 2023; Picazo-Vela et al., 2018). Although *collaborative capacity* is important in shaping the ability of actors to engage in cross-organisational exchanges, the selection and feedback mechanisms for the enacted technologies also influence the strategies. *Technological capacity* is linked with the actors' ability to recognise the different functionalities of the digital solution, explore potential opportunities for the technologies, develop a solution in a form that makes it possible to achieve the intended goals, and then enact and integrate the digital solution successfully within the organisation (Lember et al., 2018). This includes the mobilisation of different *resources* (e.g., knowledge, tangible resources) in the processes and practices linked with designing and enacting the functionalities of digital solutions (Picazo-Vela et al., 2018). It encompasses routines relevant for the development (e.g., financing, procurement, development) as well as the enactment (e.g., piloting, scaling up) of the digital solution. Feedback from existing routines affects the integration and institutionalisation of the functionalities of the digital solution into intra-organisational processes and the ability of actors to reshape semantic, operational, and technical logic. Actors have developed *technological capacity* over *prior digital developments*, which is encapsulated in existing processes and routines (Lember et al., 2018). The existing processes and routines may enforce established frames of thinking regarding technologies, or they may encourage openness and experimentation with the digital solution.

Alongside contributions, routines, and processes, the *priorities of actors* impact the strategies of participating in digital innovation initiatives. Actors have formulated specific *priorities* based on their defined role and links with other existing networks within the field they operate in (Dawes et al., 2009). *The priorities of actors* affect their interpretation of the benefits and disadvantages of the specific functionalities of digital technologies (Bannister & Connolly, 2014; Hellberg & Grönlund, 2013). The *priorities* are shaped by input from a variety of sources – e.g., prior experience with digital initiatives, professional knowledge, existing organisational structure and processes, values and norms within the organisation and in other networks in the policy domain (Dawes et al., 2009; Klijn & Koppenjan, 2016; Raadschelders & Whetsell, 2018). *Actor priorities* are also impacted by the *technological* and *collaborative capacities* present. This involves the

formation of *priorities*, but also how the functionalities of the digital solution are perceived. Actors with higher levels of *technological capacity* may be better able to interpret the different potential functionalities of the digital solution, and thus, find ways of potentially amplifying the expected benefits of the digital technologies (Chen et al., 2019; Kattel et al., 2019). Depending on the interests of the actors, they adopt specific strategies in collaborations with regard to their willingness to commit (Klijn & Koppenjan, 2016). Based on the combination of *priorities* and *capacities*, the actors can prioritise organisational goals, or they may look to commit to cross-organisational aims.

2.2 Network management

As digital initiatives cross established boundaries, actors work together within a collaborative process through networks. The strategies for managing the networks have to limit potential collaborative challenges, whilst capitalising on the potential for synergies and benefits from collaborative exchanges. As networks increase in composition, more diverse *resources* and *capacities* are involved, which increases the need to manage the differences and find common ground in semantic, operational, and technical details. Through network management, these *resources* and *capacities* can be utilised in the service of a shared goal, which can facilitate collaborative advantages in positive-sum games. The collaborative advantage can be achieved through a variety of strategies, encompassing both the composition of the network as well as the rules of interaction. To cover the different aspects, the thesis focuses on the following: A) *structural factors*; and B) *process-based factors*.

A) *Structural factors*

The functioning of networks is largely impacted by the design of its governance (Juell-Skielse et al., 2017). This impacts the intended dynamics for integrating the relevant cross-organisational processes and designing interoperability (Chen et al., 2019; Hellberg & Grönlund, 2013). The design of governance results from a combination of *structural factors*, the composition of actors, and the role of the lead actor(s).

As digital initiatives look to provide solutions to complex societal challenges, the network management approaches have to be adapted accordingly to provide the required competencies and capacities (Kattel et al., 2020). The complexity is also reflected in the composition of the network, which includes transboundary exchanges across policy domains and sectors (Quick & Feldman, 2014). This has led to cross-organisational networks occurring within governments (e.g., interagency collaboration) but also through public-private and public-non-governmental relations (Gasco-Hernandez et al., 2022; Picazo-Vela et al., 2018; Torfing et al., 2020). Engagement of private and other non-governmental actors can occur through formal (e.g., contractual partnerships, formal agreements) and informal (e.g., personal networks) interactions (Juell-Skielse et al., 2017; Kattel et al., 2020). The structural design of network governance affects the power allocation that shapes the availability of resources and capacities present within the network (Bailey & Barley, 2020). The allocation of power can originate from a variety of sources, such as the resources committed to the initiative, the reputation from previous initiatives, and the interdependencies with other engaged stakeholders (Bryson et al., 2015). Through the power allocation within the network, *structural factors* establish specific interaction dynamics between the actors, which can shape the potential to interact and influence the digital innovation process (Bailey & Barley, 2020).

This can provide innovation initiatives access to new cognitive frames, streams of knowledge and understanding (Stadtler & Karakulak, 2020). However, the asymmetries can also reinforce the perspectives of more dominant actors, with problems analysed through selective lenses (Wegrich, 2019).

A core element within the design of network governance is the role of lead actor(s). From the structural perspective, the position of the lead actor(s) within the network governance structure may take a variety of single or shared formats, with certain asymmetries with regard to responsibilities (e.g., discretion to design rules regarding interactions and decision-making) and resources available (Provan & Kenis, 2007). In more centralised structures, lead actor(s) adopt a top-down position in relation to other engaged actors. Alternatively, actors can agree upon sharing certain leadership roles by adopting shared formats or agreeing upon the creation of separate organisations (Juell-Skielse et al., 2017). Within the different structures, lead organisations shape the network management and the innovation process within the collaboration by balancing the interdependencies and autonomy of actors, reducing tensions within the initiative and facilitating an environment conducive to new ideas and perspectives (Ansell & Gash, 2012; Stadtler & Karakulak, 2020). Alongside an active role in shaping the network, the lead actor also affects the interactions with external actors and adjacent networks. The role of the lead organisation facilitates the legitimacy that the initiative is able to foster both with the engaged actors and networks, as well as within the broader administrative structure (Kattel et al., 2020; Torfing et al., 2020). The reputation and trustworthiness of the lead actor(s) transfers to the collaborative process, thus affecting the contribution of resources and the confidence of other engaged actors (Lewis et al., 2018).

B) *Process-based factors*

Alongside defining the structural design of actor composition and leadership roles within the governance structure, the actors also shape digital initiatives by engaging in different management interventions to foster more effective forms of coordination (Bryson et al., 2015). The management interventions look to bridge the tensions present and foster positive dynamics between the different actors and networks. This includes a wide variety of strategies to foster the collaborative advantage within networks, including agreements regarding the overall goals and objectives, the forms of participation and interaction, exchanging and sharing information, resolving conflicts, and other crucial processes (Klijn & Koppenjan, 2016). The collaborative innovation and collaborative governance literature has highlighted different process-related interventions, which are relevant for managing networks (Bryson et al., 2015; Emerson et al., 2012; Hartley et al., 2013):

- *Building trust*. For digital initiatives, trust is relevant at multiple levels – interpersonal trust, trust in organisations, trust in technologies. Trust reflects confidence in the predictability of the different actors, whether it be the individual, the organisation, or the technology, which affects perception of risks, and thus, the positions and interactions of individual actors (Provan et al., 2009; Klijn et al., 2010; Sun & Medaglia, 2019).
- *Developing capacity for collective action*. Transitioning from an organisation-centric perspective to cross-organisational coordinated activities requires establishing processes for coordinated actions (Chen & Lee, 2018; Emerson et al., 2012; Klijn & Koppenjan, 2016). This includes both formal and informal

norms facilitating cross-organisational interactions (e.g., through rules determining inclusion, decision-making, conflict mediation) as well as networks for exchanging and sharing resources.

- *Establishing meaningful learning processes*. Moving towards productive interactions requires the development of skills for reflection and learning among actors (Tuurnas, 2015; Mergel et al., 2020). Such *learning* occurs during the collaborative process when interactions and the outcomes of digital technologies introduce new cognitive frames to reevaluate existing processes (Young et al., 2019). Through new perspectives, actors may be able to better understand the problems with existing service provision, and thus, re-engineer such processes.

Process-based interventions, i.e., *building trust*, *developing capacity for collective action,* and *establishing meaningful learning processes*, are strongly interconnected and facilitate collaborative advantages within networks. However, networks experience limitations in establishing and maintaining process-based interventions as substantive and strategic challenges limit the options as well as their impact. From the substantive side, networks experience divergent interpretations from the blind spots and biases present amongst the engaged actors (Jessop, 2003; Raadschelders & Whetsell, 2018; Trondal, 2023). From the strategic perspective, networks may be composed of divergent interests, which may lead to more powerful actors steering the agenda and problem solving (Bailey & Barley, 2020; Klijn & Koppenjan, 2016). By limiting the available options and the impact of management interventions, substantive and strategic challenges also affect the ability of the networks to establish and maintain collaborative advantage. Due to the challenges in reaching common ground and agreement regarding the decisions taken within the collaborative venues, the actors are unable to recognise and capitalise on cross-organisational exchanges. This results in actors becoming reluctant to contribute and exchange within networks, leading to a collaborative malaise within the network.

Through network management, actors engaged in cross-organisational initiatives decide upon the strategies to shape the design and enactment of digital initiatives. The interventions and challenges change over time, as actors experience new internal and external events that reshape the dynamics within networks. The ability of the networks to formulate a response shapes the potential role of the enacted technologies, with new ideas either discarded or tested through experimentation.

2.3 Institutional context

Contrary to techno-deterministic perspectives, the systems and cultural perspectives emphasise the importance of the surrounding institutions in creating the necessary conditions for the development of digital solutions (Fountain, 2001; Pollitt, 2012). The impact of the surrounding institutions can be both conducive or limiting during the design and use of new technological solutions (Emerson et al., 2012; Randma-Liiv, 2023). To better understand the role of surrounding institutions in enacting technologies in inter-organisational contexts, the thesis focuses on: a) *prior digital developments*; b) *established interaction dynamics*; c) *horizontal and vertical embeddedness*.

Digital innovation initiatives take place in contexts where *prior digital developments* have already been conducted. The *prior developments* have a role in defining the digital solutions in place as well as institutionalising the structures and processes for subsequent digital innovation initiatives (Luna-Reyes & Gil-Garcia, 2011; Kattel et al., 2019; Kempeneer & Heylen, 2023). This creates certain technological trajectories, which can

encourage some digital innovation initiatives, whilst discouraging others (Dunleavy & Margetts, 2023). *Prior digital developments* interact with the digital initiative through a variety of roles, such as through the mandate provided to different networks, through existing digital solutions acting as a tangible resource, through formalising a syntax for public services, and through the provision of new knowledge by way of increased information processing capacity (Ansell & Miura, 2020; Chen et al., 2019; Kattel et al., 2020; Peeters, 2020). However, established digital solutions also nurture path dependencies in technological trajectories, which are difficult for public administrations to overturn (Kempeneer & Heylen, 2023; Vial, 2019). *Prior digital developments* tend to reinforce and infuse specific values and norms, which also steer the direction of follow-up developments (Cordella & Tempini, 2015; Luna-Reyes & Gil-Garcia, 2011). For example, this occurs by formalising specific processes and structures for maintaining accountability and responsibility, establishing automation and standardisation for efficiency gains (Bannister & Connolly, 2014; Cordella & Tempini, 2015). Furthermore, *prior digital developments* reinforce existing interpretations and biases with regard to data, which can impede its use for potential new service provision (Dunleavy & Margetts, 2023). As a result, digital initiatives attempting to introduce new logic and standardisation face more pressure, as they have to engage with resistance from established routines at the operational and technical levels. Alongside the choice of technologies, previous experience also influences perceptions about networks. Networks and actors who have been successful in *prior digital developments* are perceived positively with regard to success in future digital initiatives (Chen et al., 2019). While it streamlines the formation of governance arrangements, it can also create challenges for alternative networks and actors with less technological capacity looking to compete with existing arrangements (Wynen et al., 2019). As a result, *prior digital developments* can foster and nurture an ecosystem for new digital innovation initiatives but can also impede potential new digital initiatives that are incompatible with the established solutions, routines, and processes.

Digital innovation processes take place through *established interaction dynamics* that involve different types of actors (Di Giulio & Vecchi, 2023; Gil-Garcia et al., 2019; Juell-Skielse et al., 2017). Actors rarely possess monopolistic power within a policy field, as they have connections and interdependencies with other actors who also have a mandate to engage in specific processes to do with policy-making and/or service provision (Trondal, 2023). From their position, actors and networks possess the relevant legitimacy to initiate digital innovation initiatives (Breznitz & Ornston, 2013; Juell-Skielse et al., 2017). Public actors can adopt a number of other roles relevant to the digital innovation initiative – from designing the broader framework for steering digital innovation (e.g., detailing technical requirements and standards) to being an active partner within the specific digital innovation initiative (from the legal dimension to business processes to actively developing digital components inhouse) (Dunleavy & Margetts, 2023; Juell-Skielse et al., 2017). While digital innovation initiatives within the public sector are primarily related to public actors, private and societal actors have become increasingly relevant as well, as they become engaged with both the design and implementation of digital solutions (Di Giulio & Vecchi, 2023; Dunleavy & Margetts, 2023). This includes their ability to design the digital and business processes, as well as their potential role as intended end-users (Janssen et al., 2020; Juell-Skielse et al., 2017; Wouters et al., 2023). Through the interdependencies present within a policy field, the venues may steer towards distinct modes of collaboration. For example,

the centralisation of competencies and top-down mandates can lead to centralised digital agencies being seen as the legitimate actor to develop digital solutions for ministries and agencies within a policy field (Juell-Skielse et al., 2017). Collaborations can also include public-private and other public-non-governmental relations, as private and societal actors may possess the relevant resources, legitimacy, and commitment to engage in digital innovation initiatives (Ashaye & Irani, 2019; Sæbø et al., 2011). The *established interaction dynamics* and prominent modes of collaborations (e.g., inter-agency collaboration, collaboration among public and private actors, collaboration among non-governmental and public agencies) shape the choices within the digital innovation initiative regarding both structure and processes. The imbalances and plurality of backgrounds also impact the potential challenges within the digital innovation initiative.

Through the different modes of collaboration and established interaction dynamics, actors experience interdependencies in both *horizontal* and *vertical embeddedness*. The division of resources, tasks, and competencies within policy fields facilitates the formation of different networks of public, private, and societal actors, which necessitate interactions during policy-making and/or service provision (Jugl, 2023; Trondal, 2023). Organisations and networks become more embedded as the division of resources, tasks, and competencies for policy-making and/or service provision becomes more sectioned between different networks. For the digital innovation initiatives operating in the complex landscape of interconnected networks, increased *embeddedness* leads to more diversity in the semantic, operational, and technical logics present in the design and implementation of digital solutions. Engagement in networks leads to agreements regarding the specific use of professional language, mutual understanding regarding operational logic, and established interoperability regarding the digital solutions in place (Quick & Feldman, 2014). Through mutual agreements and compromises, these routines are guided by entrenched goals, values, and norms, which help steer the participating organisations in their actions (Klijn & Koppenjan, 2016). As actors participate in multiple networks to achieve different organisational goals, they have to prioritise their commitment to the different networks and thus choose the proper strategies to balance between different networks (Hinings et al., 2018). From a substantive perspective, increased *embeddedness* can open digital innovation initiatives up to more diverse perspectives, as different professional and organisational backgrounds from networks are engaged during the digital innovation process (Torfing, 2019). The differences within and across policy fields at a semantic (regarding the meaning of key concepts as well as relevant criteria), operational (regarding the provision of different services) and technological dimension (regarding the technological solutions relevant) are engaged and compromised on (Bailey & Barley, 2020; Hinings et al., 2018). From a strategic perspective, *embeddedness* leads to negotiations regarding the values, norms, and goals that engaged actors and connected networks face. Within more heterogeneous venues, i.e., diverse actor backgrounds and multiple connected networks, actors face more variety in proposed perspectives and norms, which create further challenges with transboundary exchanges (Klijn & Koppenjan, 2016; Quick & Feldman, 2014).

2.4 Combining actor characteristics, network management, and institutional context for enacting technologies

Actor characteristics, *network management*, and *institutional context* are strongly interlinked with one another, shaping the potential alternatives for the enactment of technologies. *Network management strategies* adopted within the digital initiative are limited to the resources and capacities of actors as well as the decisions previously made in the surrounding context. *Actor characteristics* change the viability of different structure- and process-related strategies for *network management*. Through collaborative and technological capacities of individual actors, networks establish different approaches for mitigating substantive and strategic challenges (Wouters et al., 2023; Kattel et al., 2020). This involves the potential interpretations for the enactment of technologies as well as the position of individual actors and the forms of interactions. The resources and capacities of individual actors are strongly shaped by prior digital initiatives, which often establish the availability for and allocation of resources by setting out clear values and norms that are deemed a priority within the organisation (Kempeneer & Heylen, 2023). The strategies for *network management* can impact the surrounding environment and institutions by shifting existing boundaries and interdependencies (Weerakkody et al., 2016). This occurs as digital initiatives can encourage moving beyond established siloes and boundaries with regards to decision-making and/or service provision, and thus, considering new potential opportunities for maximising the use of enacted technologies. Through positive synergies in *network management* approaches in the chosen structures and processes, both the actors engaged with the digital initiative as well as the external actors may re-evaluate best routines and practices for meeting their organisational goals and adhering to priorities within the policy field (Ibid.). By rethinking the processes and structures in existing networks, the division of resources and tasks may be reconfigured as well.

The combinations of *actor characteristics*, *network management*, and *institutional context* shape the opportunities for the enactment of digital technologies. On the one hand, positive synergies may be established, which result in the potential of the underlying digital solution being maximised. However, the connections between the factors can also produce conflict, which limits the enactment of the underlying technologies. Positive synergies are enabled by the connections between *actor characteristics*, *network management*, and *institutional context* in expanding the opportunities for enacting technologies (e.g., successes in past digital innovations combined with high technological capacity facilitating broader acceptance of enacting digital solutions). The positive synergies occur as the surrounding institutions, actors, and the engaged network(s) are able to contribute to recognising and utilising the different potential functionalities of the digital solution. This leads to flexible adaptations and adjustments to existing policy-making and/or service provision processes to integrate them. It can occur by way of a variety of strategies, which are able to capitalise on the resources and capacities they have available in the contexts they are in (Juell-Skielse et al., 2017; Wouters et al., 2023). On the other hand, configurations of *actor characteristics*, *network management*, and *institutional context* can result in a more restrictive environment for the enactment of new digital technologies (e.g., limited technological capacity and mutual learning leading to an inability to recognise technological functionalities and evaluate their potential value) (Kempeneer & Heylen, 2023). The conflicts begin to hamper digital innovation initiatives when frictions between

actor characteristics, network management, and institutional context discourage the exploration of technological functionalities for digital innovation and limit the integration of the digital solution with existing policy-making and/or service provision processes.

3 Methodology

The primary work for this thesis was conducted while working on the Horizon 2020 project TROPICO (Transforming into Open, Innovative and Collaborative Governments), which analysed the (potential) transformation of public administrations in the digital age through a wide range of public administration theories – from network governance and collaborative innovation to digital government literature. The overall aim of this thesis is to use network perspectives to study digital innovation initiatives by exploring and evaluating the impact of actor characteristics, network management, and institutional context on governing cross-organisational digital initiatives and their impact on enacting digital innovation. Consequently, the thesis aims to answer the following research questions:

- *How do actor characteristics impact the governance of cross-organisational digital initiatives?* (**Article I; II; III** and **V**)
- *How does network management impact the governance of cross-organisational digital initiatives?* (**Articles I; II; III; IV** and **V**)
- *How does institutional context impact the governance of cross-organisational digital initiatives?* (**Article II; III**; **V**)
- *Which configurations of cross-organisational governance are conducive to enacting digital innovation?* (**Article I; II; III** and **IV**)

As the thesis aims to both explore and understand certain network factors in the field of digital government, it has adopted both explanatory and exploratory approaches through in-depth case studies. The research strategy was guided by the complexity of the research subject. Due to the highly complex nature of multi-actor collaborations, the number of factors impacting the collaborative process and potential outcomes is quite large, which makes case studies a suitable approach (Van Thiel, 2014). The thesis relies on an in-depth study of the cases of digital innovation initiatives. It includes cases of digital innovation in e-health and taxation. The papers employed different approaches for the cases as well as the perspective for studying the venues. While most articles presented cross-case analyses and comparative cases (**Article I**; **II**; **IV**; **V**), one paper (**Article III**) focused on a single case study of the Estonian Employment Register. The articles adopted different perspectives to analyse the interaction venues, including interactions within a single venue (**Article III**), studying the interactions across multiple venues (**Article I**; **IV**), and adopting a system perspective (**Article II**; **V**). An overview of the methodological approaches is provided in Table 1.

For data collection, the thesis relied mostly on primary data, which was collected through interviews and surveys. The interview method involved both semi-structured (**Article II**; **III**; **V**) and structured formats (**Article I**; **IV**). In preparation for conducting the interviews, guidelines were designed that included the key themes and topics to be covered in interviews. The survey instruments (**Article I**; **IV**) included a written questionnaire and a Q-sort, which the respondents filled out during and following the structured interview. Both data collection instruments went through a piloting phase to improve the reliability and validity of the study.

For data analysis, the articles forming the core of the thesis have adopted both explanatory and exploratory approaches. The exploratory approaches included Q-methodology (**Article IV**), qualitative content analysis (**Article III**) and thematic

analysis (**Article II**; **V**), which aimed to better understand specific traits and conditions relevant to actors and collaborations. The explanatory approaches included fuzzy-set qualitative comparative analysis (fsQCA) (**Article I**), which studied the combined effect of the different set of conditions. The methods chosen were crucial for a deep dive into the conditions relevant for the specific phenomenon as well as for understanding the relevance of individual conditions in producing specific outcomes (Van Thiel, 2014; Schreier, 2012; Ragin, 2008).

The exploratory papers primarily aimed to conduct an in-depth analysis of the role of actor characteristics and the surrounding institutions as well as the management of collaboration regarding digital innovation. This perspective was covered in three articles (**Article II**; **Article III**; **Article V**) that provided an overview of the factors relevant for shaping collaboration on the digital initiatives. The articles have adopted different perspectives, from an actor-centric perspective (**Article III**) to comparative perspectives on collaborations (**Article II; V**), which provide different approaches to better understand the relevance of individual actors and networks for initiating and steering digital initiatives.

The explanatory papers focused on the relevant structural and process-based conditions in fostering digital technologies. This was covered in **Article I** and **IV**. The aim of the papers was to delve further into the conditions and look for specific pathways in fostering digital innovation as well as analyse the user-perspective with regards to role formation within established cross-organisational collaborations. This was achieved by surveying the actors in cross-organisational collaborations and obtaining in-depth qualitative information for the explanatory power of the results.

***Table 1**: Methodological approaches used in the articles*

Publication	Case approach	Chosen cases	Method of analysis	Interaction venues
Article I	Cross-case	E-health initiatives	Fuzzy-set qualitative comparative analysis	Multiple interconnected venues
Article II	Comparative cases	Smart city initiatives; national digital initiatives linked to the EU Single Digital Gateway	Thematic analysis	System perspective
Article III	Single case	Estonian Employment Register	Qualitative content analysis	Single interaction venue
Article IV	Cross-case	E-health initiatives	Q-methodology	Multiple interconnected venues
Article V	Comparative cases	Smart city initiatives; national digital initiatives linked to the EU Single Digital Gateway	Thematic analysis	System perspective

Source: Author

Article I discussed the impact of partnership design on technological innovation in eHealth partnerships. The paper studied 19 eHealth partnerships across five countries (Belgium, Denmark, Estonia, Spain, the Netherlands). The data collection process relied on input from 132 interviews and 124 respondents to the survey, consisting of the following: (1) the coordinating actor; (2) public and private partners; (3) users. The data collected was analysed through a fuzzy-set qualitative comparative analysis (fsQCA) to test the hypotheses.

Article II focused on a cross-case design to analyse the interrelatedness of different types of challenges (power, risk, complexity) and digital solutions present in intra-governmental collaborations at the national and local level. Eight digital initiatives from four countries (Belgium, Estonia, Germany, the UK) were analysed through 50 semi-structured expert interviews. The national level cases had to be at or past the

implementation phase, collaborative in nature, and linked with the EU single digital gateway. The local level cases involved the implementation of smart city strategies and had to take place in a city that is considered a digital pioneer in the country and had a population of at least 50,000. The cases were coded using MAXQDA software and analysed for relevant themes.

For **Article III**, a single-case study approach was adopted. The article went in-depth into actor-centric perspectives on the challenges and coordination of the Estonian Employment Register. The choice of the case was related to its perceived success and the cross-organisational collaboration involving multiple technologically capable actors (ETCB and EUIF). The data collection involved desk research combined with altogether eight semi-structured interviews conducted between the period of October to November 2019. The desk research included strategic documents related to the engaged actors, media releases, relevant legislative acts, and surrounding documents. The data was analysed through a qualitative content analysis based on the coding conducted with a concept-driven and data driven coding scheme.

Article IV focused on user perceptions regarding their roles in public-private collaborations. The article theorised and tested four distinct theoretical user roles: (1) legitimators, (2) customers, (3) partners, and (4) self-organisers. The roles were tested using the Q-methodology on users in 19 public-private eHealth collaborations from five countries (Belgium, Denmark, Estonia, Spain, the Netherlands). The findings highlighted the emergence of three hybrid empirical profiles, indicating a variation in the viewpoints of users with regards to their involvement in the design and implementation of digital technologies. The findings reflected the importance of previous experience in shaping views and the need to establish feedback lines with users.

Article V adopted a multi-case study approach, analysing cases of digitalising public services in different administrative traditions. This involved both the digitisation of existing processes (e.g., digitising and centralising the Civil Registry in Belgium) as well as transforming processes (e.g., designing new services on the basis of the data collected with the Estonian Employment Register). The book chapter focused on the link between system context through administrative tradition and pre-existing relationships with specific collaborative process challenges and the subsequent choice of management measures. The book chapter concerned five countries (Belgium, Denmark, Estonia Germany, United Kingdom) with three different administrative cultures (Continental, Scandinavian, Anglo-Saxon) adopted as perspectives. The data collection involved 36 semi-structured interviews with public, private, and societal users. The interviews were transcribed and coded, with reliability established through a review of results between co-authors.

Whilst the publications forming the core of this thesis used a variety of methodological approaches to improve both the reliability of the research conducted and the generalisability of the findings presented, there are still distinct limitations present. This concerns both the methodological strategies adopted as well as the foci of the individual papers, which affect the reliability of the answers to the different core research questions.

First, the main data collection methods were interviews and surveys, which rely strongly on individual perceptions. This could increase the likelihood of biases resulting from the perception of the interviewees. It can be related to both the initiative and other stakeholders. Furthermore, individuals may have limited memories of the initial phases of the technological initiatives, which can affect the level of data quality. The data

collection included additional steps in sampling as well as interview guidelines to limit the risk of individual perceptions affecting data quality. Throughout the publications, the representativeness of the sample was ensured by having specific criteria regarding characteristics (e.g., public, private, societal actors; core and peripheral roles) to balance the perspectives of different sub-groups. Furthermore, the reliability and validity of the interviews were improved through a variety of methods, e.g., triangulation of data sources, testing for intercoder reliability, pilot studies.

Secondly, the focus was narrowed down to digital initiatives where public sector organisations have an asymmetrical position regarding the design and use of enacted technologies. This is likely to have an effect on some of the results presented within this thesis. The asymmetrical position of public sector organisations impacts the potential roles of private actors and end-users. This can limit certain end-user profiles (for example, the user-innovator) and constrain the advantages provided by private actors (e.g., flexibility in experimentation). It also affects the perceived importance of different actor characteristics and network management approaches. To mitigate potential biases from research findings, different subgroups, i.e., public, private, and societal actors, were included in the sample to incorporate additional perspectives. Furthermore, the interview guidelines included themes and topics on challenges to understand the limitations of the asymmetric structures studied.

4 Main findings

The main findings are structured according to the research questions highlighted in the section "Focus and aim of the thesis" and are based on key findings from the articles.

4.1 How do actor characteristics impact the governance of cross-organisational digital initiatives?

In terms of actor characteristics, the research results indicated the prominence of the following dynamics: a) asymmetric contributions of the lead actor(s); b) collaborative capacity affecting the viable strategies for process-based interventions; c) technological capacity affecting the ability to interpret and enact functionalities in a cross-organisational venue; d) priorities of actors shaping the balance between intra-organisational routines and cross-organisational functionalities.

Regarding the combinations of resources individual actors possess, the studies showed that the reputation, tangible resources, and knowledge of the lead organisation(s) are the most crucial for defining network management strategies. The reputation the lead actors can provide for the digital innovation initiative is important for the perceived legitimacy as seen by external actors as well as engaged partners, affecting their initial contributions (**Article II**). Furthermore, during the development and enactment of digital technologies, knowledge, tangible resources, and reputation are utilised to balance the process-based interventions in mutual learning and trust-building. For example, with the case of the mobile health technology for women with osteoporosis in Denmark, the initiative experienced strategic challenges due to diverging perspectives regarding the enactment of the mobile application. The intervention from the lead actor became crucial for bypassing the collaborative deadlock. As they possessed an asymmetric position in terms of knowledge, tangible resources, and reputation, they were able to replace less relevant and conflicting partners, whilst maintaining the legitimacy and trust of other engaged actors (**Article I**). The resources committed shape the network management strategies. Through different combinations of resources, actors can capitalise on them through structure- and process-based approaches to design and enact digital technologies.

Although resources are crucial for shaping the alternatives for governing digital initiatives, the viability of using a different combination of resources is ultimately shaped by the collaborative and technological capacity of the individual actors. The collaborative capacity impacts the ability of actors to engage in transboundary exchanges, while technological capacity affects their ability to interact with the functionalities of the digital solution. Regarding collaborative capacity, the findings showed the role of the collaborative capacity of individual actors in reaching a common understanding within the policy field regarding the semantic dimension (agreement on core concepts and data definition), operational logic (mandates of actors, rules with cross-organisational interactions), and technical factors (data exchange rules between different information systems) for digital initiatives. Namely, high levels of collaborative capacity enhance the potential for mutual learning, which improves the viability of more diverse actor compositions for cross-organisational digital initiatives. For example, for the case of the eIDas regulation in Denmark, the lead role was adopted by the Danish Agency for Digitalization, which had considerable experience in steering digital innovation initiatives. Their prior experiences had developed their collaborative capacity, so they were able to capitalise on it to achieve mutual learning within inclusive venues (**Article V**). However, in cases of low levels of collaborative capacity, organisations become

more rigid and fixed on their organisational perspectives and priorities, less able to adjust and capitalise on the potential changes proposed from cross-organisational venues. This was revealed in the case of the Civil Registry in Belgium, where several engaged actors possessed lower levels of collaborative capacity, which affected the quality of cross-organisational interactions (**Article II**; **V**). Actors with lower collaborative capacity tended to view the changes as violating the established routines and practices for collecting citizen data. Namely, the centralisation to a single database was seen to affect existing practices regarding the information systems in use, the rules and norms for accessing, and the handling and storing of data. Rather than engaging in seeking compromise, the actors exhibited passive and active forms of resistance, with the divergence in rules and norms utilised as justification to resist the changes. This indicates that collaborative capacity affects the viability of certain network management approaches as well as the substantive and strategic challenges experienced.

The technological capacity has an impact on the actors' ability to adjust their perspectives on substantive and strategic issues. This includes the ability to interpret the functionalities of the underlying digital solution and the routines for integrating with existing intra-organisational processes. Namely, actors with low levels of technological capacity possess limited ability to comprehend and articulate the value of the functionalities of the digital technologies. This leads to increased reluctance to engage in digital innovation initiatives that have extensive interactions with established structures, processes, and technologies. Due to low levels of technological capacity, the preference is towards innovations that are highly compatible with prior digital developments. For example, in the case of the Government as a Platform (henceforth GaaP) in the UK, different departments indicated their lack of knowledge (e.g., comprehension of the computer programmes, data exchange rules, the templating language) regarding the information systems present, which impacted their ability to effectively engage in multi-actor collaborations. This resulted in them showing reluctance towards collaborations which had a stronger impact on already existing procedures and routines. Simultaneously, the engaged partners exhibited more openness towards peripheral digital initiatives that resulted in new independent processes (e.g., Notify and Pay) (**Article II**). On the other hand, the findings show that actors with higher levels of technological capacity are more flexible and open to different potential outcomes of the functionalities of the digital solution. In the case of the Estonian Employment Register, certain actors, i.e., the Estonian Unemployment Insurance Fund (henceforth EUIF) and the Estonian Tax and Customs Board (henceforth ETCB), possessed a high level of technological capacity that they had fostered in past initiatives. Through their initiative, they both reformulated existing routines (e.g., data exchange regarding employment data) and created new processes (e.g., the use of data to analyse risks of unemployment) and articulated value for other actors as well (**Article III**). This points to the ability of actors with higher level technological capacity to formulate potential functionalities for technologies and define value for the partners within networks.

The research findings indicate that actor priorities affect the perceived value of the digital initiatives, and thus, the willingness of actors to contribute to the cross-organisational initiative. Actors who see conflict between intra-organisational routines and cross-organisational solutions are more likely to adopt strategic behaviours that tend towards maintaining existing routines and processes. In the case of the centralised patient registration system in Estonia, the collaboration included a diverse set of actors, with the cross-organisational solution conflicting with intra-organisational

routines and processes (**Article I**). The goal within the multi-actor initiative was to centralise the existing routines for appointments. The standardisation resulting from a centralised system limited the *ad hoc* flexibility for managing patients needing follow-up appointments for smaller healthcare providers. As a result, some actors perceived that the digital solution conflicted with their organisational goals regarding user-centric service provision, which led them to distance themselves and reduce contributions to the cross-organisational initiative. This highlights how divergences between organisational and cross-organisational priorities can result in actors being incentivised towards strategic behaviour to maintain existing organisational routines and organisation-centric perspectives. However, cross-organisational goals can be compatible and complement with organisational priorities, which motivates actors to contribute further resources towards the cross-organisational initiatives.

4.2 How does network management impact the governance of cross-organisational digital initiatives?

The findings show different strategies for network management for digital innovation initiatives. The strategies themselves can be aimed at a variety of goals – maintaining the focus of the digital initiative, improving the legitimacy of the decision-making process, and achieving broader acceptance for the initiative. The strategies reflect a compromise between exploring the functionalities of digital innovation and maintaining compatibility with the existing structures and processes. The main results regarding the impact of network management are as follows: a) asymmetric structures due to the central role for the lead actor; b) importance of legitimacy amongst users for scaling up the digital solution; c) balancing between trust-based relations and mutual learning; d) challenges in establishing strategies for transitioning from organisation-centric perspectives to cross-organisational compromises.

When it comes to structure-based approaches, different actor roles can provide multi-actor arrangements with further options for steering the cross-organisational arrangement. The lead actor role is related to both the exploration of the functionalities (e.g., setting the overall vision of the digital initiative) as well as enacting the digital technologies (e.g., establishing ownership relations for the cross-organisational digital solution). The findings indicate that the lead actor adopting a central role is crucial for encouraging the exploration of functionalities, whilst avoiding collaborative deadlocks. For example, in a case regarding digital solutions in a nursing home in Belgium, the lead actor maintained an elaborate accountability structure, formulating an overall vision and maintaining shared understanding to mitigate conflicts. Within the agreed frames, the lead actor created a space for trial-and-error experimentation and encouraged other partners to freely test prototypes and provide open feedback (**Article I**). The centrality of the lead actor is achieved through the contingent roles it adopts to maintain a strong legitimate position. The contingency is exhibited by shifting between different modes – from hierarchical top-down control for maintaining control to shared forms of leadership through collaborative decision-making for exploring different functionalities across organisational boundaries. Lead actors can adopt the contingent approach for roles by having the necessary reputation, as low levels of legitimacy for lead actors affect the engagement of actors, perceived challenges, and efficacy of intervention measures (**Article II**; **V**). For example, in the case of the Online Access Act in Germany, the fragmentation of tasks and resources between different actors in a federal system

and the low levels of legitimacy of the central coordinating body led to considerable efforts in trying to convince actors of the viability of the initiative (**Article V**).

Alongside lead actors, users are a crucial part of the collaborative process, especially in scaling up and institutionalising digital innovation initiatives within organisations. User perceptions regarding the legitimacy of the network and the perceived digital outcomes affect their willingness to contribute and their acceptance of modifying existing processes. This is upheld by the ability of the network to establish and maintain effective interactions, which provide a space for considering substantive feedback. The findings indicated three distinct user profiles (service consultants, co-designers, hands-off supporters) for cross-organisational digital innovation initiatives in the public sector. These user profiles range from passive roles to more active partner roles. Despite the considerable differences in perceived roles, there were certain commonalities between them. The primary commonality between the user profiles indicates that the minimum requirement for legitimacy among user profiles is the provision of spaces for adopting end-user feedback and a clear vision with regard to the digital solution. With a lack of user-innovating profiles, the findings emphasised the importance of the network in managing the interactions by providing easily accessible and time-efficient interfaces for engaging end-users (**Article IV**). The governance structures therefore need to be able to accommodate to end-users with limited resources (e.g., lack of time, limited motivation) and consider the potential downsides of participation fatigue. This is achieved by prioritising the phases where user contribution is the most critical.

Regarding interactions within the network, actors tend to adopt different combinations of process-based strategies to foster trust, expand mutual learning, and improve collective action capacity. Whilst strategies to improve collective action capacity are noted, the most relevant dynamic concerns balancing between maintaining trust-based relations while engaging in a mutual learning process. While trust-based relationships are critical to fully comprehending the potential functionality of a digital solution, the ability to expand and look for further potential functionalities tends to depend on expanding the network across established boundaries (**Article I**; **III**). As digital initiatives expand across established boundaries, trust-based relations tend to become less prevalent within the network, with formal measures complementing informal approaches. For example, in the case of the Estonian Employment Register, actors initially utilised informal *ad hoc* interactions based on prior relationships, which enabled them to reach compromises more quickly within a single functionality (e.g., establishing semantic interoperability in categorising different types of employment for implementing data exchange between a variety of actors). By looking to expand the functionalities of the register, the network expanded across established boundaries, including new actors, which also involved a shift in the modes of interactions (e.g., relying on established legal mandate during negotiations to compromise on interoperability in operational logic regarding data storage and retroactive changes between actors) (**Article III**). Whilst moving beyond boundaries can bring new valuable insight and perspectives, multi-actor initiatives experience increased conflicts in perspectives alongside the pressure to implement more formal interaction measures. Transboundary exchanges shift the established balance between trust, mutual learning, and collective action capacity, requiring networks to be more reflexive and modify existing measures.

The choice between structural and process-based measures is also shaped by the collaborative process challenges present within the network. The findings indicate challenges transitioning from organisation-centric perspectives to cross-organisational

compromises. A lack of interpersonal trust, diverging perspectives on the role of digital technology, differences in the technological infrastructure implemented, asymmetric imbalances in available resources and capacities all are prominent issues furthering organisation-centric approaches. As networks increase in size, the organisation-centric perspective becomes more dominant. Even when collaborative deadlocks are bypassed in these larger venues, the divergence in perspectives causes challenges in finding agreement on the purpose and role of the functionalities of the digital solution. An example of the substantive challenges affecting the collaborative process can be seen in the case of a smart city policy in Antwerp. The smart city policy was coordinated within a voluntary network that included shared leadership with considerable autonomy for ideation and implementation. This led to considerable diversity in perspectives yet limited control over the focus within the smart city initiative. Due to a lack of shared understanding of what the underlying policy problems being solved were, the initiative experienced issues with performance, which required reconfiguring to bring in a policy-oriented perspective to a technology-driven initiative (**Article II**). From a strategic perspective, cross-organisational digital initiatives entail shifts in structures, resources, and processes, which may lead to increased uncertainty between actors. Siloisation and power positions result in the predominance of organisation-centric perspectives when negotiating for compromises as opposed to the goals at the cross-organisational level. This was apparent also in the case of the Estonian Employment Register where negotiations for follow-up developments after the initial phase were guided by organisation-centric interests and resources. One of the partners, the Estonian Labour Inspectorate, made a proposition for a follow-up development to improve risk analysis capacities. However, the lack of technological capacity and resources of the Estonian Labour Inspectorate led to the proposition being discarded. Although the lead organisation had a higher level of technological capacity and availability of resources, the lack of direct organisational benefits limited their interest in engaging with the follow-up development. The predominance of organisation-centric mindsets in multi-actor initiatives leads to the enactment of technologies being driven by the balance of resources and capacities of the engaged partners rather than the potential of the functionalities.

4.3 How does institutional context impact the governance of cross-organisational digital initiatives?

The structures, processes, and procedures surrounding the cross-organizational digital initiative are important in shaping the potential pathways for both the design as well as the enactment of digital technologies. As actors look to cross established boundaries within policy domains regarding resource and task allocation, they are impacted by previous digital developments and established interdependencies, which influence viable alternatives and actor compositions. The findings express that: a) prior digital developments entrench specific venues and routines for follow-up cross-organisational initiatives; b) existing interdependencies improve understanding of the different routines present amongst engaged actors and affect the exploration of functionalities.

Experiences from prior digital innovation and digitalisation efforts can have both a positive and a negative effect on multi-actor arrangements. This occurs because prior digital development efforts validate procedures for enacting digital technologies by reinforcing existing practices and institutionalising new pathways for future digital

innovation. By institutionalising certain pathways, prior digital developments can also impose certain priorities for relevant actors and networks (**Article II**; **V**). As a result, there are advantages for digital innovation initiatives that are largely compatible with the surrounding context. Here, prior digital innovation initiatives affect the legitimacy of other digital developments the actors and networks are engaged in. The routines, processes, and technologies instituted entrench the pathways and compatible follow-up digital developments can enjoy a supportive environment. For example, in the case of implementing the eIDas Regulation in Denmark, the past digital developments undertaken by the Danish Agency for Digitisation were crucial for instituting specific pathways for follow-up digital innovation initiatives. This also included an established network for digitalisation initiatives where the Danish Agency for Digitisation adopted a central role. The legitimacy this collaborative structure had accumulated reduced concerns regarding both power asymmetries and strategic behaviour (**Article V**). However, limited technological and collaborative capacity and poor network management strategies in prior digital initiatives can lead to negative feedback cycles, which have consequences for future digital initiatives. As a result, the failures in past digital developments can amplify the risk perception in institutions that are already risk averse and affect the reputation of key actors in digitalisation. For example, in the case of the GaaP, the Government Digital Service as a central coordinating actor experienced legitimacy issues. Other public actors were concerned about the history of overambitious and overpromising digital initiatives resulting in considerable costs and limited benefits, which led to caution in committing to follow-up digital initiatives (**Article V**). Positive and negative experiences affect the potential for transformational change, with positive experiences providing actors with more flexibility for designing governance approaches and negative ones limiting the alternatives available.

Through a combination of prior digital developments, technological capacities, mandates provided within the policy field, and other factors, interdependencies between certain clusters tend to become institutionalised for digital initiatives. This tends to reinforce certain interactional patterns between actors, who also use them for digital developments. As a result, established networks tend to be relied on more for inducing digital innovation, with developments and follow-up developments fostered within an established set of actors. Within these networks, actors improve collaborative capacity by becoming more aware of the semantic, operational, and technical logic of other actors. This becomes an important factor in new cross-organisational digital initiatives, with improved collaborative capacity enabling venues with limited interaction costs and the ability to better explore the potential functionalities of digital technologies. For example, in the case of the Estonian Employment Register, the embeddedness of the organisations was important for moving beyond the initial intra-organisational approach during ideation. The initial concept was purposed for the lead organisation, but it expanded into a cross-organisational initiative. Knowledge of organisational needs, awareness of the established semantic, operational, and technical logic, as well as the interdependencies in processes related to monitoring employment relationships incentivised the shift towards a cross-organisational approach. Namely, actors were able to interact and jointly recognise the potential value offered by the register (**Article III**).

4.4 What configurations of governance were conducive towards enacting digital innovation?

The studied cross-organisational digital initiatives showed a variety of governance approaches, which led to different outcomes for enacting digital technologies. Some of the cross-organisational arrangements resulted in digital innovation, where the digital solution led to novel approaches, introducing new or modifying existing processes. In other instances, the collaboration led to no substantive change, as the digital solutions failed to move beyond the piloting phase. The successes and challenges were dependent on both the potential of the underlying technology through its different potential functionalities and also on the ability of networks to adopt and institutionalise them in existing structures and processes (**Article I; II; III; IV**).

A core dynamic for instilling digital innovation in cross-organisational initiatives is to do with establishing agreement over the core functionalities and the value proposition of the digital solution. This includes reaching compromises between the different actors engaged in the network. The compromises include agreements and trade-offs between the actors on the semantic, operational, and technical dimensions. The findings indicate that the configurations conducive to cross-organisational digital innovation were able to consistently adjust process-based strategies in learning and trust-based relations, whilst maintaining the capacity for collective action. Such balancing is required to optimise the mutual learning process, while maintaining overall levels of trust within the multi-actor arrangement in order to foster acceptance. The governance configuration associated with achieving this balance entailed both structure- and process-based characteristics:

1) homogeneous actor compositions;
2) central position of the lead actor;
3) precise vision;
4) framing strongly linked with output legitimacy.

An example of this combination can be seen in the use of an AI-based solution to diagnose non-cooperative patients (e.g., children) in Spain, which managed to successfully enact a sophisticated solution (**Article I**). The findings linked the successes of enacting the solution to exploring different functionalities in a controlled setting. Namely, by constricting the overall focus to a specific problem, linked to a concrete process and end-user group (i.e., non-cooperative patients), the network managed to develop a clear understanding of the tools (e.g., information systems in use, data available) and the alternatives available. The precise vision was possible because of the limited inclusion of actors with connections from prior developments and/or compatibility in terms of the semantic, operational, and technical logic. This enabled the network to flesh out a limited set of ideas with functionalities, rather than remain stuck trying to find compromise between diverging sets of ideas with limited prospects of being developed into potential functionalities. The findings showed that by limiting the diversity of perspectives, digital initiatives managed to bypass collaborative challenges and establish a clear frame for the collaborative process (**Article I**).

The advantages of combining homogeneous actors, the role of a strong lead organisation, precise vision and framing towards output legitimacy enable mitigating potential impeding conflicts in substantive and strategic collaborative process challenges, whilst also nurturing both the exploration of functionalities and their enactment. The conflicts in substantive challenges are curtailed by having a mutual understanding of the semantic, operational, and technical logic present, with actors possessing significant overlap through homogeneity (**Article I; II**). The strategic challenges are mitigated

through the central position of the lead organisation, who is crucial for negotiating clear responsibility and accountability structures (**Article I**; **III**). By way of clear responsibility and accountability structures, actors agree upon the ownership of different functionalities, which encourage better understanding of the potential value of digital innovation initiatives. With the homogeneity of actor characteristics and a strong lead actor role, digital initiatives are better positioned to act against the pressures to maintain existing routines, and thus, engage in more transformational change (**Article III**). Their enactment is further enabled by a precise vision and framing towards output legitimacy. As actors have a better understanding of the potential impact with regards to effectiveness and/or quality in comparison with existing processes, they can also better comprehend the pathways to integrating the digital solution with existing processes and its adoption (**Article IV**). Over time, the precise vision can be broadened within multi-actor networks, as positive feedback cycles amongst actors lead to further resources and increased commitment towards follow-up developments. Actors build confidence on the basis of successful network management approaches regarding mutual learning, trust-building and collective action capacity, which factors in when considering the potential for follow-up developments.

5 Discussion

Digital innovation has provided public administrations with additional options for handling increasingly complex problems and conditions. By enacting digital technologies, public administrations address the existing boundaries between organisations and institutions, as digital technologies provide new potential routines and practices for effectiveness, efficiency, and accountability gains (Chen et al., 2019; Wouters et al., 2022). Through the practices and routines related to digital solutions, existing organisational interdependencies are reshaped and new ones formed, which has raised the importance of networks for governing digital initiatives. The thesis aims to contribute to existing literature by discussing some of the fundamental dynamics present in cross-organisational digital innovation initiatives through network perspectives – actor characteristics, network management, institutional context. Through this, the thesis also aims to contribute to developing stronger connections between public management and e-government literature, which still largely remain disjointed (Bannister & Connolly, 2020; Dunleavy & Margetts, 2023; Gil-Garcia et al., 2017; Pollitt, 2011). The empirical findings contribute to existing knowledge regarding the relevance of organisational and institutional factors in digital innovation, such as the relevance of technological capacity for lead actors to nurture cross-organisational thinking, finding balance between mutual learning and trust building, and challenges in defining viable spaces for collaboration.

The findings indicate that successful cross-organisational digital innovation initiatives are based on the combination of homogeneity of actors, the central role of the lead actor, agreement on a precise vision and framing towards output legitimacy (**Article I**; **Article III**). The cross-organisational digital initiatives that sport this combination are composed of actors that are similar with regards to the available knowledge sources as well as priorities. Furthermore, the access to decision-making within the network is limited to a small set of actors and the lead actor adopts a central role in which they utilise command and control measures. Within this governance approach, the positive feedback loop is maintained by providing a clear value proposition through a precise and narrow vision and framing the initiative regarding output legitimacy (**Article I**; **Article III**). Whilst other combinations and configurations are present in cross-organisational digital innovation initiatives, they tend to face more issues in enacting functionalities that cross existing boundaries. This is due to the substantive and strategic challenges and limited network management strategies impeding mutual agreement regarding semantic, operational, and technical logic. The existing literature in collaborative governance and collaborative innovation sees the core dynamic in inducing innovation as being linked to diversity in ideas and trust-based relations (e.g., see Hartley et al., 2013; Torfing, 2019). This is connected to the actors being able to engage each other in a trust-based environment and have as many relevant perspectives available as possible (Torfing, 2019). The findings from the thesis indicate certain nuances about the salience of this dynamic for digital innovation initiatives within the public sector. While the findings do emphasise the critical role of trust-based relations, the diversity of ideas was perceived as less relevant (**Article I**). The shift towards homogeneity of actors and exclusivity of the network even indicates a potentially contradictory shift to low levels of diversity in ideas. Whilst low levels of diversity are preferred, mutual learning, which is also at the core of collaborative innovation (e.g., see Sørensen & Torfing, 2011), remains a priority for the engaged actors.

A potential reason for the seeming inconsistency, i.e., presence of both low diversity of ideas and high levels of learning, may originate from issues with misevaluating

interdependencies (e.g., see Elston et al., 2023; Hamilton et al., 2021). The engagement of a diverse set of actors with limited collaborative capacity may result in a negative impact on networks through erosion of trust and diminishing mutual learning ability as organisation-centric priorities and bargaining overtake the collaborative capacity of the actors (**Article II**; **V**). As diverse actors perceive the value of cross-organisational initiatives differently due to their individual priorities, it can be challenging to have larger venues that are able to establish trust between engaged stakeholders (Elston et al., 2023). Trust is built upon the predictability of actors and their unwillingness to take advantage of other actors through opportunistic behaviour (Klijn et al., 2010). As networks become more diverse, the findings indicate that the network management strategies undergo increasing challenges in facilitating positive dynamics in trust-building and mutual learning. Furthermore, such diversity can lead to an ideational overload from individual priorities during the decision-making process, which causes collaborative deadlocks and affects the perceived value of cross-organisational initiatives. Here, the risk-aversion characteristic of public sector actors may also further affect the perception of the value of the cross-organisational initiative, leading to more reluctant and cautious behaviour in taking on additional risks (Kempeneer & Heylen, 2023; Mikhaylov et al., 2018). Through homogeneous networks, the process of mutual learning is directed towards a more controlled environment where actors possess the resources and flexibility to engage in trial-and-error practices with a limited set of ideas, rather than being overwhelmed by a plurality of perspectives and interests.

Alongside ideational overload, diverse actor compositions and heterogeneous networks also experience inertia within the collaborative process due to organisation-centric priorities. Namely, the emphasis on organisation-centric priorities leads to challenges in finding mutual understanding regarding semantic, operational, and technical logic across existing boundaries (**Article III**; **V**). As a result, the diversity of actors provides additional pressures within the cross-organisational collaboration, as additional technological legacies and intra-organisational path dependencies (from outdated data, formats, standards, information systems, processes) need to be addressed at the cross-organisational level (Kempeneer & Heylen, 2023). This also provides important nuances for collaborative innovation and collaborative governance theories regarding the collaborative advantage from diverse in-depth knowledge and broad inclusion (Ansell et al., 2023; Torfing, 2019). As individual actors have tied their technical know-how very strongly with the established digital infrastructure, embracing new semantic, operational, and technical logic requires a reframing of the structures and processes already in place. The translation of the functionalities of the digital solution into potential intra-organisational value necessitates the presence of technological capacity alongside trust-based relations and mutual learning. Due to the varying levels of technological capacities within the public sector, some public actors may have a limited ability to interact with the new functionalities of technologies beyond their established digital infrastructure and thus to evaluate the value of the solution. This also leads actors to misevaluate the potential of cross-organisational exchanges and makes the actors more prone to opting for the strategic position to maintain existing technological legacies. In an attempt to limit the likelihood of collaborative deadlocks that comes from diverse settings, i.e., ideational overload and inertia from organisation-centric priorities, cross-organisational digital innovation initiatives have shown more preference towards low diversity settings.

Although cross-organisational initiatives include a number of actors who provide resources and capacities for the initiative, the lead actor tends to remain central in digital

innovation initiatives in terms of steering communication and affecting the eventual output. This includes setting frames within which to focus on the full development of single ideas as well as encouraging the collaborative process (**Article III**). Their role is not only limited to managing the interactions within the network but lead actors are also the main representative of the network during communication with external actors and networks in the surrounding environment (**Article I**; **III**). The role of the lead actor(s) has a considerable emphasis in existing literature as well, with their presence being crucial for facilitating collaborative dynamics within the networks and interacting with the surrounding environment (Tangi et al., 2021; Vial, 2019). Through this central role, they shape the potential for expanding on the functionalities and scaling up the adoption of technologies as they have a significant role in maintaining boundary spanning and cross-organisational interpretation. With digital innovation induced by the process of mutual learning and trust-based relations, the hierarchical measures available for the lead actor provide them with the tools to steer the digital initiative from emulation towards transformational framing (**Article III**; **V**). This corresponds with existing e-government literature where the shift from emulation to transformation entails both an exploration into the design of the technologies, evaluating the surrounding environment the technology is embedded in, as well as an active search for potential improvement opportunities (Tangi et al., 2021). The centrality of the lead actor leads them to be responsible for finding the balance between maximising existing functionalities and shifting towards new functionalities.

While lead actors do have significant influence, often being the driving force behind the cross-organisational functionalities of the digital solution, the findings also show that they adopt primarily cautious and incremental approaches (**Article II**; **V**). With the complexity of the interconnections between the actors, the networks they operate in, and the surrounding environment – e.g., limited technological capacity of actors resulting in further efforts to define functionalities, diverse actor interests (e.g., legal requirements, privacy and security concerns) affecting the enactment process, interconnectedness between different information systems and overall IT architecture – the viable governance alternatives for maintaining positive dynamics become limited for the lead actor(s). As technologies become more transformational by new routines and practices for organisations, the combination of challenges shifts increasingly towards the strategic dimension, which further nudges lead actors towards incremental approaches. The main challenge during this process is maintaining the commitment of other partners to cross-organisational interaction. Through transformational change, lead actors have to put in increasing effort to translate the potential value of cross-organisational interactions to the engaged partners. Actors with lower technological capacity tend to pose a larger challenge, as the lead actor must put more effort into reframing the cross-organisational goals for their perspectives. This aligns with ideas regarding established technological and institutional path dependencies, which entrench a specific interpretation about the technological solution as well as its adoption in surrounding structures and processes (Kempeneer & Heylen, 2023; Dunleavy & Margetts, 2023; Abraham et al., 2019). As expanding technological functionalities requires a compromise between actors regarding the semantic, operational, and technical logic, the lead actor is crucial in avoiding the negative dynamics of collaborative excess by attempting to establish a limited set of functionalities and negotiate a value proposition for the different individual actors engaged with the process.

Although the cross-organisational arrangements most conducive towards successfully enacting digital innovation were homogeneous and strongly controlled by the lead actor(s), they could still uphold acceptance and legitimacy for the engaged partners as well as the end-users connected to the digital innovation. The findings indicate that the perceived benefit from adopting and integrating the digital solution (output legitimacy) into existing structures and processes was crucial for enabling cross-organisational exchanges. Both the partners within the network as well as the intended end-users stressed the importance of effective resource usage and the limited room for error, which creates the need for a clear and precise vision regarding the potential functionalities of the digital solution and its integration into surrounding structures and processes (**Article III**; **IV**). This resulted in the connected actors being willing to compromise on the design of the decision-making process, thus providing the lead actor(s) with a considerably asymmetric position. It enabled the collaboration to facilitate a mutual learning process, whilst still being closed and exclusive.

A key factor in enabling the adoption and scaling up of digital innovation is also the willingness to establish spaces for receiving user input and valuing their contribution. The nature of user knowledge (both easily transferrable as well as stickier long-term specialised knowledge) is crucial for understanding the potential value proposition of the different functionalities of the technology as well as the potential deviations that occur during the enactment of the digital solution (**Article IV**). However, these spaces are often designed to assign end-users with passive roles, rather than enabling an equal partnership. Despite their limited roles, digital initiatives with a clearly stated vision and framing towards output legitimacy manage to maintain a high level of legitimacy amongst users (**Article III**; **IV**). With the strong emphasis on results in a viable digital solution (output legitimacy), the questions regarding the relevance of other sources of legitimacy for innovation arise – i.e., inclusion of perspectives (input) and open decision-making (throughput) (Torfing, 2019; Linders, 2012). A potential reason for the limited importance of input and throughput legitimacy for digital innovation initiatives may originate from the cooling enthusiasm for broader inclusion (Loeffler & Bovaird, 2016; Elston et al., 2023; Kempeneer & Heylen, 2023). Furthermore, the findings suggest that both the engaged actors in the network as well as end-users show willingness to engage in a trade-off where they prioritise the precise vision and high output legitimacy for the digital solution and agree on a decision-making structure that is more asymmetric, i.e., the power is concentrated in the lead actor(s) (**Article II**; **IV**). With resources and technological capacities often concentrated with specific actors and networks over the course of different digital innovation initiatives, these venues are more accepted and seen as legitimate. As a result, they can provide potential solutions and changes to long-term acute problems and tensions, which makes actors and end-users more open to different configurations as long as they perceive its ability to produce change.

In conclusion, whilst cross-organisation digital innovation initiatives may lead to the enactment of transformative digital technologies, the change is likely to occur in specific conditions. Cross-organisational digital innovation initiatives are more likely to achieve success by combining the homogeneity of actors, the central role of the lead actor, a precise vision, and framing towards output legitimacy. This combination enables reducing the potential substantive and strategic challenges that impede positive dynamics from balancing mutual learning and trust-building. Furthermore, it manages to limit the plurality of perspectives and focus more on comprehensively testing out a limited set of ideas, which is overseen by a strong lead actor.

6 Conclusions

By focusing on cross-organisational digital innovation, the aim of the thesis was to provide new conceptual and empirical insights into the governance of technological innovation processes in the public sector. The empirical insights were informed by the network governance perspectives and based on in-depth case studies of multi-actor digital innovation cases in the public sector. The thesis highlighted that substantive change through enacted technologies requires governance approaches, which include homogeneous actors and are steered hierarchically. Within these cross-organisational approaches, the interactions are based on high levels of interpersonal trust, which provides actors with confidence regarding the potential of the digital solution. These interactions occur in a context of low diversity of ideas, where actors have high levels of mutual understanding regarding the semantic, operational, and technical logics present. The success of enacting digital technologies is linked with the flexibility to engage in trial-and-error practices with a limited set of ideas rather than emphasising the plurality of perspectives. The cross-organisational digital initiatives manage to maintain positive feedback by having a precise vision and framing through output legitimacy, which avoids ideational overloads.

Based on the results of the thesis, several key topics have been highlighted that require further research. First, this study is primarily based on cases from the field of health care and taxation. These policy sectors were chosen due to high levels of technological capacity present within the respective fields, which enabled to better study digital initiatives. However, this also includes specific institutional contexts (e.g., cultures affecting professional and organisational backgrounds) as well as actor characteristics, which may not be easily generalisable to different policy fields. The thesis suggests that enacted technologies are more likely to be engaged in transformative change when the governance venues are exclusive to homogeneous actors, who are steered in a top-down manner by a lead actor. The salience of the findings would benefit from further analysis by looking at alternative governance configurations, countries, and policy sectors. This could help to better understand the dynamics between actor characteristics, network management, and institutional context.

Second, there is a significant amount of literature on the role of users and their contributions to fostering digital innovation and creating new innovative spaces. The findings of the thesis highlight different hybrid user profiles (co-designer, service consultant, hands-off supporter) and perceived priorities, yet indicate a distinct lack of user-led innovation. For future research it would be of value to delve further into the role of users in digital innovation. As this study focuses predominantly on the perceptions regarding user roles through Q-methodology, other qualitative and quantitative methods would help to investigate user profiles further. It would also be helpful to understand whether the lack of user-led innovation is affected by the framing of the collaboration, analysis of prior experiences, characteristics of the user group, or whether the user-innovator role is limited for public sector innovation.

Third, while the thesis combines network and e-government perspectives through analysing actor characteristics and network management, temporal dynamics have been included to a limited extent. Whilst the in-depth case studies provide insight into temporal shifts, this relies on the perceptions and ex *post* evaluations. A possible future research avenue would be to study the agility and adaptability of governance structures over time to better understand the developments that take place from the design of the

functionalities of the digital solutions to their enactment. This would help to validate the findings of the thesis and provide further insight into their impact over different time periods.

In conclusion, the combination of network and e-government perspectives for the study of digital innovation initiatives within the public sector provides new potential insight for understanding the developments taking place during the digital age. As digital technologies become increasingly sophisticated and provide public, private, and societal actors with opportunities to cross existing boundaries, an understanding of the enablers and hindrances becomes more salient. With interdisciplinary research combining public management and e-government perspectives remaining few and far between, the potential to further the knowledge of digital innovation initiatives within the public sector warrants further studies.

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Abstract

Governance of Cross-Organisational Digital Innovation in the Public Sector

Digital innovations have become an important mainstay within the public sector, with technologies improving effectiveness, responsiveness and transparency of public policy and administration (Dunleavy and Margetts 2023). Despite the irreplaceable role of digital technologies, their enactment in the public sector has been far from a straightforward success, with past decades providing a myriad of examples of low performance outcomes, unintended consequences and even downright failures (Kempeneer and Heylen 2023). Whilst some of the failures have to do with overoptimistic expectations, the main challenges tend to originate from the integration of new technologies with established administrative structures and processes. The complex interactions between the actors, networks and institutions influence the potential for capitalising on technological functionalities and thus inducing digital innovation (Pollitt 2011). Whilst researchers have stressed the importance of integrating e-government research with broader public administration debates to better comprehend the role of structures and processes (see for example Gil-Garcia et al., 2017), the respective research communities remain detached from one another. This has resulted in a research gap regarding the effect of the role of structures, actors and processes central to the public sector in enacting technologies.

The aim of the thesis is to provide new conceptual and empirical insights into the governance of cross-organizational digital innovation processes in the public sector. This is achieved by combining network and e-government perspectives for the analysis of digital innovation initiatives. Introducing a network approach for the analysis of digital initiatives provides an alternative perspective for the study of interactions between the technical, organizational and the institutional dimensions. The thesis focuses on the role of actor characteristics, network management and institutional context in affecting the governance of cross-organizational digital innovation initiatives within the public sector.

This thesis shows that mutual learning built on trust-based relations can induce digital innovation in cross-organizational initiatives, when utilized for a limited set of ideas, where actors can comprehensively test the functionalities of the digital solution through trial-and-error. The thesis points out that homogeneous venues with lead organizations adopting a central role through command and control are best able to achieve the dynamics for capitalising on the potential for digital innovation. This is due to the ability of the configuration to simultaneously nurture positive dynamics, i.e. mutual learning and trust-building, whilst limiting negative dynamics, i.e. substantive and strategic challenges. The asymmetric position of the lead actor enables cross-organizational initiatives to maintain the overall focus and bypass collaborative deadlocks. The homogeneity of actors improves mutual understanding regarding the semantic, operational and technical details, thus increasing the quality of cross-organizational exchanges. The cross-organizational digital initiatives maintain their legitimacy and acceptance by adopting a narrow vision and framing the value from engaging within the initiative through output legitimacy.

Lühikokkuvõte

Avaliku sektori organisatsioonide koostöö digitaalse innovatsiooni juhtimisel

Digitaalne innovatsioon on muutunud avaliku sektori lahutamatuks osaks, kus läbi tehnoloogia on parendatud poliitikakujundamise ja elluviimise tõhusust, reageerimisvõimekust kui ka läbipaistvust (Dunleavy and Margetts 2023). Tehnoloogia asendamatust rollist hoolimata ei ole digitaalsete lahenduste kasutuselevõtt avalikus sektoris olnud vaid sirgjooneline edulugu. Viimased kümnendid on pakkunud näiteid nii ootamatustest kõrvalekalletest kui ka läbikukkumistest (Kempeneer and Heylen 2023). Kuigi mõned väljakutsed on tingitud ebarealistlikest ootustest tehnoloogiate suhtes, kipuvad peamised probleemid pärinema olemasolevatest struktuuridest ja protsessidest. Seotud osapoolte, ümbritsevate võrgustike ja institutsioonide omavaheline dünaamika mõjutab võimalusi tehnoloogia funktsioonide rakendamiseks ning digitaalse innovatsiooniks (Pollitt 2011). Kuigi eelnev teadustöö on rõhutanud vajadust e-valitsemise ja avaliku halduse uurimissuundade paremaks integreerumiseks struktuuride ja protsesside mõistmiseks (vaata näiteks Gil-Garcia et al., 2017), on need kogukonnad jäänud üksteisest eraldatuks. See on põhjustanud puudujäägi meie teadmistes avalikus sektoris olevate struktuuride, osapoolte ja protsesside rollist tehnoloogiate rakendamises.

Käesolev doktoritöö keskendub uue kontseptuaalse ja empiirilise arusaama loomisele avaliku sektori organisatsioonide koostööst digitaalse innovatsiooni juhtimiseks. Doktoritöö teostamiseks kombineeriti võrgustikupõhist ja e-valitsemise kirjandust digitaalse innovatsiooni algatuste analüüsimiseks. Võrgustikupõhise perspektiivi rakendamine võimaldab luua uut arusaama tehniliste, organisatsiooniliste ja institutsionaalste tegurite rollist. Kõnealune doktoritöö on keskendunud seotud osapoolte omaduste, võrgustikupõhise juhtimise ja institutsionaalse konteksti mõjule organisatsioonidevahelise digitaalse innovatsiooni algatustes.

Käesolev doktoritöö toob välja, et avaliku sektori organisatsioonide koostöö on võimeline juhtima digitaalset innovatsiooni kindlates tingimustes, kus usalduspõhised suhted võimaldavad üksteiselt õppimist. Kui osapooled keskenduvad piiratud hulk ideedele, kus nad on võimelised põhjalikult testima digitaalse lahenduse funktsioone katse-eksitus meetodil, siis see soodustab digitaalse innovatsiooni teket. Antud doktoritöö näitab, et homogeensetest osapooltest koosnev koostöö koos keskset positsiooni omava juhtorganisatsiooniga, kes kasutab ülalt-alla juhtimismeetmeid, on kõige tõhusam kooslus digitaalse innovatsiooni loomiseks. See on tingitud selle koosluse võimekusest samaaegselt säilitada positiivseid dünaamikaid, s.o vastastikune õppimine ja usalduse loomine, ja piirata negatiivseid arenguid, s.o sisulised ja strateegilised väljakutsed. Juhtorganisatsiooni asümmeetriline positsioon võimaldab säilitada üldist fookust ja ületada ummikseise lihtsamalt. Osapoolte homogeensus parendab üksteise mõistmist semantilistes, operatiivsetes ja tehnilistes detailides, täiustades avaliku sektori organisatsioonide koostööd. Avaliku sektori organisatsioonide koostöö säilitab legitiimsust kitsa visiooni ja väljundipõhise raamistamise abil.

Appendix

Publication I

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RESEARCH ARTICLE

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Designing cross-sector collaboration to foster technological innovation: Empirical insights from eHealth partnerships in five countries

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Abstract

This article examines the impact of partnership design on technological innovation in public-private innovation partnerships. It develops two competing hypotheses on how specific partnership characteristics lead to innovation in health care services. The study compares 19 eHealth partnerships across five European countries and uses fuzzy-set qualitative comparative analysis to test the hypotheses. The findings show that small, centralized, and homogeneous partnerships are most successful at achieving technological innovation. The study highlights the importance of partnership design in spurring innovation and calls for a reconsideration of some of the underlying assumptions of collaborative innovation theory.

Evidence for practice

- Public-private innovation partnerships (PPIs) are increasingly used to innovate public services through new technology.
- The results from this study demonstrate the importance of partnership design, showing that small, centralized, and homogenous PPIs generate technological innovations.
- The presence of high levels of interpersonal trust among participants is necessary to create technological innovations.

INTRODUCTION

Public administration scholars increasingly emphasize the potential benefits of cross-sector collaboration for innovating public services (Lindsay et al., 2020; Torfing, 2019). Developing new ways of producing and delivering public services calls for a broad range of stakeholders and their complementary resources, including government agencies, private contractors, nonprofit organizations, and users (Di Meglio, 2013). Consequently, governments engage in public-private arrangements to innovate their services, often referred to as public-private innovation partnerships or PPIs (Alonso & Andrews, 2022; Brogaard, 2021). Such partnerships pose important opportunities for transformative learning, joint ownership, and empowered participation, which can stimulate innovation processes (Lindsay et al., 2020).

Despite a recent increase in public administration studies on innovation partnerships (Alonso & Andrews, 2022; Lindsay et al., 2020), the important role of partnership design for spurring *technologically sophisticated* service innovation has been largely overlooked. This oversight is surprising for two reasons. First, recent empirical studies demonstrate that effective partnership governance is vital for positive outcomes in PPIs (Alonso & Andrews, 2022). Second, advanced digital technology such as artificial intelligence (AI) has become a central vehicle for transforming public services, which calls for more research on technologically sophisticated service innovations (Mergel et al., 2019).

Koen Verhoest and Chesney Callens both contributed equally to this work.

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A recent systematic review of PPIs demonstrates that the impact of collaborative innovation on the digital transformation of public services is particularly visible in the health care sector (Brogaard, 2021). According to Kraus et al. (2021), the health care sector functions as an intricate ecosystem in which various health care actors interact with each other in their use of digital eHealth technologies. eHealth technologies can be defined as digital technologies which have the purpose to monitor, track, and inform health, to efficiently communicate between health stakeholders, and to collect, manage, and use health data sources (Shaw et al., 2017). Examples of such technologies are AI-based technologies that use pattern recognition software and big data to identify illnesses, electronic health records that facilitate the exchange of important health data, and mobile health apps that assist people in their daily activities.

This article investigates the partnership features of PPIs responsible for producing technologically sophisticated eHealth innovations. Using theories on collaborative innovation and network governance, we develop two competing hypotheses and test them on a dataset comprising 19 eHealth partnerships in five European countries. The study utilizes survey and interview data from over 130 respondents, analyzed through fuzzy-set qualitative comparative analysis (fsQCA). Surprisingly, the findings show that small, centralized, and homogeneous partnerships are most successful at achieving technological innovation, contrary to theoretical expectations. These results challenge some of the underlying assumptions of contemporary collaborative innovation in theory and practice, calling for further consideration and testing.

The article is organized as follows. First, the theoretical section introduces our theoretical framework and develops the two hypotheses. Subsequently, we elaborate on the case selection, methodology and operationalization, and present our QCA results. Finally, we discuss the results, address the implications for theory and practice, and suggest opportunities for future research.

TECHNOLOGICALLY SOPHISTICATED SERVICE INNOVATION THROUGH COLLABORATION

Technologically sophisticated service innovation

Although there is no universal definition of innovation, most scholars agree that innovation is something that is perceived as new and is implemented in a real-life context (Rogers, 2003). Public innovation is often conceptualized into several categories, including service innovation (i.e., new ways to provide services) and product innovation (i.e., new products/technology) (Hartley, 2005, 28). However, public service innovation often entails the development and/or use of new technology such as digital tools, systems, or applications (Torugsa & Arundel, 2016). eHealth, which is the focus of this study, exemplifies this entanglement of service and product innovation, as new digital technology changes how a service is provided to health care users. For instance, introducing a new way to extract and communicate important user information (e.g., patient information) requires the introduction of a new information-sharing system.

Such technologically sophisticated service innovations have become central in the digital transformation of the health care sector, as they can significantly improve outcomes, decrease process complexities, and reduce administrative burdens (Klinker et al., 2020). Technological sophistication refers to the functional diversity and internal complexity of the used technologies (Alexander & Wakefield, 2009; Paréa & Sicotte, 2001). Indeed, technologies that introduce multiple functionalities are more impactful as they can be deployed more broadly (Shaw et al., 2017). Likewise, increasing the internal complexity of the technologies by introducing advanced technologies (e.g., AI) and extensively integrating the used technologies enables novel usage, process integration, and interoperability (Alexander & Wakefield, 2009).

Collaborative innovation and public-private innovation partnerships (PPIs)

Introducing technologically sophisticated innovations in complex service environments such as the health care sector is challenging. The required knowledge to generate these services and the needed capacity to implement them are often spread across multiple actors and sectors. Recent developments in innovation research have addressed these complex environments by adopting a "collaborative governance" perspective on the innovation process (Sørensen & Torfing, 2011). Theories of "collaborative innovation" propose that a close collaboration between public and private actors (e.g., in PPIs) is a viable innovation strategy for these complex service environments, as it stimulates partnership synergies out of which novel ideas and shared commitment can arise (Torfing, 2019). Through collaboration, a wide range of ideas and perspectives can be accessed and connected, and the involvement of various actors can help support the implementation and diffusion of newly created services (Sørensen & Torfing, 2011).

Public-private innovation partnerships are partnerships between public and private actors, where the main goal is to innovate public services (e.g., through incomplete contracts that provide space for creative thinking, Alonso & Andrews, 2022). In comparison to highly contractual, long-term, procurement-based public-private partnerships (PPPs) (Grimsey & Lewis, 2007), PPIs often have a shorter life span, are less formalized, and represent a multiplicity of organizational forms (Alonso & Andrews, 2022; Di Meglio, 2013). Because of these specific features, and as we are particularly interested in how partnership design leads to innovation, we focus our study on PPIs. Furthermore, a recent literature review shows that the vast majority of PPIs take place in health care, eldercare, and social services (Brogaard, 2021). In such human capital-intensive environments, new services

are often too specialized or technically advanced to allow service organizations to procure them from the market or to create them on their own (Brogaard, 2021).

Collaborative innovation and partnership design

Public sector collaborative innovation is thoroughly embedded in the New Public Governance (NPG) paradigm (Lindsay et al., 2020), which encompasses several theories on cross-sector collaboration, including theories on network governance (Provan & Kenis, 2007), collaborative governance (Ansell & Gash, 2007), and network management (Agranoff, 2007). For a general overview of this literature, we refer to Bryson et al. (2015). Roughly speaking, these theories distinguish between conditions related to the partnership design (e.g., size, types of involved partners, governance structure, etc.) and process-related conditions (e.g., trust-building, process management, dialogue, commitment, etc.).

Contemporary collaborative innovation theories have emphasized the process components of collaborative innovation, as innovation is often regarded as a process in which collaboration-related process conditions can interfere. For instance, Sørensen and Torfing (2011) provide distinct process conditions such as empowered participation, mutual learning, and joint ownership, which are in line with process conditions in collaborative governance models (cf. Ansell & Gash, 2007). Moreover, the effectiveness of the collaboration dynamics is often ascribed to the presence of *interpersonal trust* (Provan et al., 2009), which has also been empirically demonstrated to have a positive relationship with innovation (Torvinen & Ulkuniemi, 2016). The innovation process is inherently risky, which requires commitment among the partners and willingness to invest time and resources with no guarantee of a successful outcome (Brogaard, 2021).

However, although trust has proven a vital component of partnership success, recent studies on cross-sector innovation partnerships highlight the impact of *partnership design* on innovative outcomes (Alonso & Andrews, 2022; Torfing et al., 2020). For instance, partnership design defines which collaborative interactions are possible by establishing interaction and decision arenas (Klijn & Koppenjan, 2016), and centralizing or decentralizing these arenas (Provan & Kenis, 2007), thus directly interfering in the collaboration process. These design choices not only influence the collaborative dynamics in PPIs, they may also directly affect the creative expressions of actors in the partnership. Indeed, contemporary views on collaborative innovation perceive partnerships as *creative arenas*, where a multitude of actors openly engage with each other and share perspectives and ideas, thus providing a foundation for innovative solutions to emerge (Torfing, 2019).

The presence of a high degree of *diversity in ideas and perspectives* is central to these creative arenas. Diversity at the start of the innovation process fosters an increase in the variation of ideas (Milliken et al., 2003), which may prevent tunnel vision and encourage groupthink among the innovators (Sørensen & Torfing, 2017), and optimize the quality of idea creation and selection (Sørensen & Torfing, 2011). Moreover, a diversity of ideas and perspectives throughout the collaboration process may also encourage the participants to elaborate and build on the information and knowledge of others, which increases group creativity (van Knippenberg et al., 2004). Two design conditions may stimulate these creative processes: the *number of involved partners* and the level of *centralization of authority* in the partnership. These design conditions are closely connected and carry important trade-offs that lead us to develop two competing hypotheses regarding their combined influence on generating technologically sophisticated service innovation.

First, as PPIs typically involve a broad range of different types of actors (Brogaard, 2021), increasing the number of actors in the partnership should support the diversity in ideas and perspectives. This is especially important for the level of technological sophistication, as this diversity might generate new combinations of different technologies, which may provide the basis for sophisticated technological innovations (Davis & Eisenhardt, 2011). There is, however, a trade-off. The large number of actors may also create more transaction costs and managerial challenges (Vivona et al., 2022), which may complicate the already complex integration of these technologies. Because of these challenges, the decision-making/authority should be more centralized in large partnerships (Provan & Kenis, 2007). According to Provan and Kenis (2007), more centralized partnerships should be particularly effective in large partnerships where interpersonal trust is often relatively low, as the centralization of authority allows dyadic interactions between a lead actor and individual participants. In other words, the partnership design allows the partnerships to generate innovation, despite having relatively low levels of trust. These assumptions lead us to the following hypothesis:

> **H1.** Large, centralized partnerships that include diverse ideas and perspectives, and have low to moderate levels of interpersonal trust, generate technologically sophisticated eHealth innovations.

Second, while centralized authority can help manage the diversity that leads to innovation in large partnerships with low levels of trust, partnership designs with decentralized authority can support the initial diversity of ideas. Specifically, decentralized authority might reduce the risk that one actor will force its decisions and opinions on the other partners, which can inhibit the creative expression of the involved actors (Hirst et al., 2011). Moreover, it also allows partners to self-organize by removing restricting interaction barriers (e.g., enforced interaction patterns), from which access to and recombination of diverse technologies can

be enhanced (Davis & Eisenhardt, 2011). Such decentralization of authority might be very hazardous in large partnerships with relatively low levels of interpersonal trust, as many actors have decision-making power that might inhibit the collaboration process (Provan & Kenis, 2007). However, in small, trust-based partnerships, the benefits of successful collaboration are concentrated around only a few actors rather than being dispersed across many, which provides a strong incentive to share knowledge and ideas to produce innovative outcomes (Brogaard, 2019). Moreover, high levels of trust can foster more innovative and risky ideas in the perceived absence of opportunistic behavior from others (Brogaard, 2021). Hence, we propose our second, alternative hypothesis:

> **H2.** Small, decentralized partnerships that include diverse ideas and perspectives and have high levels of interpersonal trust generate technologically sophisticated eHealth innovations.

CASES AND METHODOLOGIES

Case selection

Digital transformation in the health care sector is one of the European Union's most important priorities (European Commission, 2018), which makes the European countries an ideal empirical context for testing our hypotheses. A total of 19 public-private innovation partnerships in eHealth were selected in five European countries. The detailed features of these cases are illustrated in the Annex (Table A1). To ensure the comparability and representativeness of the selected cases, we used a purposeful sampling of the cases by adopting specific case selection criteria on three levels.

At the country level, we selected cases from five European countries, representing the two dominant health care systems (i.e., National Health Services and Etatist Social Health Insurance System) (Böhm et al., 2013). In the former, government is responsible for regulation, finance, and provisioning of health care, while in the latter system, government is responsible for regulation, finance is societally controlled (e.g., societal, para-fiscal funds), and provisioning is conducted by private actors (i.e., for-profit/nonprofit actors). Because both health care systems are regulated by government, the four most dominant administrative traditions in continental Europe were selected. Pollitt and Bouckaert (2017) make a distinction between different administrative traditions along five criteria: (1) state structure, (2) executive government, (3) minister/mandarin relations, (4) administrative culture, (5) diversity of policy advice. Based on these criteria, the following countries were selected: Belgium (Etatist Social Health Insurance System, mixed Napoleonic tradition), the Netherlands (Etatist Social Health Insurance System, Continental tradition), Denmark (National Health Services, Nordic tradition), Estonia (Etatist Social Health Insurance System, Eastern European tradition), and Spain (National Health Services, Napoleonic tradition). By including these countries in the study, we believe that we can infer insights on PPI-enabled technological eHealth innovations in Europe.

At the partnership level, we applied three selection criteria. First, as PPIs are partnerships between public actors and private actors, which often involve users to innovate services, all the included cases were eHealth partnerships between public actors (e.g., governments, agencies, public hospitals, etc.), private actors (e.g., nonprofit organizations, firms, etc.), and service users (e.g., GPs, medical professionals, patients, residents of nursing homes, etc.). Second, as PPIs can be coordinated by the public actor or the private actor, these two "types" of PPIs were included in our sample. Third, as PPIs can vary in size, we included both smaller (i.e., less than 10 partners) and larger (i.e., more than 10 partners) PPIs. The two latter features were equally distributed among the selected cases.

At the service innovation level, we selected cases which produced the two most commonly recognized types of eHealth services: (1) eHealth technologies related to the innovation of digital information flows between stakeholders, and (2) eHealth technologies related to telehealth, mobile health, and smart devices (Shaw et al., 2017). Examples of the former are central patient registration platforms, and central communication systems for monitoring patients, while examples of the latter are health technologies using motion sensors, mobile apps, and security systems. Because of our interest in the technological sophistication of the implemented services, only cases that implemented or at least extensively tested the developed services in the last 5 years were selected.

Fuzzy-set qualitative comparative analysis

This article employs fsQCA. QCA is known for its configurational causation (Ragin, 2008), which means that multiple conditions can have a combined effect on a certain outcome. As both of our hypotheses claim a combined effect of specific conditions, QCA allows us to test these hypotheses. In essence, QCA uses sets of conditions (e.g., large partnerships) and an outcome (e.g., technological sophistication) to determine patterns between these conditions and the outcome (Ragin, 2008). Each of our empirical cases is assigned to these sets. Cases can be present in a set (e.g., case A is a large partnership, typically indicated as a 1) or absent in a set (e.g., case B is a small partnership, indicated as a 0), which means that they show low or high levels of a certain condition or outcome. Sets of conditions can overlap with the set of the outcome to a greater or lesser extent. The greater the fit between the sets of the condition(s) and the set of the outcome, the stronger the pattern between these sets. QCA uses *consistency* as a measure of fit between sets, and *coverage* as a measure for the

number of cases that are covered by the overlapping sets. For a thorough introduction to QCA, we refer to Schneider and Wagemann (2012).

As we use *fuzzy set* QCA, the boundaries of these sets can be fuzzy, which means that some cases may also be partially in a set (indicated in this article as 0.67) or partially out of a set (indicated as 0.33). The case membership scores for each set are assigned during the calibration procedure, which we return to. The crossover point[1] of 0.50 represents a point of maximal indifference of a case for the presence or absence in a particular set. The crossover point is thus an important reference when assigning case membership scores (Schneider & Wagemann, 2012). If the outcome is always present when a condition is present, we call this condition a *necessary condition*. When a condition or a combination of conditions consistently leads to a certain outcome, we call this condition/these conditions *sufficient conditions*.

Data collection

To test our hypotheses, we gathered data using varied methods by five country-specific research teams. The interviews involved 132 participants, including project coordinators, public and private partners, and users. Each research team provided standardized interview reports for their cases. Prior to the interviews, centralized Qualtrics surveys were conducted with 124 of these respondents. Additionally, contextual case summaries were offered by the research teams for each case, detailing project backgrounds, partners, collaboration, and innovation dynamics.

The interviews, surveys, and case reports represent a robust comparable dataset spanning the five countries. Yet, relying on perception-based data entails risks of common-source and positive response biases (Andersen et al., 2016). We countered this by triangulating our methods, diversifying respondents, and avoiding evaluative questions. The coordination by a central research team ensured data consistency (e.g., in constructing questions, translations, case selection, and calibration), by aligning methodological decisions. Interviews and case insights also deepened our QCA results. For further details on respondents and methods, we refer to the Annex (Table A2).

Operationalization and calibration

Outcome: Technological sophisticated innovations

Our outcome variable is measured and calibrated using survey and interview data, and focuses on the two features of technologically sophisticated innovations: (1) the *functional diversity* of the used technologies in the innovation, and (2) the *internal complexity* of these technologies (Alexander & Wakefield, 2009; Paréa & Sicotte, 2001). Functional diversity was measured by asking project coordinators, public actors, private actors, and service users about the presence of three different types of eHealth technologies in the service innovations: (1) monitoring and health information technologies, (2) communication technologies, and (3) health data management technologies (Shaw et al., 2017) (see Annex, Table A3). The percentage of present eHealth technologies was calculated for calibration, and a case score was determined based on the mean of responses from all respondents. A crossover point of 0.50 was used (see Table A6 for calibration rules).

The internal complexity of the used technologies is composed of survey items concerning (1) the level of integration of the technologies and (2) the use of new and advanced technologies. Fully integrated systems connect different processes, functions, and technologies together, which increases interoperability and ultimately stimulates technological sophistication (Alexander & Wakefield, 2009). The presence of highly advanced technologies coincides with the introduction of new technological inventions. Qualitative interviews were conducted to gather detailed information about technology newness, availability, importance, and impact of the technologies indicated in Table A3. The researchers used specific criteria to distinguish between different levels of technological integration and advancement and the calibration score that corresponded to these levels (see Annex, Tables A4 and A5). Finally, the mean of the three case scores was calculated and transformed to a case score of 0; 0.33; 0.67; or 1 (see Annex, Table A6).

Conditions

We measured four conditions corresponding to our hypotheses. Partnership size is the number of individual partners that were involved in each PPI. The PPIs in our dataset typically include three types of public actors (governments, hospitals, and public health insurance funds), three types of private actors (private health actors, consultants, and tech firms), and three types of user actors (citizens/patients, patient organizations, and health professionals) (which is similar to partnerships in other studies, Brogaard, 2019), which motivated our selection of a crossover point of 10. With these nine types of actors, and a coordinator as a separate actor, large partnerships should include at least 10 actors. A 0.33 anchor point was defined at four actors (i.e., public actors, private actor, user, coordinator). Applying a similar range of the number of actors above and below the crossover point, a score of 0 was assigned to PPIs with less than four actors, 0.33 for those with 4–10 actors, 0.67 for those with 10–15 actors, and one for PPIs with more than 15 actors.

The diversity of ideas and perspectives is measured through survey items and interview questions. We asked two bipolar survey questions corresponding to the diversity of ideas and perspectives *at the start* of the project to the coordinators, public actors, and private actors:

(1) there were no differences/a lot of differences in opinions or perspectives of the actors, and (2) the ideas and opinions of the respondent were very similar to/distinctive from the ideas and opinions of the other actors. Based on the seven-point scale, a crossover point of 4 was determined. Mean values were calculated over the different items per respondent (see factor loadings in Annex, Table A8). Additionally, qualitative interviews gathered examples of diversity in perspectives of the respondents *during* the project. Specific calibration rules were used to assign a *case membership* score from these values (see Annex, Table A6).

(De)centralization of authority was operationalized based on the conceptualization of Provan and Kenis (2007). Through interview data, each partnership was categorized as lead organization-governed partnerships (centralized governance and decision-making, i.e., centralization of authority), shared participant-governed partnerships (governance and decision-making shared among the participants, i.e., decentralization of authority), or network administrative organizations (NAOs). In NAOs, the governance might be centralized, but the decision-making depends on the represented actors in the NAO, meaning that individual actors are usually unable to dominate the entire collaboration process. Using these considerations (see Table A6 for more details), we assigned lead organizations with a single lead actor a 0, lead organizations with a few lead actors or NAOs with a single lead actor a 0.33, shared-participant partnerships with a single lead actor or NAOs with a few lead actors a 0.67, and shared-participant partnerships with a few lead actors or a shared collective and NAO's with a shared collective a 1.

Interpersonal trust was operationalized through the three frequently used aspects of trust, that is, ability, benevolence (taking the other actor's interest into account), and integrity (good intentions) (Mayer et al., 1995). We based our survey items and scales on the trust process of Dietz (2011) and the widely acknowledged operationalization of trust by Mayer et al. (1995), which has been used in previous studies (Brogaard, 2017). Project coordinators, public actors, and private actors were presented with six seven-point Likert items (see Table A7). As we are interested in "considerable levels of trust" as opposed to "low to moderate levels of trust," we selected a relatively high crossover point of 5 based on the survey scale. Mean values were calculated over the different items per respondent (see factor loadings in Annex, Table A9). Specific calibration rules were used to arrive at a case membership score (see Annex, Table A6).

RESULTS

QCA results

The QCA analyses were performed with fsQCA software, version 3.1b (Ragin & Davey, 2017). The calibrated dataset appears in the Annex (Table A10). Table 1 illustrates the distribution of cases above and below the crossover point for technological sophistication and innovativeness. Nine of the cases show high levels of technological sophistication of the created services, while 10 of the cases show low levels of technological sophistication. There is a relatively even distribution between the different countries for high and low levels of technological sophistication.

We follow standards of QCA practice and first report the results of the analysis of necessary conditions (Schneider & Wagemann, 2012), which are illustrated in Table 2. Schneider and Wagemann (2012) suggest a consistency threshold of 0.90 to determine if a condition is necessary. Although we did not expect a condition to be necessary, the analysis demonstrates that the presence of considerable levels of interpersonal trust is necessary for the creation of technologically sophisticated innovations. Due to the asymmetric nature of QCA (Ragin, 2008), the necessity of a condition for the presence of the outcome does not mean that this condition should always be absent when the outcome is absent. This is confirmed by the analysis for the absence of technologically sophisticated services, where the absence of the conditions is not necessary for the absence of the outcome (see Annex, Table A11).

Next, we performed the analysis of sufficient conditions. A (combination of) condition(s) is sufficient when it consistently leads to the outcome (Schneider & Wagemann, 2012). Table 3 presents a truth table with all the logically possible combinations of conditions, where at least one case is covered. A consistency threshold of 0.80 is advised to select truth table rows for the next step in the analysis (Ragin, 2009). Although the first four truth table rows exceed the consistency threshold, only the first row exhibits a satisfactory proportional reduction in inconsistency (PRI)[2] value, which drops very quickly from row 1 onward.[3] Furthermore, the raw consistency score also rapidly drops from row 1 to row 2, which also indicates that the consistency threshold is reached (Schneider & Wagemann, 2012).

Next, the rows are logically minimized and the consistency and coverage values of the solution are calculated through the Standard Analysis (Schneider & Wagemann, 2012). Because of our theoretical expectations (see hypotheses), we pay special attention to the intermediate solution path (parsimonious and complex solutions are reported in Table A13 and Table A14), which is illustrated in Table 4. Because of the solution consistency and coverage of respectively 0.900 and 0.601, we can conclude that *small PPIs that possess a low diversity of ideas and perspectives, a centralization of authority, and considerable levels of interpersonal trust generate technologically sophisticated eHealth innovations*. The five cases that are covered by this solution path are relatively well distributed over the five countries. The analysis for sufficiency for the absence of the outcome is reported in the Annex (Table A12), and shows that large, decentralized PPIs with high diversity of ideas and perspectives lead to an absence of

TABLE 1 Set membership of the cases for the outcomes.

Outcome			Cases
Technological sophisticated innovations	High tech. soph.	Above 0.50	C1, C4, C6, C8, C12, C13, C16, C17, C18
	Low tech. soph.	Below 0.50	C2, C3, C5, C7, C9, C10, C11, C14, C15, C19

TABLE 2 Analysis of necessary conditions.

Presence of technologically sophisticated innovations		
Conditions	**Consistency**	**Coverage**
Large partnerships	.533	.533
Small partnerships	.680	.655
High diversity of perspectives and ideas	.426	.518
Low diversity of perspectives and ideas	.787	.647
Decentralization of authority	.249	.499
Centralization of authority	.893	.580
Considerable levels of trust	**.928**	**.649**
Low to moderate levels of trust	.390	.643

technologically sophisticated eHealth innovations. Thus, our results do not fully support either of our two hypotheses, which we return to in the discussion.

In-depth qualitative analysis

QCA results are best interpreted using qualitative case information (Schneider & Wagemann, 2012). All cases in the solution path had early agreement among actors on problem definition, project scope, and required features, which increased the interpersonal trust. For instance, in case C17, the small, centralized structure, low level of diversity, and high levels of trust allowed a tight combination of technical expertise that was needed to create AI-driven solutions for visual disorders. We see something similar in partnership C12 which needed to be small, centralized, and homogeneous in order to tackle technically complex issues related to constructing a mobile application that would enable patients of osteoporosis to receive and interpret their results from bone scans.

The central position of the lead actor was also crucial for the early alignment of the actors' perspectives. The lead actors determined and protected the boundaries of the project, sometimes by using a written contract, which reduced process complexity and smoothened the collaboration. This leadership profile has strong similarities with the role of "steward" formulated by Ansell and Gash (2012, p. 8), who establishes and protects the integrity of the collaboration process.

While the covered cases exhibit tensions between public and commercial interests, the central position of the lead actor helped overcome these tensions and maintain the trust between the partners. Several cases exemplify the influence of the lead actors. For instance, the strong position of the lead actor and the small scale of the partnership in case C12 prevented that the private actor unilaterally commercialized the created product, as the lead actor had the power to replace the private partner by another actor and restore trust. In case C18, the lead actor constructed an elaborated accountability structure to consolidate its influence over the partnership, which helped to mediate conflicts and facilitate shared understanding. This leadership role has similarities with a "mediator" (Ansell and Gash 2012), who serves as broker to smoothen the relationships between the involved actors. The following quote from the lead actor of case C18 illustrates this:

> We wanted to prevent accountability issues by establishing hierarchical ties between the contractors. This means that partner A is

TABLE 3 Truth table.

	Partnership size	Diversity of perspectives and ideas	Decentralization of authority	Interpersonal trust	Tech. soph.[a]	#Cases	Raw consist.	PRI consist.
1	**0**	**0**	**1**	**1**	**1**	**5**	**.900**	**.821**
2	0	1	1	0	0	1	.853	.493
3	1	1	1	0	0	2	.798	.500
4	0	1	1	1	0	1	.798	0.596
5	1	1	1	1	0	1	0.767	0.497
6	1	0	1	1	0	3	0.748	0.553
7	1	1	0	0	0	1	0.596	.330
8	1	1	0	1	0	1	0.569	0.248
9	0	0	0	1	0	3	0.557	0.432
10	0	0	0	0	0	1	0.496	0.330

Note: Bold indicates the truth table row that is retained in the next step of the analyses.
[a]The 1 in the columns indicates that row 1 consistently and unambiguously (i.e., high PRI) leads to the outcome.

TABLE 4 Analysis of sufficiency for the presence of technologically sophisticated innovations.

	Consistency	Raw coverage	Unique coverage	Cases in path
Small partnerships * low diversity of ideas and perspectives * centralization of authority * considerable interpersonal trust	.942	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.900			
Solution coverage	.607			

> the contractor of partner B, and partner B is the contractor of partner C, etc. We also worked with a network broker who only had a hierarchical tie with us, but who was responsible for aligning the different systems with each other.

Having this degree of control over the involved partners enabled the lead actor to directly stimulate the contractors to pursue bold, technologically sophisticated solutions, even when this was not commercially beneficial for the private actors in the short term. Cautious, incremental steps through compromise and pragmatism were not necessary as the lead actor was able to impose its wishes on the contractors, hence taking the role of a "catalyst," who identifies and creates opportunities for value-creation (i.e., innovation in our case) (Ansell & Gash, 2012). The following quote from the lead actor in case C18 illustrates this:

> Because our residents need to wear bracelets with Bluetooth trackers at all times, they need to be comfortable and client friendly, which was not the case with the initial bracelets. [The private contractor] complained that they were not a supplier of bracelets, but in the end, they will have to provide us with a suitable product.

Furthermore, interaction dynamics such as learning, experimentation, and trial-and-error behavior are also visible in the covered cases. For instance, case C8 shows that informal meetings between the involved actors were essential to develop ideas and manage the collaboration. In case C12, workshops were organized with all partners from which new ideas were generated, and in cases C1 and C18, a separated space for experimentation was established in which ideas and prototypes could be tested. In other words, the small size, low diversity of ideas and perspectives, and centralized nature of the partnerships did not stifle creative exploration within the overall design boundaries of the project.

DISCUSSION

The results show that, surprisingly, none of our two hypotheses are confirmed by the QCA analyses. We obtain only one solution that differs from our hypothesized paths, and, moreover, has a very high consistency value. This finding offers strong evidence that small PPIs with centralized authority, low diversity of ideas and perspectives, and high levels of trust generate technologically sophisticated eHealth innovations. Furthermore, an opposite solution path (i.e., large, decentralized partnerships with high diversity) is found for the absence of technologically sophisticated eHealth innovation, which further supports our results (see Annex, Table A12).

Three important theoretical implications arise from these findings. First, we find that partnerships that limit the diversity of ideas and perspectives in the innovation process seem to produce technologically sophisticated service innovations. This observation is tied to the small size of the partnerships and their centralized authority. A possible explanation is that a high degree of diversity impedes the innovation process through an "overload" of conflicting ideas, goals, and interests, which can result in conflict and deadlock, whereas limited diversity creates a more focused innovation process early on. While current collaborative innovation literature places a large emphasis on the advantages of diversity for enhancing creative expression, partnership synergies, and 'reducing tunnel vision and groupthink' (Milliken et al., 2003; Sørensen & Torfing, 2017; Torfing et al., 2020), our results suggest that the required level of diversity might be contingent on the type of partnership design.

Second, we find that small partnerships with a centralization of authority produce technologically sophisticated service innovations. According to creativity literature, highly centralized and hierarchically organized settings inhibit the creative expression of individuals (Hirst et al., 2011). However, insights from our qualitative data indicate that the typical interaction dynamics of collaborative innovation (e.g., learning, experimentation, and trial-and-error behavior) are still present, and even promoted, in these partnerships. These findings suggest the presence of lead actors who adopt the three principal collaborative leadership roles, suggested by Ansell and Gash (2012): steward, mediator, and catalyst. This finding is also supported by recent research by Torfing et al. (2020), who discovered the same three leadership roles in innovation partnerships in several policy domains, including the health care sector. We extend these findings by showing that these leadership roles also have an impact on the level of technological sophistication of the created innovation.

Third, we obtained convincing evidence from our observations that considerable levels of interpersonal

trust should *always* be present to create technologically sophisticated services. In other words, PPIs with only low to moderate levels of trust, even centralized ones, are unable to create technologically sophisticated innovations. This finding questions Provan and Kenis' (2007) assumption that the importance of trust for network outcomes varies depending on the governance structure, at least in the case of innovation partnerships. Our evidence does, however, match the general emphasis on trust for achieving innovation in the collaborative and network governance theory and as demonstrated by empirical research (Torvinen & Ulkuniemi, 2016). Considering the other conditions, small, homogenous, and centralized partnerships might be especially suitable for achieving high levels of trust, which potentially facilitates intensive interactions between the involved actors, from which technologically sophisticated innovation emerges.

These results suggest that partnerships that focus on the generation of technological sophisticated innovations can also be seen as *arenas of complexity*. In a context of complexity, small, homogeneous, centralized, and trust-based partnerships would be better able to produce innovative services because they can reduce their coordination costs and simplify decision-making (Vivona et al., 2022). Indeed, complexities related to differences in partners' knowledge, perspectives and backgrounds (substantive complexities), interests and agendas (strategic complexities), and institutional and cultural realities (institutional complexities) (Klijn & Koppenjan, 2016) may lead to intergroup biases and conflicts (van Knippenberg et al., 2004), opportunistic behavior (Ostrom, 2007), and cultural clashes (Vangen, 2016). In partnerships that pursue highly technical and complicated innovations, these complexities might increase the risk of becoming trapped in collaborative inertia, which can impede collaborative advantages and synergies (Huxham, 1996). These findings seem to be confirmed by recent, tentative empirical findings on innovation partnerships, in which lead organization networks are better at generating a variety of high-quality and low-cost innovations than partnerships with a decentralization of authority (Lam & Li, 2018). The findings also echo organizational innovation literature, in which organizational cohesiveness has been connected to the creation of innovation cultures (Xie et al., 2021), increased organizational learning (Montes et al., 2005), and increased commitment to adopt the innovation (Hirunyawipada et al., 2015).

CONCLUSION

In this article, we analyzed which combination of partnership design conditions leads to technologically sophisticated service innovation in PPIs. Different from what we initially expected, our results show that small, centralized, homogeneous, and trust-based partnerships are best at achieving technologically sophisticated eHealth innovations, as they are able to reduce the complexities inherent to collaborative innovation processes (Vivona et al., 2022). PPIs reduce these complexities by designing compact and manageable partnerships, with considerable levels of interpersonal trust, and an explicit lead actor, who protects, supports, and propels the collaborative innovation process by combining steward, mediator, and catalyst leadership roles (Ansell & Gash, 2012).

This practical implication is highly relevant in demanding and intricate service environments such as health care, in which highly specialized technical expertise is necessary, and the prevalence of specialized users (e.g., physicians, medical specialists, etc.) requires the generated solutions to comply to high user standards. Moreover, these particular design features of health care PPIs are likely relevant for collaborative innovation in other human service areas, thus broadening the applicability of our results. Specifically, our results might be relevant to similar services that are human capital intensive and/or increasingly driven by technological innovation such as eldercare (Lassen et al., 2015) and to some degree specialized social services (Alonso & Andrews, 2022; Desmarchelier et al., 2020).

Our results provide rich insights for theory and practice, which may be instructive for future research. The value of this study lies in its ability to explain which combinations of partnership characteristics and governance lead to technologically sophisticated innovations in PPIs. This perspective provides new insights and explanatory power to the emerging literature on PPIs. We used data from 19 partnerships in five different European countries, which allows us to (cautiously) generalize these results to similar projects in Europe. By using QCA, we were also able to look deeper into the qualitative data and discover some clues as to how the studied conditions cause technological sophistication.

However, our study also has limitations. Due to our research design, our study is largely based on perception data, and we were only able to look at the influence of partnership design in specific partnerships (PPIs), countries (European countries), and policy sector (health care sector) on the presence of specific types of technological innovations (eHealth innovations). Further research is needed in other types of partnerships (e.g., interagency partnerships) and other policy sectors (e.g., infrastructure sector) to shed more light on the possible generalization of these results to other empirical setting, and to better understand the causal mechanisms that are responsible for our results. Future research can also benefit from developing measures of partnership conditions and/or innovative outcomes using administrative and register data, while in-depth qualitative case studies, process-tracing studies, and quasi-experimental designs (see Alonso & Andrews, 2022) can solidify potential causal inferences.

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ENDNOTES

[1] Both the terms crossover point and cutoff-point are used in QCA, but here we adhere to "crossover point" because we use a fuzzy set QCA logic, in which the boundaries between the presence and absence in sets are more blurred (i.e., cases cross over from being (partially) out of the set into the set) (see also Schneider & Wagemann, 2012).

[2] The proportional reduction in inconsistency (PRI) expresses the degree to which a condition (or combination of conditions) is a subset of both the presence of the outcome ánd the absence of the outcome (Schneider & Wagemann, 2012, p. 242). A low PRI value (i.e., < 0.600) means that the truth table row might not only produce the presence of the outcome but also the absence of the outcome.

[3] Following Schneider and Wagemann (2012, p. 243), we also considered the product of the raw consistency and the PRI consistency, which was, for the four truth table rows above the 0.80 threshold resp. 0.858; 0.000; 0.498; 0.407. The large deviation between the products and low values of the three latter products shows that only row 1 should be retained.

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ANNEX A

TABLE A1 Selected cases.

Case code	Case description
C1	Tracking technologies in a nursing home, created through the collaboration between a semi-private association, software developer, and patient organization
C2	Platform which brings people with health/social care demands together with volunteers, created through municipalities, communal network, private hospitals, private ICT companies, consultant companies, citizens, and health professionals
C3	Centralized patient registration system, created through a collaboration between the ministry, government agencies and public authorities, ICT companies, private health care providers, physician associations, hospital associations, individual physicians
C4	Voice command app to guide health care providers, created through a collaboration between a ministry, public health insurance authority, colleges, network of health care providers, ICT companies, several health care organizations
C5	E-learning program regarding dysphagia, created through a collaboration between a regional government, municipalities, public hospitals, ICT company, representatives of health professionals
C6	A way of creating, validating, and disseminating official evidence-based guidelines for health care providers, created through a collaboration between universities, private health organizations, national and regional government agencies, red cross organizations, knowledge organizations, ICT suppliers, and individual health professionals
C7	"Smart diaper" for elderly people, created through the collaboration between a semi-private association, ICT company, consultant company
C8	Digital platform designed to foster neighborhood collaborations between clients and consultants, created through the collaboration between a municipality, private health care provider, neighborhood teams, citizens
C9	Web application for computerized cognitive behavior therapy (CCBT), created through the collaboration between public hospitals and health care services, public research institute, private technology center, several health professionals (e.g., psychiatrist, psychologists, physicians, etc.)
C10	National portal website which provides information for all the citizens, created through a collaboration between government agencies, ministerial cabinets, hospital networks, regional governments, private health suppliers, and insurance organizations, and user organizations
C11	Patient information sharing tool for GPs and home care organizations, created through a collaboration between private nursing organizations and federation, ministerial cabinets, national government agencies, hospital networks, individual GPs, and several private health organizations
C12	Smartphone app that helps convey the results of bone scans to patients with osteoporosis, created through a collaboration between a public hospital, university, ICT and health service companies, patient associations, health professionals
C13	Home health ICT tools for chronic patients, created through the collaboration between a public hospital/health service, regional government, ICT companies, consultancy companies, several other private companies, universities, health professionals, and patients
C14	Integration of application processes for rehabilitation, disabilities, aids, created through a collaboration between ministries, public health insurance authority, government agencies, physician association, interest groups
C15	Smartphone app for patient reported outcomes, created through a collaboration between a public hospital, ICT company, health professionals
C16	Electronic prescription system, patient appointment system, robot for automatic storage and dispensing, created through the collaboration between several public hospitals, private ICT companies, several patient organizations, university
C17	AI used to diagnose uncooperative patients, created through the collaboration between public hospitals, ICT and telecom companies, physicians
C18	Several technologies in a nursing home (wearables, smart cameras, etc.), created through a collaboration between a public nursing home (local government), private construction companies and contractors, consultant companies, nurses, and patients
C19	ICT platform which facilitates the exchange of health information between partners and patients, created through the collaboration between a municipality, public hospital, and several private health organizations

TABLE A2 Data collection.

Case code	Surveys (124)			Interviews (132)		
	Coordinator	**Public and private partners**	**Users**	**Coordinator**	**Public and private partners**	**Users**
C1	Manager/project coordinator (1)	Public service provider (2), ICT company (1)	Representative user organization (1), nurse (1), physician (1)	Project coordinator (1)	Public service provider (1), ICT company (1)	Representative user organization (1), nurse (1), physician (1)
C2	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (2)	Project coordinator municipality (1)	Employee municipality (1), ICT company (1)	Citizens (3)
C3	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)	Project coordinator (1)	Ministry (1), ICT company (1)	ICT technicians (3)
C4	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (1), nurse (1)	Project coordinator (1)	Ministry (1), private health network (1)	Representatives users (2), nurse (1)
C5	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Program manager (1)	Public hospital (1), ICT company (1)	Health professionals (3)
C6	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (1), ICT company (1)	GPs (3)	Chairman and CEO network (2)	Representative government steering committee (1), private service providers (2), ICT company (1)	GPs (3)
C7	Manager/project coordinator (1)	Public service provider (1)	/	Manager/project coordinator (1)	Public service provider (1)	Nurses (2)
C8	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (4)	Project coordinator municipality (1)	Coordinator private service provider (1), employee municipality (4)	Social workers and other professional users (5)
C9	Public hospital (1)	Public hospitals/health care organization (3), ICT company (1)	Physicians (4), nurse (1) and technician (1)	Public hospital (1)	Public hospitals/health care organization (2), ICT company (1)	Physicians (4), nurse (1) and technician (1)
C10	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (1)	Representatives of patient organizations (2), physician association (2), and user groups (1)	Government agency (1) and ministerial cabinet (1)	Public hospital (1) and private ICT company (2)	Representatives of patient organizations (2), physician association (2), and user groups (1)
C11	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)	Project coordinator (1)	Government agency (1), private service provider (1), ICT company (1)	GPs (3)
C12	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)	Project coordinator (1)	Public hospital (1) and ICT company (1)	Health professional (1), social worker (1), user representative (1)
C13	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)	Innovation director ICT company (1)	Public hospital (1), private service organization (1)	Patient (1), physician (1), social worker (1)

(Continues)

TABLE A2 (Continued)

Case code	Surveys (124)			Interviews (132)		
	Coordinator	**Public and private partners**	**Users**	**Coordinator**	**Public and private partners**	**Users**
C14	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)	Project coordinator (1)	Ministry (1), physicians association (1)	Representatives of users (2) and individual user (1)
C15	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)	Project coordinator (1)	Public hospital (1)	Physician (1), nurse (3)
C16	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (4)
C17	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)	Public hospital (1)	Public hospital (1), ICT company (1)	Health professionals (3)
C18	Manager nursing home (1)	Municipality (1)	Nurses (3)	Manager nursing home (1)	Municipality (1), external private consultant (1)	Nurses (3)
C19	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)	Project coordinator (1)	Public service organization (1), ICT company (1)	Service organization (1), physicians (3)

TABLE A3 Types of eHealth technologies.

	Innovations in the way…
eHealth technologies to monitor, track, and inform health	Mobile devices, mobile sensors, and wearables are used to increase the health and well-being of users
	Apps, social media, and online information are used to increase the health and well-being of users
	The user can access and control their health and health care services
eHealth technologies to communicate between health care actors	The communication and overall interaction between the user and the health care provider is organized
	The service choices for personalized care services users have because of eHealth technologies
	eHealth technologies support health professionals by providing interprofessional collaboration
eHealth technologies to collect, manage, and use health data sources	Personal health data is collected, stored, and communicated between relevant stakeholders (consider also innovations regarding data protection)
	(Big) data is used to provide more precise and personalized health care (e.g., personalized interventions, predicting and preventing diseases, etc.)

Note: Based on Shaw et al., 2017.

TABLE A4 Level of technological integration.

Present technologies	Description	Calibration score
Absence of integrated systems	The individual technological components are not connected with each other, or with the functionalities of each other. They are fully independent of each other.	0
Weakly integrated systems	The individual technological components are connected with each other, or with the functionalities of each other, but function independent of each other.	0.33
Strongly integrated systems	The individual technological components are connected with each other, or with the functionalities of each other, and function dependent of each other. Individual technological components will be (de) activated because of other individual technological components.	0.67
Fully integrated systems	The individual technological components function as one technology. Each technological component acts with the input of the other components. Technological components have no individual functionalities (they dependent on the other components)	1

TABLE A5 Level of technological advancement.

Present technologies	Description	Calibration score
Basic technologies	Use of basic soft- and hardware components (e.g., databases, websites, basic communication technologies, etc.)	0
Weakly advanced technologies	Use of multifunctional technologies which have proven their functionalities for some time, but with low internal complexity (e.g., Bluetooth trackers, sensors, interconnected databases, etc.)	0.33
Advanced technologies	Use of technologies with a high internal complexity: a lot of integrated software/hardware components	0.67
Highly advanced technologies	High internal complexity of technologies with a lot of integrated software/hardware components. Autonomous decision-making based on input data (i.e., expert systems, AI/self-learning systems, etc.).	1

TABLE A6 Calibration rules for the outcome technological sophistication and the conditions decentralization of authority, diversity of ideas and perspectives, and interpersonal trust.

Technological sophistication	Decentralization of authority	Diversity of ideas and perspectives	Interpersonal trust
The following intervals for the mean scores were used to assign the calibration values: • [0–0.33[→ 0 • [0.33–0.5] → 0.33 •]0.50–0.67] → 0.67 •]0.67–1] → 1	• Lead organization-governed partnership + single lead actor → authority centralized in lead actor → full non-membership in set → 0 • Lead organization-governed partnership + multiple lead actors → authority not fully centralized → partial non-membership in set → 0.33 • NAO + single lead actor → authority not fully centralized because of characteristics NAO → partial non-membership in set → 0.33 • NAO + multiple lead actors → authority not fully decentralized because of lead actors → partial membership in set → 0.67 • Shared participant-governed partnership + single lead actor → authority not fully decentralized → partial membership in set → 0.67 • NAO + shared collective → authority fully decentralized because of shared collective and characteristics NAO → full membership in set → 1 • Shared participant-governed partnership + multiple lead actors or shared collective → authority fully decentralized → full membership in set → 1	Survey answers: • All of the answers of the respondents above the crossover point → 1 • More than half of the answers above the crossover point → 0.67 • Less than half of the answers above the crossover point → 0.33 • None of the answers above the crossover point → 0 • An equal number of answers above and below/on the crossover point, consider the distance of the answers toward the crossover point → larger distance is indicative Interview answers: • Listing of all the mentioned examples of diversity in perspective and ideas per respondent per case • Qualitative evaluation of the level of diversity (0; 0.33; 0.67; 1) based on the number of distinct examples per case and their content Final calibration score: • Mean of the scores if survey score and interview score are below and under cross-over point (e.g., 0.33 and 1 → 0.67) • If survey and interview scores are both below or under crossover point → interview score becomes final score • If survey and interview scores are exactly the same, this score becomes the final score	• All of the answers of the respondents above the crossover point → 1 • More than half of the answers above the crossover point → 0.67 • Less than half of the answers above the crossover point → 0.33 • None of the answers above the crossover point → 0 • An equal number of answers above and below/on the crossover point, consider the distance of the answers toward the crossover point → larger distance is indicative

TABLE A7 Operationalization of interpersonal trust.

Interpersonal trust								
At the start of [the project] there was no trust at all between the involved actors	1	2	3	4	5	6	7	At the start of [the project] there was a lot of trust between the involved actors
Throughout [the project], the trust between the involved actors decreased a lot	1	2	3	4	5	6	7	Throughout [the project], the trust between the involved actors increased a lot
The involved actors in [this project] were not at all willing to share relevant information with each other	1	2	3	4	5	6	7	The involved actors in [this project] were very much willing to share relevant information with each other
The involved actors in [this project] were not at all taking each other's interests into account	1	2	3	4	5	6	7	The involved actors in [this project] were very much taking each other's interests into account
The involved actors in [this project] lacked the capacities and skills necessary for this process	1	2	3	4	5	6	7	The involved actors in [this project] had the capacities and skills necessary for this process
Throughout [the project], I was very unsure if the intentions of the other involved actors were good	1	2	3	4	5	6	7	Throughout [the project], I was very sure that the intentions of the other involved actors were good

TABLE A8 Factor loadings diversity of ideas and perspectives.

Diversity of ideas and perspectives	
Survey items	**Factor loadings**
There were a lot of differences in opinions and perspectives of the actors	.839
My own ideas and opinions were very distinctive from the ideas and opinions of the other actors	.839

TABLE A9 Factor loadings interpersonal trust.

Interpersonal trust	
Survey items (only right hand side)	**Factor loadings**
At the start of [the project] there was a lot of trust between the involved actors	.509[a]
Throughout [the project], the trust between the involved actors increased a lot	.705
The involved actors in [this project] were very much willing to share relevant information with each other	.797
The involved actors in [this project] were very much taking each other's interests into account	.873
The involved actors in [this project] had the capacities and skills necessary for this process	.771
Throughout [the project], I was very sure that the intentions of the other involved actors were good	.643

[a]Note that we also did QCA analyses without this item because of the low factor loading. However, these analyses turned out to be exactly the same.

TABLE A10 Calibrated dataset.

Case	Partnership size	Diversity of perspectives and ideas	Decentralization of authority	Interpersonal trust	Technological sophisticated innovations
C1	0	0.33	0	0.67	0.67
C2	1	0.67	0	0.33	0
C3	1	0.67	0.33	1	0.33
C4	0.67	0.33	0	0.67	0.67
C5	0.67	0.67	0.33	1	0
C6	1	1	1	0.33	0.67
C7	0	0	0.67	1	0
C8	0	0	0	0.67	0.67
C9	0.67	0	0	0.67	0.33
C10	1	1	0.33	0.33	0.33
C11	0.67	0.33	0.33	0.67	0.33
C12	0.33	0.33	0	1	1
C13	0.33	0.33	0.33	0.67	1
C14	0.33	0.67	0	0.33	0.33
C15	0.33	0.67	0	0.67	0.33
C16	0.33	0	0.33	1	0.67
C17	0.33	0	0	1	1
C18	0.33	0.33	0	1	1
C19	0.33	0.33	1	0.33	0

TABLE A11 Analysis of necessary conditions—absence of technologically sophisticated services.

Absence of technologically sophisticated innovations		
Conditions	**Consistency**	**Coverage**
Large partnerships	.655	.679
Small partnerships	.550	.550
High diversity of perspectives and ideas	.586	.740
Low diversity of perspectives and ideas	.618	.527
Decentralization of authority	.377	.785
Centralization of authority	.759	.511
Considerable levels of interpersonal trust	.791	.573
Low to moderate levels of interpersonal trust	.516	.881

TABLE A12 Analysis of sufficiency—absence of technologically sophisticated services.

	Consistency	**Raw coverage**	**Unique coverage**	**Cases in path**
Large partnerships * high diversity of ideas and perspectives * decentralization of authority	0.876	0.241	0.241	C3, C10
Solution consistency	0.876			
Solution coverage	0.241			

TABLE A13 Parsimonious solution for the presence of technologically sophisticated innovation.

	Consistency	**Raw coverage**	**Unique coverage**	**Cases in path**
Small partnerships * low diversity of ideas and perspectives * centralization of authority	.851	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.851			
Solution coverage	.607			

TABLE A14 Complex solution for the presence of technologically sophisticated innovation.

	Consistency	**Raw coverage**	**Unique coverage**	**Cases in path**
Small partnerships * centralization of authority * considerable interpersonal trust	.850	.607	.607	C1, C8, C12, C17, C18
Solution consistency	.850			
Solution coverage	.607			

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Deconstructing complexity: A comparative study of government collaboration in national digital platforms and smart city networks in Europe

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Abstract
This research deconstructs complexity as a key challenge of intergovernmental digitalisation projects. While much of the literature acknowledges that the fundamental restructuring coupled with technical capacity that these joint projects require leads to increased complexity, little is known about how different types of complexity interact within the collaborative process. Using established concepts of substantive, strategic, and institutional complexity, we apply complexity theory in collaborative digital environments. To do so, eight digital projects are analysed that differ by state structure and government level. Using a cross-case design with 50 semi-structured expert interviews, we find that each digitalisation project exhibits all types of complexity and that these complexities overlap. However, clear differences emerge between national and local level projects, suggesting that complexity in digitalisation processes presents different challenges for collaborative digitalisation projects across contexts.

Keywords
Collaboration, digitalisation, public sector, complexity, Europe

Introduction

Collaboration is a highly influential topic for public sector governance and innovation research, including the digitalisation of government where projects increasingly rely on collaborative work (Luna-Reyes et al., 2007). The reliance on collaboration is due to digitalisation's boundary-crossing nature, high initial financial investments tied with increasing cost pressures, bureaucratic and legal rules of accountability, staff retraining, and high rates of failure (Anthopoulos and Reddick, 2016; Mergel, 2016; Neumann et al., 2019; Torfing, 2019). As a result, digitalisation becomes a holistic process in the sense that technological components are only one of many aspects under consideration during this change (Breaugh et al., 2023; Gil-García, 2012; Gil-Garcia and Flores-Zúñiga, 2020). One salient component of collaborative digitalisation projects is their complexity (Costumato, 2021; Parker et al., 2021) as they combine characteristics that clearly distinguish them from complicated systems (cf. Klijn and Koppenjan, 2014). These include, for example, joint efforts to establish nationwide digital platforms (such as citizen registries) or to implement smart city projects.

Digital innovation represents a technical innovation, focusing on different components linked to the nature in which data is collected, stored, and utilised (Yoo et al., 2010) to create streamlined government services. Ironically, as with many collaborations, while digitalisation aims to reduce complexity, it requires both technical innovations *and* institutional innovations to reflect the environment in which they are embedded (Hinings et al., 2018; Huang et al., 2017). This fundamental restructuring paired with technical innovation leads to increased complexity within the collaboration process, yet little is known about how diverse types of complexity interact within the collaborative processes in digital innovations. While Mergel (2022) and Tangi et al. (2020) identify organisational

complexity as one of the most important structural barriers to digitalisation, the concept of complexity is yet to be fully understood in this context (di Giulio and Vecchi, 2021).

In their seminal work Klijn and Koppenjan (2014) present complexity in three forms: substantive, strategic, and institutional. Substantive components refer to cognitive perceptions for problem definition in collaboration projects, strategic components refer to the effect of organisational goals and biases on (in) actions of stakeholders in the projects, while institutional components refer to prioritisation and conflicts of formal and informal rules from different networks that govern actor behaviours. The purpose of this paper is to assess how complexity emerges within the context of intergovernmental digitalisation projects, and which factors contribute to this complexity, in particular, across different countries and levels of government.

To empirically explore this, we adopt a small N comparative case study design. This approach is particularly suited to comparing several cases without compromising on analytical depth (Nowell and Albrecht, 2018). To ensure a large degree of complexity, we take a cross-country (four countries) and multi-level (national vs local) perspective, something that is essential for understanding the universality of our claims across conditions and called for by scholars in the field (e.g., Neumann et al., 2019). In total, eight cases are used which come from Belgium, Estonia, Germany, and the UK., one case for each level of government per country. The cases focus on the implementation of smart city technologies at the municipal level, and government platform approaches at the national level.

The structure of the paper is as follows: we begin by presenting the theoretical framework that our empirical analysis will test. We then present the methodological framework with respect to the eight case studies as well as the coding framework used followed by the results. We conclude with a discussion of our findings and areas for future research.

Theoretical framing

In this section, Klijn and Koppenjan's (2014) framework of substantive, strategic, and institutional complexity will be used to deconstruct complexity within collaborative digital government environments, forming the theoretical basis for our empirical investigations. Complexity in this context is defined by the relationships between the elements of a system and their dynamic nature, rather than simply by the number of elements–characteristics that make them non-deterministic and thus particularly unpredictable and distinguish them from complicated systems (Klijn and Koppenjan, 2014).

Substantive complexity

Substantive complexity relates to differences in problematisations among actors in a collaboration project. Knowledge production occurs within existing organisational routines and activities that subject the expertise-based idea to a value-based environment (Agranoff and Yildiz, 2007; Head, 2008). Substantive complexity emerges when different

actors perceive both the problems and solutions differently. In these cases, it is not about information shortage, but rather, the "lack of a joint frame of reference and shared meaning among actors" (Klijn and Koppenjan, 2014, p. 63). Individual agency of diverse actors means that these problematisations can also change (Gilpin and Miller, 2013) and selective perceptions emerge where individuals support processes from their own perspective rather than that of the whole (Dearborn and Simon, 1958; Wegrich, 2019). Because of this, different actors come to a collaborative environment with their own perspectives, which does not preclude a common goal but may mean misaligned understandings of how to achieve it (Basadur et al., 2000).

Strategic complexity

Strategic complexity focuses on the strategies used to solve network problems, or the complexity inherent in reconciling different interests while dealing with the risk of opportunistic behaviour (Bonomi Savignon et al., 2021; Waardenburg et al., 2020). In this case, strategic complexity emerges from having to develop one solution to a particular problem, but stakeholders have their own strategic goals (Head and Alford, 2015). The individual actors are affected by existing capabilities and personal and organisational values that guide their behaviours within a collaboration, which can lead to a lack of coordination (Klijn and Koppenjan, 2016; Raadschelders and Whetsell, 2018). When goals are not aligned across the collaborative project, strategic complexity emerges. This can occur in environments of competitiveness and limited resources with actors prioritizing the maintenance of their position over collective goal-attainment (Wegrich, 2019).

Institutional complexity

Institutional complexity is a third form of complexity. Institutions define rules that regulate behaviour (March and Olsen, 1989; Scharpf, 1997). In the public sector context, these include both the legal apparatus and institutional culture. These rules can help to regulate behaviours, but on the other hand, "if the number of rules grows, become inconsistent, opaque, and not well understood, they may generate complexity instead of predictability" (Klijn and Koppenjan, 2014, p. 64). This occurs, when actors have interaction arenas with conflicting patterns of rules, requiring stakeholders to prioritise one set of rules over the others (O'Leary and Vij, 2012). This may be exacerbated by differences between and/or fundamentally contrasting institutional logics between collaboration partners. The varying logics could lead to diverging behaviours, which are guided, to a large extent, by their own employing institution rather than that of the collaboration, therein increasing institutional complexity.

Complexity within the context of digitalisation

With the differentiation of complexity outlined in the collaboration literature, we argue that the subcomponents of complexity are not only magnified through digitalisation but also, become more interdependent. Digitalisation projects are characterised by multi-

channel access to information and services, system interoperability and distributed, multi-agent systems, and cross-boundary social interactions (Dawes, 2009). These include the interdependence between technological, organisational, and institutional arrangements, as well as how IT is used by internal and front-facing users leading to relationships that are recursive and dynamic (Anthopoulos et al., 2016; Luna-Reyes and Gil-Garcia, 2011). The lack of consideration and understanding of the overlapping complexity could, in part, help to understand why IT projects end up failing or stalling (Omar et al., 2020).

The digitalisation process serves the multitude of stakeholders who are involved in the projects (Liu and Zheng, 2018; Mergel, 2018). As such, within the context of digitalisation, substantive complexity emerges as stakeholders developing collaborative digital solutions may have different perspectives on both the problems and solutions that information technology (IT) can offer. This variance in cognitive framing is based on both the collaborative environment, as well as their own understanding of digital processes and outcomes (Orlikowski & Gash. D, 1994).

Within the realm of complexity in digitalisation, strategic complexity can emerge in several ways. In some cases, actors must balance the co-design between the legislative framework which includes the legal context of the programme and country, programme goals and IT functions (Apostolou et al., 2011), for example, combining the technical and design skills of IT professionals with the traditional logic of public sector bureaucracy (Neumann et al., 2019). This can result in a diversity of actors, searching for solutions to cater to their own agendas. Furthermore, it can result in the group of actors looking to either take control of the process or change the technical solution and in doing so, change the intended outcome (Bailey and Barley, 2020). Moreover, the centralisation of digitalisation projects typically requires new organisational forms to emerge (Orlikowski, 2007). How these develop can become a point of contention, and likely overlap with institutional complexity. Finally, digitalisation projects are long-term and evolving with feedback loops from the solution and surrounding environment shaping the direction. This means that they require continuous adaptation to the needs of their users, legislative frameworks, and programme decisions and delivery. This can create clear tensions between different stakeholders, especially those wanting to optimise IT with those handling legal compliance and service delivery dilemmas (Apostolou et al., 2011). It may also create problems with aligning short-term and long-term goals, especially if basic IT infrastructures (such as data-sharing capabilities and issues related to interoperability) are overshadowed by an immediate service need. This includes centralisation, and technical requirements related to interoperability and data sharing, cloud computing that can, at times, operate across jurisdictions (Scholl et al., 2012; Waardenburg et al., 2020). This can lead to a lack of clear understanding of the legality of information-sharing across organisations as well as to delays in development (Waardenburg et al., 2020). In line with this, regulations need to be changed or are constantly being changed and updated as emerging IT becomes more mainstream adding both institutional and substantial complexity to the projects (McLean et al., 2021).

National-level versus local-level dynamics

Thus far we have argued that there is an interplay between different complexities in collaborative digitalisation projects, however, complexity dynamics could be different based on the level of government under analysis (for example, national versus local level).

Digitalisation projects initiated by national governments to overcome existing boundaries between organisations, administrative levels, and functional areas, face greater complexity as they involve horizontally and vertically distributed processes within and outside the organisation (Meijer, 2015; Willem and Lucidarme, 2014). Moreover, due to the exhaustive nature of the projects, there is often a clash of different preconditions, such as unequal access to human or financial resources, but also cognitive aspects, manifesting in opposing views or different rationale for change (Luna-Reyes et al., 2021). National platform projects are thus prime examples of pronounced complexities, as they involve specific agencies and ministries and often multiple levels of government while at the same time confronting the complexity of the IT itself (Luna-Reyes et al., 2007) and the capacity to adopt it (Liu and Zheng, 2018; Mergel et al., 2018; Rackwitz et al., 2021).

By contrast, local government is characterised by the interaction of various local actors, the need for internal change management, and the technical requirements that digitalisation projects entail, which all add to the complexity of local governance processes (Ruhlandt, 2018; Scholl and Scholl, 2014). However, it is less difficult to motivate and engage partners because they have the prospect of benefitting from practical project outcomes as project performance feeds back into their immediate habitat (Karppi and Vakkuri, 2020; Neumann et al., 2019). It can be argued that at the level of a local government (vis-à-vis national government), interactions are proximate and take place not only formally but also informally. In addition, both decision-makers and citizens may find it easier to establish public support and action for locally experienced problems. This is referred to in the literature as 'the proximity principle' (Reese, 2018). While local government actors are also interdependent, they have access to a more homogeneous pool of partners, as they come from similar regional contexts. It is more likely that there is a common regional identification and regular or spatial forums for personal exchanges that facilitate the creation of joint frames of reference or a "single meta-narrative" (Eppel, 2012: p. 895). Local partners are therefore potentially more aligned in preferences and understandings of what is considered appropriate behaviour than in national government projects. Based on these specifics of digitalisation projects at national versus local scales, we can infer that complexity constitutes a different challenge for digitalisation projects at the national level than for those at the local level.

From these considerations, two propositions emerge, which will be empirically examined in the remainder of this paper:

1. *Complexity in digitalisation*, in its three subcomponents of substantive, strategic and institutional complexity, takes a different form at the national level of collaborative project implementation than at the local level.
2. Government digitalisation projects at the national level face more intense complexity overall than projects at the local level.

Methodology

Research design

To analyse complexity mechanisms across conditions, we adopt a qualitative comparative case design (Yin, 2014). We focus on inter- and intra- governmental collaboration networks on digitalisation projects, that is both, between (inter) and within (intra) public organisations. We selected cases based on several criteria. First, variance in state structures and governmental levels had to be present, likely reflecting varying intensities of complexity. The cases had to be beyond their starting phase, collaborative in nature, and linked to the EU Single Digital Gateway (national level) or be a city of at least 50,000 that is considered a digital pioneer and implementing a smart city strategy (local level). This means that the projects are well known in the countries of study.

Our final case selection consists of eight public networks from two sets of European countries: two federal (Belgium and Germany) and two unitary (Estonia and the UK). The rationale behind this is that federal countries are inherently more prone to complexity compared to unitary state structures. This is because they have more fragmented legislative and cognitive frameworks that may be at odds with top-down government-wide initiatives. In addition (semi-)autonomous local governments are less willing to accept centralised control. Within each country, we selected a digital platform in line with the EU Single Digital Gateway, representing the national scale and a smart city network, representing the local scale (see Table 1 for case characteristics).

Case characteristics. This section will outline the key characteristics of the selected cases

Civil registry, Belgium. This project aims to digitise and modernise the Belgian Civil Registry (the database where key citizen information regarding life is done) by moving from a decentralised paper-based system to a centralised digital database. It started in 2010 and was completed in 2019. There was one central coordinator for the project and participation was mandatory.

Smart city policy, Antwerp. This project aims to implement smart city projects in a living urban lab in the city of Antwerp. The project began in 2016 and is ongoing. Two main partners are coordinating the voluntary network.

Online access act, Germany. The project aims to implement the Online Access Act, which requires all levels of government to provide government services (such as car registration, birth registration, and parental leave) online through a single digital gateway, or platform. The project started in 2017 and is mandatory for government levels, it is coordinated by a central coordinating body.

Digitalstadt Darmstadt, Darmstadt. The project aims to develop the city of Darmstadt into an experimental space for designing and testing smart city technologies and includes

Table 1. Key characteristics of the cases selected.

Country	State structure	Case	Level	In-text reference
Belgium	Federal	Civil registry	National	BE
		Smart city policy, Antwerp	Local	ANT
Germany	Federal	Online access Act	National	DE
		Digitalstadt Darmstadt, Darmstadt	Local	DAR
Estonia	Unitary	Employment registry	National	EE
		Sustainable urban mobility plan (SUMP), tallinn	Local	TAL
The UK	Unitary	Government as a platform	National	UK
		Bristol is open (BiO), Bristol	Local	BRI

projects such as implementing smart traffic lights that adjust to real-time traffic. The voluntary project began in 2017 and is coordinated by an arm's length company.

Employment registry, Estonia. The Employment Registry provides a single coherent set of employment data for each person who works in Estonia. Its goal is to enable relevant government agencies access to employee records for different processes (i.e., pensions, health, and unemployment insurance) from a single registry in compliance with the once-only principle. This mandatory project was initiated in 2013 and is still ongoing. There was one main coordinator.

Sustainable urban mobility plan (SUMP), Tallinn. SUMP is a public transport initiative, aimed to improve multi-modal accessibility. The initiative aimed to incorporate an enhanced data-based decision-making framework by systematizing mobility-related data (i.e., traffic congestion, travel times etc.). It was voluntary and ran between 2016 and 2019, with one city department providing coordination.

Government as a platform (GaaP), UK. This project aimed at developing online tools (both citizen-facing and internal) to facilitate the adoption of streamlined digital public services across all UK ministries. It has been running since 2011, is voluntary and coordinated by the UK Cabinet Office.

Bristol is open (BiO), Bristol. BiO is aimed at implementing smart city technologies by establishing a citywide and programmable testbed for experimentation and digital innovation. It was established in 2015, is voluntary and was a joint venture between Bristol City Council and the University of Bristol.

Methodological approach. To empirically test our research questions, an analysis of semi-structured, coded, interviews was used. The interviewees were key actors in each of the cases and were selected via a purposeful sampling approach (Palys, 2008). They included current and former project managers and participating departments, and technological

experts. This coverage of interviewees ensured a balanced assessment of the projects. Between September 2019 and March 2020, a total of 50 interviews across the eight cases were conducted. The MAXQDA software was used to code the transcribed interviews, using a deductive coding guide developed by the researchers. Regular coding meetings took place to ensure consistency between the six native-speaker coders. A coding leader also randomly checked the coding process for consistency (O'Connor and Joffe, 2020).

Results

This section reports the findings of the coding analysis, showing how substantive, strategic, and institutional complexity occur and are interrelated in collaborative digitalisation efforts at the national and local government levels. To increase the transparency of qualitative research (Nowell and Albrecht, 2018), all quotations have direct references to the interview that were undertaken (in an anonymised fashion) indicated at the end of the quote using the following label: country/city – project type– interview number.

Substantive complexity

Substantive complexity within the *national cases* took different forms. Many of the interviewees noted a tension between legislative and practice design aspects of the projects, including different ideas of how to design the platforms themselves to make them universal (United Kingdom (UK)), how much data to collect (Estonia (EE)), who would have access to this data (EE), and legislative changes required to dissolve responsibility required for a centralised system (Belgium (BE)). Others also noted a lack of understanding (both technical and non-technical) across different departments leading to fragmentation. For example, in the UK, one interviewee noted,

> Most government departments historically think that their problem is unique and special. They couldn't possibly be like another department. Therefore, they need to do it themselves. (UK SDG 7)

Similarly, one interviewee from Estonia also noted,

> The biggest challenge from the beginning was whether all the partners perceived the need in the same way and whether they could sell the idea internally to the officials who would use the new register in the first place. So that they are not afraid of it. (EE SDG 3)

In all cases, interviewees noted that actors were "talking side by side" (BE), "being pulled in different directions" (UK) or "having to speak different languages" (EE). When they were able to align each actor's ideas and understanding, the projects were able to move forward. This problem of different alignment also revealed itself when examining the dynamics between different actors in the collaboration in terms of different priorities (BE/UK), organisational culture (BE), and openness to change (BE/UK). For example, in

Belgium, when talking about the need to work closely with the judiciary to update legislative frameworks to allow for a centralised civil registry, one interviewee said,

> Yes [they] had to convince the Ministry of Justice a little bit, [to] go far into the digitalisation and centralisation. The Ministry of Justice has a vision, [and is] conservative. It is legal texts, papers and so on. If we go into a digital and centralised way of working there are many opportunities and different ways to do it. (BE SDG 6)

In terms of complexity related to digital infrastructure, several interviews noted that the starting IT conditions make it more complex, including different computer programmes (UK, Germany (DE), BE) which impacted who participated in the development, what templating languages were used (DE, UK), how individuals communicated (UK), where information is stored (BE), and the rules and regulations related to accessing the data (BE). It also impacted how the actor became involved in the projects, how they interpreted the goals of the projects and their level of engagement therein. In the UK, one interviewee noted,

> For example, government doesn't have a single email system. It doesn't have a single document or Wiki. It doesn't have a single chat system or a single source code repository. All these things exist within silos, or silos within silos. Actually, it can be really difficult to find out what is happening in another corner of government. Or even to be working on the same system for a lot of people can be quite challenging. (UK SDG 7)

In Estonia, the definitions of key stakeholders became a substantive issue that needed to be reconciled to build their platform related to employment one interviewee noted,

> Very trivial things that need to have a common understanding. Who are the employees, how broad is the definition of an employee? (EE SDG 3)

Others noted that the varying nature of digitalisation leads to simultaneous changes including the alignment of technical, services, and planning (DE) and policy performance and timing of new IT services to not overlap existing IT contracts (UK), lack of trust in and understanding of the IT (BE, UK) or the inability to move beyond a narrow frame of mind (BE). For example, in the UK, with reference to improving service quality, one interviewee stated,

> Often, the conversations around complexity, we were pushing back to policy colleagues and the ministers, saying, "Do you realise you're not getting the outcome you want for this policy? That's not because the service has not been designed in a particular way, or delivered by a particular technology, it is that you have oversimplified your understanding of the system. Actually, it's quite a complex system here and you are employing quite a crude policy mechanism." (UK SDG 8)

By contrast, at the *local level,* substantive complexity emerged based on a lack of common language and understanding of the projects at hand. For example, in Antwerp (ANT), one interview noted, "everyone believes in the overall smart city project, but we really talk a different language" (ANT SC 6). Beyond this, like the national level cases, balancing the technological and policy interests of actors (ANT, Bristol (BRI)), which often overlapped with strategic complexity was common. For example, in Tallinn (TAL), one interviewee stated,

> Mobility as an area is a complex issue, clashing different interests and world views you might even say. Bringing together these different substantive interests and perceptions was a challenge and there were certainly differing views on how to go about it. (TAL SC 1)

The struggle between IT development and performance outcomes is also evident from an interview from Antwerp, where they realised, "we are going to play with technology. The fundamental problem with something like smart city is that as we have done it, it is very technology-driven and had little to do with targets" (ANT SC 2). This clash was also seen in Bristol. In Antwerp, they also noted,

> That's a typical technology-driven thing like a smart city. If you're not working from a policy perspective or from a problem or something you want to solve, then you have a very broad [task]... You have a whole kitchen available, but … you don't know what dish you're going to make... So that was really a problem in the beginning. (ANT SC 2)

These examples show that overall, there appear to be more similarities with regards to substantive complexity at the local level compared to the national level projects, with the most common being the varying ideas and perspectives of the many actors involved in the projects. With respect to the starting conditions, the limited IT capacity was more problematic at the national level compared to the local levels, whereas the key issue at the local level was a lack of common understanding of the overarching projects and defining what exactly a 'smart city' entails.

Strategic complexity

Numerous themes emerged regarding strategic complexity at the *national level*. First, similar to substantive complexity, the different perceptions of problems led to diverse needs and solutions for the development and design of IT (BE/UK). For example, technical solutions collided with policy and service design requirements in the UK and Germany. In Germany, one interviewee noted,

> So, in principle, there were those who have now pursued a more ambitious path and have really worked more in the direction of this digitisation platform for Germany and the others who then said, "No, come on, it's all far too much and far too complicated and too expensive and too complex for me, and they didn't yet have an infrastructure and architecture and so,

> therefore, said, "I'll only do the minimum that is required by law, I'll make myself accessible in other projects". (DE SDG 5)

This links directly to institutional complexity in so much that different services affected the internal workings of the organisations differently, for some, it required a complete re-organisation of corporate operations, for others, it was an add-on (BE/UK). For example, in the UK case, one interviewee noted the tension between the degree of complexity and collaboration, particularly showcasing that less complex platform projects related to communication (Notify) and payment processing (Pay) were easier because of their discrete, focused, and simpler nature. They explain that,

> The more complex the technical solutions, i.e., the more complex the problem they were trying to solve, the harder it was to achieve cross-departmental collaboration because they became…very definitive and prescriptive in the kind of business operation that a department had to operate. Whereas things like Notify and Pay, which are quite discrete processes at the edge of a business, were much easier to adopt. Complexity was an absolute, major factor. (UK SDG 5)

In the case of Belgium and Germany, the delegation of authority of distinct levels of government was also used. For example, in Germany,

> The biggest challenge for us is actually to unite all the *Länder* with one goal for a project of this size without a "real structure" and to actually get all the participants, all the stakeholders to follow the course of the project. (DE SDG 1)

The challenge of interoperability on the technical level was reflected by an interviewee in Germany who noted,

> Yes, it sounds so simple the portal network. Yes, we really have to build something that somehow makes it easy to get from A to B…But in practice, it's actually super, super hard to create a uniform look in a completely heterogeneous landscape. It's a really hard task and also takes time. (DE SDG 5)

In these cases, interviewees across all the national cases noted the difficult nature of collaboration, and how the complexity of the projects themselves exacerbated this.

Strategic complexity at the *local level* was interrelated with substantive complexity and mostly focused on the inability to align the goals of the projects, which led to the development of different solutions. In most cases, this was a clear clash between technical solutions and policy performance. For example, in Antwerp, one interview noted,

> That, for us as a research centre, things that we set up jointly, didn't go far enough and for the city often went too far, too far as in the tests that we've done are not immediately scalable to the rest of the city because it's still too exploratory, too innovative, also often still too expensive innovation, a prototype that just costs a lot more money than if you just buy something from a company. (ANT SC 4)

In Tallinn, the broader goals were similar, but there was uncertainty on how they could be achieved including agenda-seeking and losing sight of the oscillating issues around the project. One interviewee stated,

> I'd say it's not so much that you're imposing your own agenda, to some extent it's maybe that you forget that there are other issues to deal with other than what's important to your organisation. (TAL SC 1)

In Bristol, the different solutions from the partners led to projects that were not "coming together" (BRI SC 3). In Antwerp, there was an issue of scalability versus research outcomes. A clear example of the overlap between strategic and institutional complexity was observed in the Bristol case. In this case, the two partners started to diverge in key areas of the project, including the need to adopt more strongly regulatory aspects into their IT operating systems. This need caused a strain in their relationship. As one interviewee stated,

> It's moved from, "we're developing a prototype tested," which was developed in an environment that is basically free of industrial quality standards, into an environment now where it needs to be a stable, [IT] operating system that's operated, maintained and upgraded. (BRI SC 2)

In Darmstadt, some interviewees also noticed the difficulties in coordinating joint data management.

Overall, there is a convergence of strategic complexity at both the national and local levels as different problematizations lead to different solutions. There were also similarities across both levels of government in the clash between technical and service innovation – with some actors more heavily focused on the technical aspects of the digitalisation process, while others focused on the potential policy impact. It was also clear at both levels of government that goal alignment was a critical point of contention.

Institutional complexity

Several themes related to institutional complexity emerged at the *national level*. First, in addition to technical applications, legislative changes to ministerial responsibility also needed to be developed simultaneously, often creating new forms of strategic complexity as different actors came to the table with quite different needs and IT solutions (BE, EE). It also challenged existing power structures and traditional roles in government. For example, in the UK, one interviewee noted,

> It can be, not quite adversarial, but because this idea of cross-government platforms, cross-government working challenges power structures, and in combination with digital transformation is challenging and replacing existing positions and roles, or positions and roles kind of change, there is a lot at stake. (UK SDG 7)

The structure of government was a second theme to emerge that added to institutional complexity. In the case of the UK, this was due to large ministerial autonomy and the rotating personnel typical of a Westminster and open career system.

> The complexity in government comes from the fact that it's completely obfuscated. There's no way of reading, from the list of departments, like what services are being delivered and who's delivering them, and so it makes collaborating really difficult. (UK SDG 2)

For Belgium and Germany's national projects, this was due to the federalist nature of the country and the necessity to bring together actors from various levels of government. For example, in Belgium, one interview reflected on regional differences, in noting "there was a difference in views and ways of thinking between north and south for example in the country. And small and large municipalities" (BE SDG 2). In Germany, one interviewee highlighted the salience of both the technological development as well as coordination complexity across various levels of government:

> It's really the sheer size and breadth //yes// that we, we are basically on the road in the entire German administration (…) Plus the development of digital infrastructures, of course, and that across the levels of federal, state and local government, indirect administration. In width and in height, horizontally and vertically. (DE SDG 6)

In Belgium, Estonia and Germany balancing the legislative frameworks of the countries with the goals of the project became tantamount to bringing the collaborations forward and ensuring they remained aligned. In the Belgium and Estonian cases, institutional complexity was created due to the technological and organisational changes required to implement the projects. In Estonia, for example, one interviewee noted,

> …Another thing is that you have to analyse other laws, not just the Health Insurance Act and the Taxation Act. For instance, like the Social Tax Act. The elements regarding data exchange between notaries were forgotten and left unchanged in the Taxation Act. These things, where other laws are connected, should be observed more carefully by the initiators. (TAL SDG 5)

Examining institutional complexity of collaborative projects at the *local level*, the most common theme that emerged was related to the legal rules and regulations related to procurement, the project approval process, and handling overlapping ownerships (all cases). This complexity was heightened by the multiple actors involved in the projects and deciding on how to create a balance between centralised and decentralised structures alongside existing authority and ownership (DAR, TAL). For example, in Darmstadt, one interviewee noted,

> We have the business enterprises. We are talking about levels, corporate advisory boards, boards of directors and CEOs. We have an ethics and technology advisory board of science, but also politically driven. (DAR SC 1)

Table 2. Summary of findings.

Complexity/Government level	National	Local
Institutional	Diversity and formality	Homogeneity and informality
Strategic	Lack of interest and 'going it alone'	Join interest and power distribution
Substantive	Disjoint frames of reference	Mismatch between technical and service goals

Overall, the local cases did not appear to be highly impacted by legislative complexities compared to the national level cases; instead, the complexity that emerged was more focused on the project governance and processes as well as procurement. One exception was in Tallinn, where interviews noted that overlapping authorities (between regions) did impact the way the project was designed. At the national level, the balance between the legislative frameworks and technical capacity was a critical area of institutional complexity. Balancing the regional differences (and powers) that added to the institutional complexity, particularly in the federal countries, was also a common theme to emerge. This may be because many of the national cases involved more multilevel actors, larger budgets and scope, and core government services, which are traditionally siloed. Table 2 summarizes these findings.

Discussion

The process of government digitalisation touches every aspect of public sector organisations. Due to its boundary-spanning nature, it also forces public sector organisations to collaborate to achieve their digitalisation goals. Our paper was therefore premised on the notion that collaborative digitalisation projects that aim to unite a greater diversity of actors, while operating in highly formal environments, are more prone to complexity (Mintzberg, 1983; Thomson and Perry, 2006). Because of this, digitalisation adds another level of complexity to the already complex task of collaboration management.

Overall, we presented two propositions. The first is that the dynamics of complexity in digitalisation would differ between national and local projects. The second was that projects at the national level would exhibit a more intense level of complexity. Our results generally showed large overlapping complexities related to introducing digital technologies into government, and this was indeed more salient at the national rather than local level. The substantive and strategic complexity was evident in the projects' struggles with managing each actor's needs and ambitions, while the institutional complexity required to engage in inter-organisational collaboration emerged as projects pushed towards the edge of legislative frameworks. Despite reporting less complexity, local projects struggled with balancing implementing IT for the sake of the technology itself compared to the sake of service improvement. As a result of this, the findings provide evidence to support the proposed propositions. We, therefore, provide three overarching contributions to the literature.

First, complexity in digitalisation is indeed overlapping and interdependent. Within the context of the national level cases, the complexity emerged from the starting conditions, attempting to convene a variety of public organisations. In many of the cases, technical skills imbalance, coupled with unclear legislative areas regarding data development, access, and management made projects increasingly difficult to navigate. Added to this was a clear variation in the goals of the digitalisation project for each actor as well as the necessity to merge both the technical aspects of the digitalisation projects with the (re-)organisational aspects necessary for the projects to achieve their goals. These findings underscore the holistic approach necessary for governing digitalisation projects (Gil-García, 2012), meaning, that the digitalisation process must then be paired with deep institutional understandings and change management skills.

Second, national-level projects tend to show more complexity due to the horizontal and vertical collaborative arrangements, as well as the more siloed government structures. In terms of how complexity takes different forms, government departments not working closely can lead to problems with technical developments, lack of interest in collaborating, or 'doing it alone' (like in the UK). The power imbalances in the projects exacerbated this, clearly showing the problems with following individual over collective goals (Klievink and Janssen, 2009), how to operate across jurisdictions (Waardenburg et al., 2020), and how to manage frameworks of accountability (Mergel, 2018). This complexity was also particularly focused on the institutional level, and the need to organise large heterogeneity of actors at various levels of government, where authorities often overlapped, and technical knowledge, funding and power imbalances were evident. This follows stipulations regarding the complexity of horizontal and vertical networks, and the necessity for a clear coordinated approach (Meijer, 2015; Willem and Lucidarme, 2014). The projects also found themselves having to balance legislative, organisational, and technical developments simultaneously.

By contrast, at the local level, complexity did not appear to be as problematic, at least at the institutional level. In most cases, the engagement was easier as there were fewer partners and clearer responsibilities. However, the smart cities did share similar elements of the national projects especially with respect to overlapping authorities if the projects went outside general jurisdiction (i.e., Tallinn). As a result of this, the concept of the 'single meta narrative' can be challenged (Eppel, 2012) as substantive complexity in balancing the interests of those working on the technical side of the projects, and those working on the applied side were evident. These findings thus follow the work of Karppi and Vakkuri (2020). In terms of institutional complexity, IT development was driving the process, with the legal regulations (for example, related to procurement), coming only after the IT was developed. Although the focus of this paper has been to provide empirically grounded insights into how complexity occurs rather than how it is managed, this lays the foundation for future research on counteracting public management strategies. For example, one might pursue Minzberg's(1983) suggestion of a stepwise approach to taming complexity, or Klijn and Kopenjan's (2014) emphasis on the mediating potential of network managers. The final contribution of the paper is its cross-national perspective. Indeed, finding trends in analysis that includes eight different cases, including varying political structures, levels of government, and types of projects points to a level of

universality that is evident across large-scale digitalisation projects. This is quite important as up until now, the literature has been dominated by single-case studies.

Limitations

Despite our interesting findings, some limitations should be mentioned. First, as this is a study based on interview data, we rely on information that is being recalled by specific individuals and could introduce bias in our sample. While we attempted to mitigate this by interviewing several individuals involved in each of the projects (between five and eight individuals) and using documentary analysis, this can only be fully mitigated through mixed methods research designs. Relatedly, with this research, we specifically aimed to address the gap in the digitalisation literature regarding the dynamics of intra- and intergovernmental collaboration. However, since all the projects we studied relied to some extent on outsourced components, future research should explore the projects' intersectoral relationships, such as with suppliers of the technologies used. These can then be contrasted with the collaborative dynamics identified in this paper.

Second, this analysis is only a snapshot of project development and does not capture how the subcomponents interact over time. While this would have been beyond the scope of an eight-case analysis, future research should include this in its design.

Third, the cases themselves differed in terms of the projects' level of technological sophistication or national digitalisation progress, which can affect the degree of complexity present in digitalisation as well as the expertise in managing it. Both are aspects that were beyond the scope of this design but are worth exploring in follow-up research. Similarly, future research could consider the effects of country size, tradition, or national degree of decentralisation.

Finally, due to the multi-lingual nature research design, there is a threat of inadequate semantic equivalence within the analysis. The researchers took several steps to mitigate this from the interview design phase, through to the coding and interpretation phases, for example, through several meetings, revisions, and discussions related to context and choice of working in each of the languages, but there is still a chance of linguistic misinterpretation.

Conclusion

Overall, complexity emerges from a project's cross-cutting nature which requires different actors and functions across organisational boundaries, increased security for task interdependence, and a complete re-organisation of work processes and technical requirements, making digitalisation projects additionally unpredictable and complex (Asgarkhani, 2005; Dawes, 2009; Klijn and Koppenjan, 2014; Ramon Gil-Garcia et al., 2007; Ran and Qi, 2019; Uppström and Lönn, 2017). This underscores the ironic symmetry that the very problem that motivated collaboration in the first place (reducing complexity) can only be addressed by temporarily exacerbating it (increasing complexity). We also showed that digitalisation tends to amplify the interrelatedness of the different types of complexity. While awareness of this is crucial for those who are to

navigate digitalisation projects, it also suggests that current trends can largely be captured by existing analytical concepts informed by complexity theory, calling into question the need to 'reinvent' public management theory in response to digital progress. Breaking down complexity into its parts thus allows for finding targeted coping mechanisms, which opens up future research that focuses on public management interventions that can be used to guide dynamics effectively.

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Cross-Organisational Collaboration Management of Digital Innovation in the Public Sector – The Case of the Estonian Employment Register

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Abstract:

Cross-organisational collaboration management has been an important topic in academic literature, representing the nexus of modern governance arrangements. Organisational boundaries are becoming increasingly blurry with continuous digitalisation through new interaction patterns, resulting in the proliferation of cross-organisational collaborations across sectors and within the public sector. This study contributes to the existing literature by analysing cross-organisational collaboration management within the public sector through the case of the Estonian Employment Register. The author conducted semi-structured interviews with engaged stakeholders and coded the data with a concept-driven and data-driven coding scheme for the analysis. The interviews were analysed for occurrences and co-occurrences. The case highlights the role of system context (pre-established connections, decentralisation, digital infrastructure), process challenges (differences in perspectives, organisation-centric approach, power imbalances) and management interventions (contingent leadership, shifting roles, trilateral connections) for cross-organisational collaborations. The findings demonstrate the importance of pre-existing informal connections in shaping the available alternatives for instruments. Digitally capable agencies can capitalise on opportunities for digital innovation through their technological capability and reputation. The key challenges remain with expanding the cognitive framework beyond the established interaction arenas to adapt to perspectives beyond the initial networks. The ability to maximise the potential of digital innovation is also contingent on designing compatible human interaction processes to manage machine interactions.

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Keywords:
collaboration, digital innovation, institutional design, leadership

1. Introduction

Over the past few decades, public administrations have experienced the growing relevance of cross-organisational collaborations. Heightened turbulence, increasing user expectations, the complexity of problems and dwindling resources have resulted in the pressure to adapt to changing conditions (Hartley et al., 2013; Bryson et al., 2006; Carstensen et al., 2023). However, the inability to solve problems in isolation has shifted perceptions of the benefits of collaboration, also known as collaborative advantage, resulting in a proliferation of new collaborative initiatives (Vangen & Huxham, 2009; Torfing, 2019). Digital innovation has only increased perceptions of the relevance of cross-organisational collaborations (Pardo et al., 2010). The demands towards increasingly personalised and customer-centric digital solutions require crossing organisational boundaries to design human interactions that can coordinate machine input from different automated processes (Bertot et al., 2016; Kattel et al., 2019; Desouza et al., 2020). Previous research has highlighted the complex dynamics between digital innovation and collaboration – on the one hand, it serves as a precondition for change in digital innovation through better-informed decision-making and broader acceptance, yet the new interdependencies also lead to opportunities for collaboration through digital innovation (Vial, 2019).

The management of these collaborations incorporates voluntary instruments alongside existing traditional hierarchical measures, as new stakeholders with varying interdependencies necessitate different approaches (O'Leary & Vij, 2012; Emerson et al., 2011; Ansell, 2016). However, the study of these collaborations has remained inconsistent due to a number of reasons, from limited consideration of external factors to oversimplified conceptualisation of collaborative arrangements (Emerson et al., 2011; Bouckaert et al., 2010). The existing literature often focuses on cross-sectoral collaboration between governmental and private or third sector actors (for example, see Ansell & Miura, 2019) with management within the public sector receiving limited attention (for example, see Picazo-Vela et al., 2017). This research aims to fill this gap by focusing on cross-organisational collaborations within the public sector, providing a unique contribution to the field. Analysing it would improve understanding of the enablers and barriers of collaboration and highlight best practices and shortcomings for collaborative digital initiatives. Furthermore, studies of cases beyond the dominant Anglo-American and Scandinavian traditions would inform researchers regarding the applicability of existing knowledge in different contexts.

This study analyses factors relevant to cross-organisational collaboration within the public sector through a single case-study approach. The chosen case, the Estonian Employment Register, provides a successful example in a context supportive of digital

innovation that has become the basis for further evolution of the solution. The paper uses qualitative content analysis to systematise and analyse distinct factors present in qualitative data (Schreier, 2012). The main research questions of the paper that will be studied are the following:

- What are the key aspects in the system context, collaborative process challenge and management intervention that have affected the development of the Estonian Employment Register?
- What are the institutional and management-related enablers, barriers and future challenges of the Estonian Employment Register?

The paper is divided into five parts. The first section covers the existing literature on cross-organisational collaboration, which informs the analytical framework. The above is divided into three main parts: system context, collaborative process challenges and intervention measures. The second section covers the research methodology, followed by the third section focusing on the research findings from the case. Two final sections are dedicated to the discussion and conclusions from the study.

2. Cross-organisational collaboration management

The concept of collaboration varies from continuum based to dichotomous dynamic vs static approaches that cover a number of aspects from the engagement of various actors as well as the ability of the collaboration to evolve beyond its initial intentions (Peters, 2015; O'Leary & Vij, 2012). For the definition of collaboration, the author relies upon Huxham (1996), who outlined collaboration as "A form of working in association with others for some form of mutual benefit" (Huxham, 1996). Collaboration can vary based on the composition of stakeholders, goals and rationale, and imposed rules (Pardo et al., 2010; Agranoff, 2006). With the different forms of collaborative arrangements, there is also a variation in relevant affecting factors, including the system context, process challenges and management.

2.1. System context

Collaborative arrangements are affected by several external factors creating opportunities or constraints, from broader institutional framework to pre-established cross-organisational relations and cognitive convergence (Emerson et al., 2011; Pollitt & Bouckaert, 2011; Jugl, 2022). The existing formal setting, from administrative features and institutional arenas, shapes individual stakeholders' approaches to new initiatives (McGuire, 2002; Jugl, 2022). The legal framework provides public actors the mandate and autonomy to steer change (Bingham, 2008). It can vary from mandates to a single organisation within a policy field to overlapping jurisdiction between agencies, necessitating interactions and resource competition (Kenis & Provan, 2006; Bingham,

2008), which shapes the structural embeddedness by creating formalised interaction arenas (Quick & Feldman, 2014). Alongside formalised arenas, the strength of informal connections can alter the use of resources and perspectives (Ansell et al., 2023). In the context of small states, this is even more accentuated by the fact that an individual fundamentally impacts the competencies and capabilities of entire organisations (Randma-Liiv & Sarapuu, 2019).

With the advent of digital innovation, the system context has expanded to include various technological determinants. The underlying technological infrastructure and motivation for standardisation shape the technological readiness of actors (Gil-García & Sayogo, 2016). The legal framework includes conditions for ownership, data-sharing, information protection and limitations surrounding sensitive data and cross-organisational data exchange (Margetts & Dunleavy, 2013). The technical architecture and the interoperability with other digital solutions shape potentialities for new initiatives (Pardo et al., 2010; Gil-García & Sayogo, 2016). Intra-organisational drivers also possess a significant role (Bryson et al., 2006). Organisational culture shapes assumptions and perceptions of individuals regarding problems and solutions, which creates biases towards specific approaches (Pollitt & Bouckaert, 2011; Kattel et al., 2019). Establishing an innovation-oriented culture affects the ability to perceive benefits from innovation based on adaptability and organisational learning (Van Der Voet et al., 2015; Wynen et al., 2013; Salge, Vera, 2012). The adoption of digital technologies is contingent on the capacity of stakeholders to interpret and incorporate solutions into existing processes, with increasing complexity resulting in the possibility towards unintended deviations (Bullock et al., 2020). The external factors from the system context can act as inhibitors and enablers towards implementing new digital innovations, shaping the environment where the new solutions are introduced and providing possible avenues for further deviation and evolution.

2.2 Collaborative Process Challenges

A collaborative process entails different challenges that emanate from external and internal sources affecting stakeholders (Agranoff, 2006; Bryson et al., 2006; Emerson et al., 2011). The challenges can be related to substantive aspects, from varying perceptions of problems and solutions, strategic or institutional dimensions, and disparity in resources committed and conflicting goals. Complexities can emerge on a substantive, strategic and institutional level through challenges with cognitive perception, organisation-centric goalsetting and limitations from overlapping jurisdictions (Klijn & Koppenjan, 2015). The substantive complexity manifests in interpretations of problems suffering from bounded rationality and "blind spots" (Raadschelders & Whetsell, 2017; Head & Alford, 2013). The reliance on expertise-based solutions derived from empirical knowledge does not consider the value-based environment affecting decision-making (Head, 2022; Wegrich, 2019).

Organisational values, resources, and priorities shape the desirable goals, which leads individual actors to choose their behaviour, leading to strategic complexity and

power imbalances (Klijn & Koppenjan, 2015). Varying perspectives, disciplinary approaches and organisational biases steer organisational behaviour towards bartering (Torfing, 2019). In a context of competition for resources and support, actors are further incentivised to opt for strategies towards autonomy (Wegrich, 2019). The strategic behaviour can create distortions through asymmetric power positions in the collaboration (Huxham, 2003; McGuire, 2002; Hartley et al., 2013). Distortions can occur through various means, from limiting the engagement of different actors to prioritising preferred perspectives over others by limiting negotiations.

Actors operate in various interaction arenas, each with distinct values, norms and rules, leading to interdependencies between arenas, which fosters distinct patterns of perceptions and interactions to appease the stakeholders in different arenas (Klijn & Koppenjan, 2015; O'Leary & Vij, 2012). Actors must balance commitment and resource use between the interaction arenas (Klijn & Koppenjan, 2014), which can foster conflicts, as actors face rapid shifts in interdependencies with highly turbulent situations subjecting actors to previously unknown domains with limited resources (Boin, 2019).

Another critical challenge collaborations may face is risk (Brown & Osborne, 2013). Public sector organisations are subject to more scrutiny than private initiatives with a limited tolerance of failure. The uncertainty present in innovative initiatives creates an amplified perception of risks (Flemig et al., 2016). Risks can originate from different sources, including unexpected changes in behaviour and reactions from users, engaged organisations and the wider community (Brown & Osborne, 2013). Failure within the arrangement either with the solution or with participation can lead to a loss of resources and legitimacy for organisations (Flemig et al., 2016).

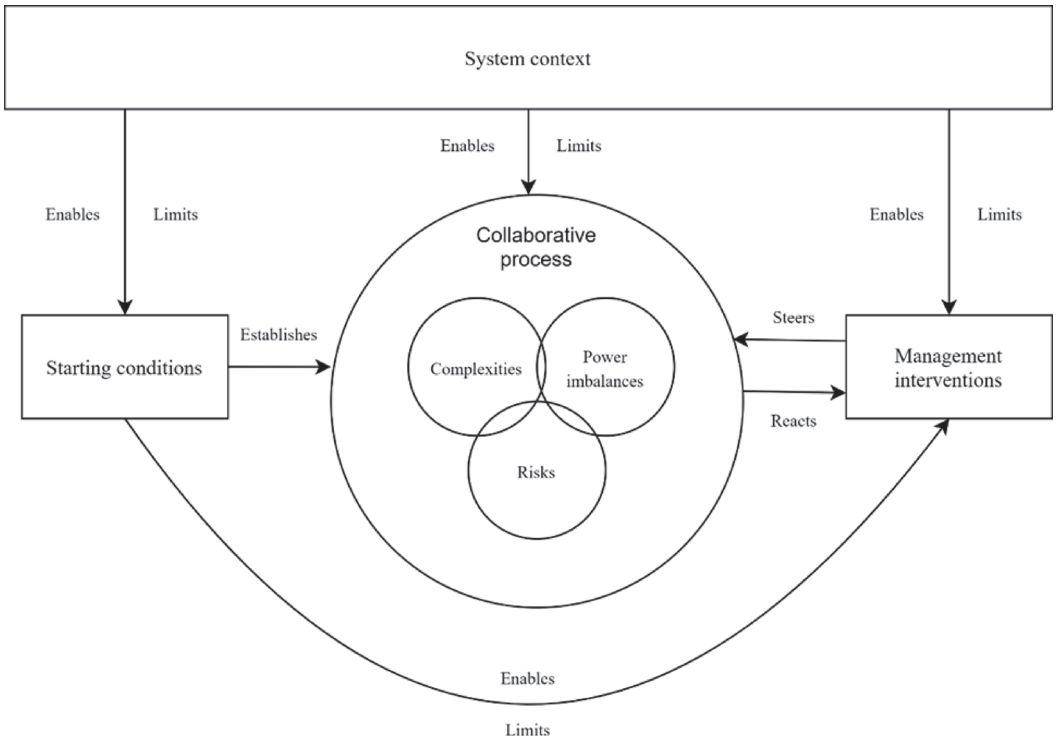
2.3 Management intervention

The actors can utilise a variety of instruments to steer collaborative processes, which is crucial for both the management of the problems experienced during the collaborative process and also for managing the idiosyncrasies of the context. A prominent differentiation is between the use of institutional design (structure) and leadership (agency) (Torfing, 2019). Institutional design is crucial for sustaining long-term collective behaviour, as the fixed rules, values and norms, both formal and informal, provide necessary predictability and stability (Klijn & Koppenjan, 2006). Rules can refer to interaction norms, including information exchange, membership entrance, role designation, or the surrounding arrangement, including mandate and task deference (Klijn & Koppenjan, 2006; Torfing, 2019). Design must balance agility for maintaining adaptability in turbulent situations and stability for providing throughput legitimacy (O'Leary & Vij, 2012; Carstensen et al., 2023). The power distribution through administrative and coordinating activities enables resource dependencies between various stakeholders based on the actor's position, surrounding environments and goals (Kenis & Provan, 2006). Positive feedback mechanisms increase stakeholders' willingness to adapt and contribute (Hartley et al., 2013). Negative feedback or unwillingness to collaborate can increase participation aversion (Wegrich, 2019).

Leadership is vital for the agility to steer stakeholders actively (McGuire, 2002). Agency can be exhibited both formally and informally, affecting day-to-day and strategic management (Ansell & Gash, 2007). Agency may exhibit various forms, with a prominent distinction being the transactional vs facilitative role dichotomy (Ricard et al., 2016; Bardach, 2015). Transactional leadership depends on stability, as it relies on agreed-upon institutional arrangements, where top-down command-oriented measures remain the driving force (Ricard et al., 2016; Jacobsen & Anderson, 2015). Facilitative leadership encompasses a form of leadership that strongly focuses on ensuring a positive environment for participation by activating stakeholders through framing to incentivise increased contribution, mediating to mitigate negative cycles and catalysing to foster new ideas (McGuire, 2002; Torfing, 2019). A leader's position is enhanced through positive feedback loops and "small wins", as the primary power source originates from the existing trust, shared meaning and beneficial framing (Head, 2022; Lewis et al., 2017).

Figure 1:

Visualisation of the analytical framework



Source: Author's own, based on literature review, 2024

3. Research methodology

This paper opted for a single-case study methodology with an extreme case within the Estonian context and a more typical case (considering the level of technological capabilities of tax agencies) within the global context. An extreme case enables the research to find new possible dynamics that have received limited insight into the literature (Van Thiel, 2014). The Employment Register represents a successful cross-organisational initiative with positive perceptions developed over the subsequent years as a building block for solutions that have enabled rapid adaptation during crises. Studying cases of digital innovation initiated by executive agencies in a conducive environment enables the analysis of the conditions for overcoming challenges and fostering change. Single-case study research provides rich empirical information necessary for subjects in public administration, especially given their uniqueness and is suitable for more explorative approaches that this study adopted (Van Thiel, 2014).

Data collection and analysis involved a qualitative content analysis of semi-structured interviews and supporting documents. The analysed period involves a timeframe from 2013 to 2019, whereby the document search aimed to comprehend the perspectives of engaged stakeholders and the framing within the cross-organisational collaboration. The document search relied on a checklist of different documents (Bazeley, 2013), including strategic documents, legislative acts, press releases, media statements connected with the collaborative arrangement, and key processes related to employment data. The strategic documents included development plans for the public sector organisations covering the development period of 2014, which were further complemented through a search of relevant legislative acts (nine legislative acts and one regulation) through two information systems containing system architectural and legal information - Administration system for the state information system (RIHA) and information system for the information of the proceedings of the legislative drafts (EIS). Finally, the paper also covered press releases from engaged stakeholders regarding the solution.

The author interviewed six individuals during the period of October-November 2019. The paper adopted a combination of snowball and convenience sampling. The sample was developed based on the information received from the interviews and the RIHA search. Engagement from the initial phase was deemed a necessary criterion, but the level of engagement was allowed to vary to provide differences in perspectives. The interviewees involved the representatives of the core and peripheral actors involved with the initiative. The snowball sampling failed to produce interviewee opportunities with some peripheral actors (Police and Border Guard Board; Social Insurance Board), which was linked to both the limited relevance of the stakeholders as well as issues with personnel turnover. It resulted in a limitation, affecting the perspectives provided for the study, which was mitigated by the document search. The research findings were anonymised, and each interviewee was allocated a code (between I1-I6), which was ordered according to their relevance (interviewee perspective, role and organisation)

within the initiative. The roles included project manager, working group member, steering committee member, and member for follow-up developments for the study. Some interviewees possessed dual roles (i.e., the steering committee and working group member), increasing their relevance within the initiative. I1 and I2 reflect the coordinator perspective, I3 and I4 reflect the core actor perspective and I5 and I6 reflect the peripheral actor perspective. The interviews lasted between one hour and 20 minutes and two hours.

The analysis involved several stages of coding with a focus on occurrence and co-occurrence between codes. The coding scheme is based on concept-driven and data-driven approaches (Schreier, 2012). The deductive approach (concept-driven) for developing an initial coding scheme was based on a review of innovation, collaboration, public management, public administration, technology implementation and e-governance literature, focusing on middle-range theories. The theoretical literature provides the space for specific a priori assumptions for the findings, but the data-driven approach maintains the flexibility for any emergent themes (Bazeley, 2013). A coding scheme was used that consists of 81 codes divided into four main categories (for more information on codes, see Appendix I)[2]. The main categories involved meta-codes, system context, collaborative challenges, and intervention measures. The code definition included its name, main category, definition, examples, and rules in writing memos. The segmentation criteria of the coding unit were based on the meaning unit, which represents a standalone idea within the text. The use of semi-structured interviews guided the choice to approach the segmentation criteria through the meaning unit instead of another formal criterion (i.e. paragraph). The segmentation process resulted in 308 coding units related to the main categories and their respective subcategories. The codes were used 733 times during the coding process of the interviews, with a coding unit coded on average 2.37 times. The author conducted two test coding sessions during separate sessions to test the validity of the results and limit possible researcher bias. The validity of the results was tested through the percentage of agreement (PoA) and the kappa coefficient, conducted through the MaxQDA 2018 program. Percentage of agreement refers to a measure to test intercoder reliability by calculating the number of times the coding units are coded in agreement with the codes, divided by all the coding units (Schreier, 2012).

$$PoA = \frac{Number\ of\ coding\ units\ on\ which\ coders\ agree}{Total\ number\ of\ coding\ units} \times 100$$

The agreement percentage has limitations, as it does not consider the possibility of agreements by chance. Due to the complexity of the coding scheme, the possibility of

2 The initial version of the coding scheme was developed during the research within the H2020 project TROPICO (GA no. 726840)

chance agreements was reduced considerably. To further mitigate the potential for chance agreements, the intercoder reliability was also checked through the kappa coefficient. The kappa coefficient takes into account the probability of two coders randomly selecting and agreeing on the same code.

$$Kappa\ coefficient = \frac{(percentage\ agreement - agreement\ by\ chance)}{(1 - agreement\ by\ chance)}$$

The agreement by chance refers to the hypothetical probability of chance agreement. Within MaxQDA, it is calculated through 0.5 to the power of the number of codes selected for analysis. On a subsample of 20 per cent of all coding units, a percentage of agreement of 82% per cent and a kappa coefficient of 0.82 were achieved. Although some of the subcategories possessed a lower level of PoA than the abovementioned, the coding scheme was deemed acceptable. The depth of the coding scheme led to a higher level of inconsistency during coding than is usually the case with a single coder, lowering the kappa coefficient and percentage of agreement. The level of agreement achieved was deemed acceptable (Neuendorf, 2002). The results are summarised through the respective categories and subcategories. The chosen methodology entails two main limitations concerning validity and reliability. Firstly, the findings are difficult to generalise due to context-specificity (Van Thiel, 2014). Secondly, the factors being examined rely considerably on the perceptions of individual engaged stakeholders, which can lead to biases.

4. The Case of the Estonian Employment Register

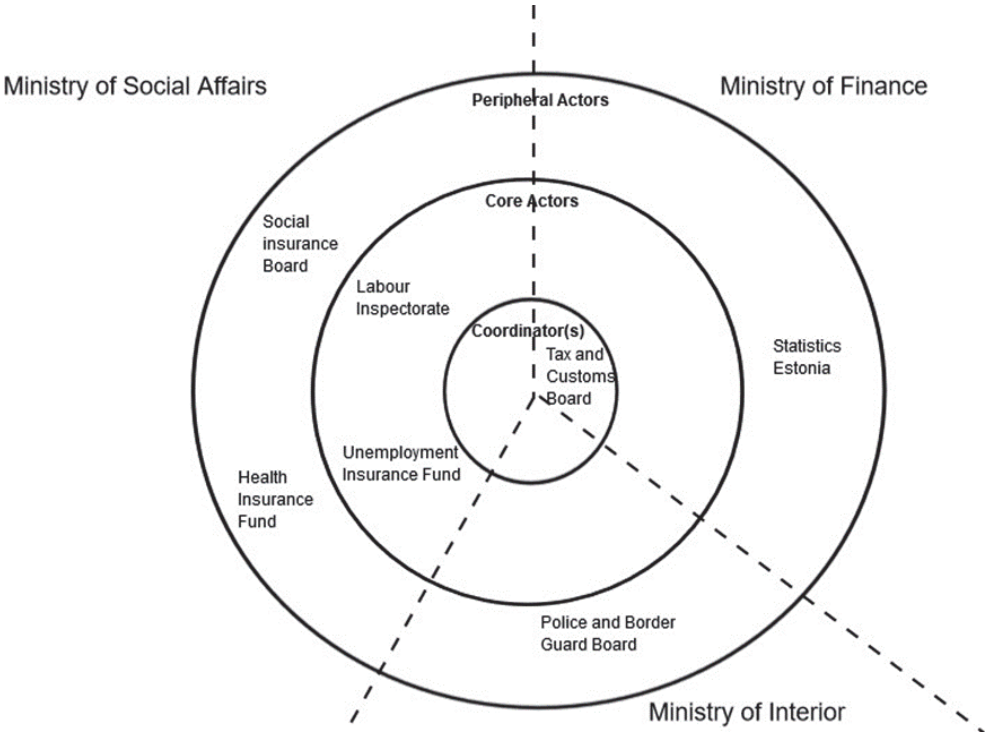
The Estonian Employment Register was originally introduced in 2014, and the initiative has been headed since its inception by the Estonian Tax and Customs Board (ETCB). The employment data of individuals is submitted to the register after entering an employment relationship, which is used as a basis for determining the obligations and eligibility for different benefits (i.e. unemployment benefits, health insurance). Over the years, there have been problems with many unaccounted wages, leading to reduced tax revenue, lack of social safety nets and abuse of employee rights. The improvement of control and supervision measures on tax discipline had been on the ETCB agenda following its formation in 2004. For 2013-2016, reducing the share of the shadow economy to remove unfair competitive advantages became one of the main goals[3]. To achieve this, the ETCB started several initiatives, including the Employment Register.

3 This goal was formulated in the ETCB's development plan and highlighted by the Minister of Finance and Director General of the ETCB.

Whilst the Employment Register began as a simple sector-based solution intended to meet the goals highlighted above, it transitioned into a comprehensive register incorporating all the employment data into a single electronic environment over time. The above was the result of the stakeholders' perceived opportunity for improvement in handling employment data and a broader movement towards adopting the once-only principle. An overview of the involved stakeholders is highlighted in Figure 2.

Figure 2:

Actors according to importance within the collaborative arrangement and ministerial governance



Source: Author's own, based on interviews, 2024

The Employment Register revolved around key actors mandated to operate with employment data to conduct different processes. These processes entail receiving tax income and monitoring correct tax discipline (ETCB), monitoring the eligibility and providing unemployment services and benefits (Unemployment Insurance Fund), monitoring safe working conditions, status and rights for employees (Labour Inspectorate, Police and Border Guard Board), monitoring the eligibility for health insurance (Health Insurance Fund), the eligibility for pension (Social Insurance Board) and conducting analyses on employment data (Statistics Estonia).

The following subsections outline the research findings according to the analytical framework of the system context, collaborative process challenges and management interventions. They are structured to highlight the findings that were the most predominant regarding the occurrence and co-occurrence of codes.

4.1. System context in Estonia and the role of digital innovation

System context was referred to 78 times, with the most frequent codes being efficiency (14 times), collaboration history/pre-existing network (11), and starting capacity (nine). The co-occurrence between high importance and system context highlighted collaboration history/pre-existing network (three), efficiency (two), and starting capacity (one). The co-occurrences of low importance occurred in the culture and features of the public administration system (one).

The findings indicate the relevance of several system context factors - the Estonian administrative system, technological infrastructure and employment as a policy field. On a central government level, Estonia operates a decentralised administrative system, where ministries are predominantly focused on policy formulation, resulting in reliance on executive agencies for administrative and professional input (Sarapuu, 2011; Sarapuu, 2012), leading to digitally capable agencies being the initiators for bottom-up developments with limited steering from ministerial level (Kattel & Mergel, 2018). The decentralisation has enabled reform-oriented agencies to develop technological capability, exhibiting the ability to introduce radical technological solutions and recognise new opportunities due to a strong starting capacity (Lember et al., 2018).

Regarding digital innovation, Estonia has retained a highly reform-oriented public sector throughout the past decades, with digital by default often being the norm for initiatives due to the potential for improved quality and efficiency (Kattel & Mergel, 2018). Focus on digitalisation is enabled by the high level of trust towards digital solutions (Lember et al., 2018). The underlying digital infrastructure with decentralised registries, X-Road infrastructure to connect various registries, electronic identification (eID), and state portals are the core building blocks for any digital developments and their expansion. The X-road provides the interoperability platform for existing decentralised databases and a data exchange layer that can be used by both public and private actors (Kattel & Mergel, 2018).

The collaboration history with the Employment Register initiative centred around the trilateral connections between the ETCB, the Estonian Unemployment Insurance Fund (EUIF) and the Labour Inspectorate. The collaborative supervision of employment activities facilitated informal connections, improving the understanding of the needs of different actors (I3, I4, I6). The mounting pressure to improve employment data collection for the trilateral collaboration led to a concerted interest towards change (I1, I2, I3, I4). Unaccounted labour led to inefficiencies in tax revenue, competition, and supervising activities (I1, I2, I4). As a result of the mutual

acknowledgement of the issues within the field of employment and the capacities present, the system context was conducive to change.

4.2 Process dynamics and challenges within the Employment Register initiative

Collaborative process challenges were highlighted 139 times, with the most prevalent codes being Insufficient/unsustainable resources/capacities (21), divergent goals/interests/personalities (16), and legal framework/red tape (10). The co-occurrence with high importance occurred with Insufficient trust/acceptance (four); communication (three); insufficient/unsustainable resources/capacities (two); divergent goals/interests/personalities (two); insufficient interest/incentive (two); legal framework/red tape (two); unclear goals/lack of direction (one) and coordination capacity (one). The co-occurrence with low importance occurred with insufficient/unsustainable resources/capacities (three); divergent goals/interests/personalities (two); insufficient acceptance/trust (one); insufficient interest/incentive (one); unclear goals/ lack of collaboration (one); timing (one); political opposition (one).

The primary challenges within the collaborative arrangement highlighted different strategic and institutional complexities and risks. First, the perceptions of the engaged organisations varied due to institutional-level differences in employment relationship supervision and health insurance, leading to divergent interests (I1, I3, I4, I5, I6). The ability to make retroactive changes to employment data entails a subtle but key difference within the policy fields, leading to legal challenges. One stakeholder summarised:

> *"The logic of the Employment Register is such that an individual submits an entry and can afterwards cancel it (…) The insured individual register doesn't delete anything (implying the inability to make retroactive change) (…) That is the main contradiction" (I6)*

The challenges were also reflected in power imbalances, with limited resources and capacities incentivising bartering and strategic behaviour for some actors (I1, I2, I3, I4, I6). The ETCB maintained the leading and coordinating role, possessing monopoly over the technical development and communication as well as considerable resources for development (I1, I2, I3, I4, I5, I6). Imbalances were further amplified during stakeholder activation with order of engagement based on relevance and perceived commitment, leading to advantages from early access (I1, I2). The perceived commitment was evaluated by the ETCB, relying on previous contacts in connection with employment data (I1, I3). Lastly, the decentralised nature of resource provision for digital innovation resulted that all continued developments were determined by individual interests, with peripheral actors possessing less resources for change (I4). One interviewee highlighted:

> *"It always came down to who has the funds in their budget and to what extent they could utilise them" (I4)*

An additional challenge originated from the overlapping jurisdictions between agencies (I1, I3, I5). The legal framework created overlapping jurisdictions with the right to access and operate employment datasets, which led to dependencies for the new register (I1, I3, I5), which was most prominent in the case of the contradictory logic with the use of employment data between EHIF and ETCB highlighted above, which provided peripheral stakeholders with an instrument to voice their feedback. An actor commented:

> *"Our (EHIF) position of strength is that they (ETCB) are legally mandated to submit data" (I5)*

The risks were connected to perceived reputation loss. Any error with employment data exchange for service provision entailed reputation loss for the organisations responsible (I4, I5, I6), resulting in concerns about relinquishing control over key processes. The findings on collaborative process challenges reflected primarily strategic level challenges (strategic, institutional complexity and power imbalances), with substantive issues regarding problem and solution formulation being perceived as a limited challenge. The challenges also reflect a combination of tensions originated from the system context (i.e. organisation-centric approaches based on legal frameworks), but also developed during the collaborative process (i.e. stakeholder activation providing advantages to core actors).

4.3 Management Interventions

The collaborative arrangement successfully utilized various intervention measures to adapt to the system context and challenges. Management measure related codes were highlighted 356 times, with the most prominent: clear goals (19), commitment to the collaboration (17), negotiation (14), outreach (13), formal procedures and rules of the collaboration (13). The co-occurrence with high importance occurred with clear goals (four); use of hierarchy (three); commitment to the collaboration (three); governance structure (two); informal rules/networks (two); personnel (two); clear responsibilities (two); stepwise approach (two); decentralised coordination (one); exclusiveness (one); trust building (one); negotiation (one). The interviewees didn't link any management measures to low importance. The research findings indicate a strong reliance on institutional design and leadership to successfully resolve the tensions arising from the context and problems.

The formal project organisation followed a standard structure with two levels - the steering committee for the strategic level and the working groups for the operative level, which was complemented by the functional leader and project manager, who coordinated the working group's activities. The steering committee consisted of top-level management from the included actors. Working groups were responsible for the substantive aspect of the collaborative process and were divided according to different topics, i.e. the legal framework and business rules (I1, I2). The steering committee monitored the progress of the working group, which received updates on the

developments. Some of the individuals (i.e. representatives of the Labour Inspectorate and Unemployment Insurance Fund) possessed dual roles, being included in the activities of both the steering committee as well as the working groups (I3). This resulted in stronger interconnectedness between the levels (I3). The functional leader and project manager maintained the overall vision and goals with a strong mandate from administrative leadership (I1, I2, I3, I4). In conjunction with strong motivation, core actors shared leadership to compensate for each other's "blind spots" (I3, I4). Furthermore, the steering committee provided support and legitimacy from administrative leadership, who took ownership and were representatives in external outreach. A stakeholder highlighted:

> *"The Director General of the ETCB started arranging meetings with representative organisations (…) to explain the benefits, starting with the Estonian Employers' Confederation, Estonian Association of SMEs, Estonian Taxpayers Association, and then he ensured that all partners were represented in these meetings" (I3)*

Several formal instruments were utilised throughout the collaboration. The main instrument was the vision document, which detailed goals, task distribution, resource usage and timeframe (I1). Scheduled formal working group meetings and subsequent protocols were used to monitor the overall progress of the vision document (I1, I3, I4). Decision-making within the project was compromise-based (I1), reflected in the agreed-upon approach to start with an MVP and a roadmap, which detailed the plans for follow-up developments to ensure the buy-in of the included actors. The entry rules centred around limitations of timeframe, legal framework, relevance with employment data and the level of commitment (I1). Deviations from initial goals were tolerated only to a limited extent to mitigate risks and challenges from overexpansion. One interviewee mentioned:

> *"We had a defined scope and wanted to stick with it. Otherwise, it would have stalled (…)" (I1)*

The trilateral connection between the ETCB, EUIF, and Labour Inspectorate enabled the reliance on informal measures (I1, I3, I4). Informal meetings were used to comprehend the possible opportunities, solve problems and maintain a willingness to contribute (I1, I3, I4). The informal measures provided the agility needed for digital innovation, to address the pressures and mitigate perceived power imbalances, thereby highlighting the importance of individual commitment (I3). One interviewee emphasised:

> *"Some things were truly done based on enthusiasm (…) At the end of the day, we were asked who would do it, we volunteered and did it in 2 days" (I3)*

The ETCB primarily retained the leadership role throughout the project. Both transactional and facilitative roles were utilised. The transactional measures were reflected through the project manager position and their role in day-to-day

management, emphasising adherence to the timeframe and reminding actors of the agreed-upon obligations (I2). A facilitative role was used to convene stakeholders and mediate through a compromise-based approach. The ETCB utilised a catalyst role through informal brainstorming sessions to engage stakeholders and expand the cognitive framework. The ETCB perceived their limited competency in comprehending all the relevant processes linked to employment data. As a result, they called out to different relevant actors to highlight their perspectives on using employment data and to look for potential improvements. One interviewee highlighted:

> *"(...) We (ETCB) had to show more initiative, to call upon other actors, ask regarding their needs or drive attention to what are their needs" (I2)*

The management intervention measures highlighted a combination of formal and informal structural instruments and contingent leadership roles.

5. Discussion

The author identified several relevant factors shaping cross-organisational collaboration management using the analytical framework. The Employment Register case reflects several key insights into enablers that originated from the context of the starting system and were exhibited during the collaborative process. The key enablers exhibited were:

a) underlying digital infrastructure;
b) the trilateral pre-existing connection between ETCB, EUIF and Labour Inspectorate; and
c) the starting capacity and role of the ETCB.
d) The underlying digital infrastructure became relevant through three interconnected advantages:
e) Interoperability between different digital solutions and registries.
f) Acceptance from end-users due to high levels of trust.
g) High initial cognitive convergence of digital innovation from previous reforms.

Combining advantages from the underlying digital infrastructure led to a conducive environment for further expansion and limited technological challenges, which parallels existing research findings on Estonia with the digital infrastructure supporting a unique system of decentralised development (Kattel & Mergel, 2018). The unique conditions proved to be crucial at the start. The initial development period for the Employment Register was condensed to a short period (less than a year) to accommodate the political interest, which was possible due to the opportunity to use the existing digital building blocks (i.e. X-road for interoperability). In the long term, the previous experiences became enablers for the legitimacy of the roadmap, resulting in preparedness for some actors to benefit from the initial MVP and others from follow-

up developments. The confidence that actors possessed from past experiences provided the initiative with flexibility and slack that could be utilised for incremental development, reducing the pressure towards the ETCB to deliver the results immediately.

The trilateral connection between individuals from the ETCB, EUIF and Labour Inspectorate proved vital in initiating, maintaining and expanding the collaborative arrangement. The findings reflect an interesting dynamic of the advantage of informal connections but in a small state context (Randma-Liiv & Sarapuu, 2012). Informal connections bypass the interaction costs present in more rigid and formalised structures. Combined with the increased importance of the individual, it provided a flexible environment for individuals and organisations to participate and shift roles in the project, providing collaboration opportunities for engaging more minor actors. Furthermore, the pre-existing informal connections provided further options for bypassing interaction costs in converging cognitive frameworks to reduce complexity initially, highlighting the importance of finding a common framework of reference for conflict resolution (Klijn & Koppenjan, 2014). The role of pre-existing connections reflects the impact of external and system context conditions in the prevalence and impact of more informal management measures.

The capacity of the ETCB became crucial for a contingent approach in leadership roles. The unique conditions of executive agencies possessing technological capacities and being the initiators enabled them additional levers to ameliorate perceived imbalances and, hence, shift between asymmetric top-down control to symmetric collaborative decision-making. Other stakeholders recognised and accepted their shifting roles, which lessened potential tensions from the shift of roles. The balance of dominant leadership roles shifted according to stages:

a) at the initial stages, convening and catalyst roles to justify the arrangement and broaden available perspectives;
b) at later stages, the transactional role is to maintain focus and limit overextension.

Shifting between activities—induce cognitive convergence, evolve the digital solution past its initial goals, retain stability—the ETCB highlighted a balancing game between seemingly conflicting goals. This highlights the use of contingency and reflects the importance of shifting the balance of instruments to maintain positive feedback loops (Emerson et al., 2011). This proved critical in utilising management measures to reduce the tensions originating from the broader system context and developed during the collaborative process.

The key enablers possessed a role in shaping the initial success stories and creating certain impediments for the future. The dynamics of the system context broadened the choice of management instruments, altered the efficacy of implemented instruments, and shaped the challenges collaborative initiatives met. The previous successes were instrumental in framing the initiative as an incremental development. The ability of the

ETCB to provide contingent leadership and balance between seemingly conflicting roles relied on the authority from the starting capacity and the unique conducive environment for digital innovation, which reduced perceptions of imbalances and risks, which in turn maintained the motivation of stakeholders to stay involved long-term even in instances, where immediate benefits were limited. The agility from informal measures was contingent on existing collaboration history and the trilateral connection between core actors. However, for the follow-up development of the register, the decentralised environment became an impediment, with actors being constrained in resource commitment and organisation-centric perspectives.

The barriers present within the Employment Register originate from tensions within the system context and the choice of management interventions. The key barriers were:

1. differences in perspectives due to differences in interaction arenas;
2. organisation-centric approach to management interventions;
3. power imbalances from available resources, commitment and legal mandate.

The findings indicated a significant barrier in cognitive convergence within the public sector from differing interaction arenas. The differences in operational logic can result in deadlocks within collaborative arrangements. Prioritising information sources from familiar interaction arenas over peripheral sources can intensify the deadlocks. The overreliance on pre-existing connections limits the ability of engaged actors to comprehend and adjust to different perspectives outside familiar domains relating to bounded rationality in knowledge creation and the resultant "blind spots" that actors possess (Raadschelders & Whetsell, 2017; Peters, 2015). Knowledge creation remains limited within an established cognitive framework, lacking the overview of obstacles from cross-use of data to machine-to-machine interactions.

Alongside biases in knowledge creation, committing to cross-organisational initiatives with support and resources requires overcoming organisation-centric obstacles. Although the initiative had a cross-organisational impact, the funding and legal framework remained organisation-centric, representing a constant tension between the two levels reflecting incompatibilities of past public management reforms with modern digitalisation initiatives with agencification limiting complex digital solutions (Peters, 2015; Savi & Randma-Liiv, 2016; Kattel et al., 2019). The fragmentation fostered perceptions of organisation-centric ownership, limiting commitment to further development. The conflict between cross-organisational design and organisation-centric institutional framework limited the possibilities to capitalise on a solution, as stakeholders gave way to bartering for organisation-centric interests. As a result, follow-up developments to a cross-organisational solution became a primarily intra-organisational initiative based on the availability of resources, which was most perceived by peripheral actors, who offered potential avenues for new developments yet lacked the resources to commit resources comparable with the core actors.

Alongside organisation-centric biases, the variation in available resources, commitment, and overlapping legal mandates at the cross-organisational level resulted in further strains. The differences in resources and commitment can often lead to distortions and disturbances within interaction arenas (Emerson et al., 2011; Huxham, 2003; Klijn & Koppenjan, 2015). Through a choice of measures tailored towards the core actors and gradual activation of stakeholders, the peripheral actors experienced perceptions of exclusion, leading to concurrent positive cycles with the core actors and negative cycles with the peripheral actors. The inability to properly align perspectives erodes trust, creating aversion towards changes (Wegrich, 2019; Ansell & Gash, 2012), leading to differences in perceptions regarding power imbalances with the peripheral stakeholders experiencing it more acutely.

The results highlight the source of challenges from the interconnected dynamics between organisational and cross-organisational levels. The inability to perceive the relevant perspectives due to limited rationality resulted in tensions in subsequent cross-organisational interactions. The adversarial positions adopted in cross-organisational bartering inhibited the ability to perceive the relevance of different perspectives at an organisational level, as stakeholders became more oriented to safeguarding existing positions and available resources. The conflict between the two levels deepens with the proliferation of actors, where the risks of losing resources and position to a single owner are amplified. The study highlights how digital initiatives expand towards processes with overlapping legal jurisdictions, and the strategic and institutional complexity is amplified.

The current enablers and barriers reflect some of the key challenges for collaborative digital innovation: a) the ability to expand positive feedback cycles towards new and peripheral actors whilst limiting the negative cycles; b) the capability of all relevant stakeholders to design human interactions to support human-to-machine and machine-to-machine interactions during the expansion of the solution beyond its initial end-goal.

The reliance on pre-existing informal connections based on key individuals' contributions possesses certain limitations for expanding digital solutions in cross-organisational dimensions. Whilst the trilateral connection in the case of the Estonian Employment Register provided significant advantages throughout the initiative, it also limited the evolution of the solution to limited perspectives. The inability to fully integrate new peripheral stakeholders into the process resulted in comprehending conflicts at later stages. The limited interaction cost between the core actors impeded the potential of peripheral actors to shape the development process. Furthermore, whilst the challenges in bypassing organisation-centric perspectives were surpassed within the initial trilateral connections, it proved increasingly more difficult with peripheral actors for whom organisation-centric perspective became an instrument (i.e. formulation of obligations within the field of employment) for negotiating. The findings highlighted the difficulty of balancing the game that collaborative arrangements face in designing interaction arenas to placate both peripheral and sceptical core and committed actors.

The need to formalise to root out informational bottlenecks yet maintain flexibility through informality creates tensions in meeting stakeholders' expectations, which can lead to disillusionment from both sides. The lack of formal measures can exclude peripheral actors from key information, whilst overformalisation can stifle ad hoc opportunities. The effects are unique within small state contexts, where individual turnover leads to considerable changes in organisations' available capacities and competencies (Randma-Liiv & Sarapuu, 2019). This results in the design becoming more susceptible to tensions, with turnover resulting in previously viable interaction arenas becoming dysfunctional. In a temporal view, the possible issues are exacerbated as the dynamics between actors are subject to change - from the change of individual representatives to the shift in relevance of actors. The complexities of the informal and formal interaction measures are further magnified by the cross-organisational patterns established to communicate with human-to-machine and machine-to-machine interactions. Existing literature has highlighted the challenges from the heterogeneity of the technologies and practices adopted by individual actors on a cross-organisational level of data exchange (i.e. Chen & Lee, 2018). Data exchanged on a cross-organisational level becomes susceptible to interpretation, necessitating proper structures to ensure fluid interactions between registries and information systems and any follow-up digital innovations. Interpretations stem from the values and perspectives of individual stakeholders and their respective interaction arenas where they operate. On a cross-organisational level, actors rely upon a mutual frame of reference to ensure consensus in interpretation, involving the harmonisation of terminology on a semantic and technical level using standards and classifications. Furthermore, there is a need for compatibility between operational logic. Rules regarding the insertion, (retroactive) change, exchange, and deletion need to be harmonised to ensure no conflicts with the processes of different actors and arenas.

To conclude, this study possesses several values for implementing digital technologies. The study was conducted in an alternative administrative tradition to Anglo-American and Scandinavian systems that dominate the understanding in (digital) innovation literature. The paper highlights the role of system context in enabling and limiting stakeholders, enabling a better comprehension of the role of context in alternative settings, thus furthering the academic knowledge of digital innovation in different settings. Additionally, the paper furthers the knowledge of the impact of collaborative arrangement and different structural factors. Digital infrastructure and the encompassing human interactions can serve as a conducive or unfavourable environment for new initiatives, shaping the actors' willingness to commit resources.

Furthermore, this highlights the role of executive agencies as initiators and catalysts for digital innovation, adjusting value propositions beyond the initial planning. In particular, in less rigid and more lenient structures characteristic to smaller states, the individual possesses key importance, as their competency and connections affect their parent organisation's commitment. The ability to determine the needs and wants

of stakeholders, together with interpretation into formats for the technological solution, improves the capacity of other connected stakeholders. The paper also provides an insight into a temporal perspective by highlighting the evolution of a solution from its initial implementation to subsequent follow-ups, which has been limited so far in literature (for example, see Bailey & Barley, 2020). The temporal perspective highlights the dynamic nature of instruments, where instruments oriented to collaboration can vary in benefits at different stages and affect the capitalisation of digital innovations. Finally, this paper furthers our understanding of digital innovation within the public sector. Literature on collaboration and innovation tends to highlight predominating cross-sectoral initiatives, thus overshadowing the role of digitally capable executive agencies in driving initiatives.

6. Conclusion

Public sector organisations worldwide are facing pressures triggered by growing societal demands for personalised solutions in digital media alongside heightened turbulence. The increasing demand on public administrations requires new cross-organisational solutions that engage different stakeholders within the public sector. The paper explored the role of system context, process challenges and management interventions in the case of the Estonian Employment Register and the connections between these factors through the analysis of key enablers, barriers and future challenges.

The paper analysed factors affecting cross-organisational collaborative arrangements. The findings highlight the importance of system context in managing the cross-organisational collaboration. The empirical study illuminates how the existing digital infrastructure and a decentralised approach shaped the initial development and subsequent expansion of the Employment Register. The established connections between the core actors affected the dynamics within the collaborative arrangement, resulting in predominantly informal management intervention. The differences strongly influenced the challenges within the collaborative process in the engagement of peripheral and core actors and the dynamics between cross-organisational and organisational levels. After the initial solution was implemented, management instruments providing a successful start became an impediment to expansion. Management interventions relied predominantly on facilitative roles in the initial phases. However, transactional roles obtained importance at later stages, highlighting the relevance of the contingency approach, with the need to shift the balance of roles to meet challenges and maximise the potential of digital solutions. The second research question focused on the institutional and management-related enablers, barriers and challenges. The pre-existing informal connections affected the interaction arenas and readjustments to the collaborative arrangement. Leaders can mitigate asymmetries through their resources – from technological capacity to pre-established networks.

However, the differences in perspectives between core and peripheral actors can impede further developments. The ability to capitalise on the potential of collaborative digital initiatives relies on surpassing the overreliance on key individuals with pre-existing informal connections to maintain existing positive feedback cycles whilst addressing the existing negative cycles.

Additionally, the ability to perceive and capitalise on any potentialities depends on the capacity of all stakeholders to create supporting human interaction arenas to machine interactions through establishing mutual frames of reference between different interaction arenas of varying logic. The results highlighted how the more positive and stronger the pre-existing connections have been, the more critical stakeholders are towards using (over) formalised management measures. However, this can change to a negative impact with the introduction of additional members for whom previous management measures are suboptimal. Furthermore, the case study indicated how the perception of imbalances is linked to the perceived importance and position within the collaboration. Lastly, digitally capable agencies can use authority from their technological capability to address ICT-based and non-ICT-based collaborative process challenges.

As the current case study focused primarily on a broad approach to the connections between the different system contexts, process dynamics, and management intervention factors, it would be beneficial to analyse their co-occurrences individually. While the paper did cover it to a limited extent, the temporal dimension could be further analysed. Furthermore, the management measures were analysed, but new insight could be developed by comparatively studying the combination of different instruments present within digital innovation projects. Finally, this study has reflected the significant role of informal connections, which could use further study from a framework better adapted to small states context. The study of cross-organisational collaboration management for digital innovation is essential for analysing the factors affected in different policy fields, which helps improve the design of collaborative arrangements.

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How service users envision their engagement in processes of collaborative innovation: A Q-methodological study on user involvement in eHealth collaborations

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Abstract

Involving users in innovating public services is an increasingly common, but challenging practice, as users often have different viewpoints on their own role in the process. Particularly in complex innovation arrangements such as public-private collaborations, governments and service innovators need to be aware of users' perceptions of their involvement to maximally exploit the advantages of including them. This article theorizes and tests four different roles of user-provider interaction on co-innovation processes:

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users as (1) legitimators, (2) customers, (3) partners, and (4) self-organizers. These theoretical roles are tested through Q-methodology on service users in 19 public-private eHealth collaborations from five European countries. Our findings suggest the existence of three hybrid empirical profiles of user involvement: (1) users as 'service consultants', (2) users as 'co-designers', and (3) users as 'hands-off supporters'. The discovery of these profiles suggests the existence of different viewpoints on user involvement, which can influence the expectations and behavior of the users in innovation processes.

Keywords
User involvement, eHealth innovation, co-creation, collaboration, Q-methodology

Introduction

Emerging societal issues such as financial crises, global warming, and an ageing population have spurred governments to collaborate with external stakeholders to innovate their services (Torfing, 2019). Prior research on public service innovation suggests that collaborating with a rich variety of stakeholders can create partnership synergies (Lasker et al., 2001), which can lead to the generation and practical adoption of innovative services (Sørensen and Torfing, 2011). This 'multi-actor' approach to innovation (Torfing, 2019) has spurred ample research into the conditions that allow such collaborations to increase their innovation potential.

A promising avenue for further research on this topic is how the involvement of *service users* in collaborative constellations increases the likelihood of achieving innovation. Service users are important stakeholders as they know which needs should be met through new services, but they also have knowledge about how similar services work in practice - knowledge which can then be used to innovate services (Simmons and Brennan, 2017). Hence, collaborative innovation constitutes a win-win situation in which service providers obtain much needed information and knowledge from the users, while the users are able to shape their own services (Baldwin and Von Hippel, 2011; Osborne, 2013). This win-win situation is particularly promising in partnerships in which public actors collaborate with private actors with the purpose of creating innovative services, for which they also often involve service users (Brogaard, 2021). These partnerships are especially prevalent in the healthcare sector in which governments, universities and public healthcare actors work together with private healthcare actors (technology firms, private healthcare providers) and service users such as physicians, specialists, patients, and user representatives to produce technological innovations (Brogaard, 2021).

Research into the co-design of innovative services explores this connection between collaborative innovation and user involvement further (Trischler et al., 2019), and argues that, among other conditions, the role that the users take on in the innovation process can affect the collaborative outcomes (Torvinen and Haukipuro, 2018). Recent research into innovation partnerships indicates that users can adopt different roles, which reflect different processes of user-enabled innovation (Callens, 2022). These roles can be

determined by the viewpoints of the users about their involvement. For instance, empirical research by Van Eijk and Steen (2014) shows that users, involved in health policy co-production, can have different motives to be involved, each of them resulting in different roles the users can take on. In service innovation processes, these viewpoints of the involved users might also affect the creation of *new* services, which makes them even more relevant to consider. The presence of these different viewpoints of the users on user involvement might also be the reason for the difficulties service providers often encounter when involving them (e.g. lack of active engagement in or commitment to the innovation process, problems to translate users' ideas to workable solutions, etc.).Thus, being unaware of the different viewpoints of the users might inhibit proper user involvement.

In this study, we examine what user viewpoints are present in innovation partnerships and how users perceive themselves in the collaborative innovation process. We propose that these viewpoints are related to the general ways in which service users (e.g. citizens) can interact with service providers (e.g. government). In contrast to previous models on user-provider interaction roles, we attempt to compare these ideal typical user roles of user behavior with the roles that the users believe to have, which makes a comparison between behaved user roles and *perceived* user roles possible. Four user-provider interaction roles – legitimators, customers, partners, self-organizers – are developed in the theoretical section of the paper and translated to possible viewpoints of users on user involvement in collaborative innovation processes. These interaction roles are operationalized through 24 statements (six statements for each interaction role), and subsequently tested on a dataset of 61 users from 19 eHealth partnerships in Europe through Q-methodology. Q-methodology is ideally suited to identify viewpoints of individuals, as it uses inverted factor analysis to derive differences between discourses (Van Exel and De Graaf, 2005).

In the remainder of the article, we first provide our theoretical framework in which the four interaction roles of user involvement are elaborated. Next, we explain Q-methodology and elaborate on the dataset. The results section then shows our findings, and we end with a discussion and conclusion section in which we formulate the implications of our study for research and practice.

Theory

Modes of interaction between service users and service providers

How governments interact with the public often depends on how the government perceives the public, or how the public perceives itself in relation to the government. For instance, Thomas (2013) identifies three *modes of interaction* between the public and the government: (1) citizen-government interaction, (2) customer-provider interaction, and (3) partner-partner interaction. The public can thus be seen as a citizen, a customer, or a partner. The *citizen* is primarily interested in the protection of the common good and assesses if decisions of the government are legitimate. The *customer* is focused on his/her own interest, and checks if the government spends public resources appropriately and to satisfy individual interests. The *partner* considers activities of the public sector as a joint endeavor of the public and the government, which is achieved through intensive

collaboration and coproduction. Each of these roles relate to the large rationales of public administration, i.e. the (New) Public Administration (citizen), the New Public Management (customer), and the New Public Governance (partner). However, rationales related to self-organization (Ostrom, 1995) and self-governance (Kooiman and Van Vliet, 2000) distinguish a fourth role of the public: the self-organizer. The *self-organizer* takes the initiative in decisions and activities of the public sector and considers the government as an important stakeholder to provide resources and support, but not as the central or dominant actor (Nederhand et al., 2019).

A practical example of the importance of these modes of interaction can be found in the realm of *service delivery*. According to public service theories, the interaction between service users (the public) and service providers (the government) is crucial for service delivery, as users are an integral part of the larger service system (Osborne and Strokosch, 2013). Services are not provided by a single actor (i.e. the service provider), but emerge out of intricate interactions between multiple stakeholders, as the production and consumption of services often occur at the same time (Osborne and Strokosch, 2013). In other words, the production and consumption of services are inseparable (Gronroos, 2007; Normann, 2001). In contrast to, for instance, the production of goods – in which it is quite clear that the main role of the manufacturer is to produce the goods, while the main role of the customer is to consume the good – the roles of the service users and service providers in the service process are more intertwined (Vargo and Lusch, 2008). Hence, users might consider themselves as important driving forces of the service delivery, as they are closely involved in the production of services. Dependent on how these users perceive their interaction with the service provider, different outcomes might be achieved (e.g. provider-led service delivery vs. user-led service delivery).

The role of users in innovation-oriented public-private collaborations

These different modes of user-provider interaction become even more important if *new* services are created, as these interactions can then mold the design process and directly influence the features of these services. For instance, Osborne and Strokosch (2013) make a distinction between (1) consumer coproduction, in which the users are empowered to influence the service experience during the consumption of the services, (2) participative coproduction, in which the users are involved to influence existing service delivery, and (3) enhanced coproduction, in which the users are involved to influence the creation of new services. The authors argue that enhanced coproduction has a far larger impact on the services than participative coproduction and consumer coproduction, as enhanced co-production combines operational-level interactions (execution of services) with strategic-level interactions (strategic planning and decision-making about services). As such, in instances of co-innovation between users and providers, the modes of interaction would become particularly influential because of the close interaction between the users and providers, and the direct contribution of their mutual endeavors to the new services.

Recent research in public-private partnerships (PPPs) and public-private innovation partnerships (PPIs) seems to support this view and reveals different roles of involved users, which strongly resemble the mentioned modes of interaction. For instance,

Torvinen and Haukipuro (2018) show in their exploratory qualitative case study based on data from 23 key stakeholders (i.e. procurers, end-users, supplier informants) in three Finnish PPPs that users that are engaged in innovation-oriented public-private partnerships adopt four different roles. First, users can be regarded as targets for service delivery, in that they are the *consumer* of services and that the interaction between the user and provider (i.e. partnership) is rather passive and one-sided. Second, the users can also assist the partnership in particular tasks, and, as such, *cooperate* with the partnership in order to create new services. Third, users can also create synergies together with the partnership, by intensively *collaborating* with each other during the project. Fourth, users can also behave as *controllers*, who control, lead and dominate the process, and have an important decision-making role in the project.

Similar results have been found in PPIs. Research from Callens (2022), who studied data from over 130 public partners, private partners and users in multiple public-private innovation partnerships through fuzzy-set QCA, indicates that some partnerships employ user-driven innovation processes, in which they involve *user-innovators* who are highly empowered and possess specialized knowledge about the services. Other partnerships employ co-designed innovation, in which they involve users as *co-designers*, who are also highly empowered, but do not necessarily possess specialized knowledge about the services. Even other partnerships involve users as *advisors* in the innovation process. Advisors have specialized knowledge about the services, but are not highly empowered in the innovation process.

Because of the similarities between the modes of interaction and the user involvement roles we find in innovation-oriented public-private collaborations, we propose that the viewpoints of the users about their role in such collaborations are related to the modes of interaction. Users that are involved in innovation collaborations have specific perceptions about the user-provider relationship in coproduction activities. We propose that these differences in viewpoints are related to the differences in the way the users perceive their user role in their day-to-day interactions with service providers. For this, we propose four interaction roles for users, which are based on the modes of interaction that were introduced in the previous section: users as (1) legitimators, (2) customers, (3) partners, (4) self-organizers. The different characteristics of these user roles are summarized in Table 1.

Note that these proposed interaction roles should be interpreted as *ideal types*, in that they represent broader theoretical inferences regarding user-provider interaction, which can be applied to innovation partnerships, but that we also do not expect that the empirically derived viewpoints of the users will be identical to these roles. For one, specific features of the partnerships, such as the type of partnership design in the study of Torvinen and Haukipuro (2018) or the application of particular partnership structures that affect the interactions between the partners (e.g. the use of particular interactions arenas), might influence the viewpoints of the involved users. Indeed, collaborative governance literature has repeatedly showed the effect of these structures on cross-sectoral collaborations (Bryson et al., 2006; Emerson et al., 2011; Klijn et al., 2010; Provan and Kenis, 2008).

Table 1. Characteristics of user roles.

Legitimators…	Customers…	Partners…	Self-organizers…
• Give support to services, but have no active role in the service process	• Check that services are client-centred	• Behave as partners of the service provider and are actively involved in the service process	• Are the central actor in the service process
• Check that rights are protected and watch over the correct application of regulation	• Are being consulted by the service provider to communicate preferences and quality expectations	• Jointly make decisions and co-create with the service provider	• Take initiative and responsibility in the service process
• Are involved to listen and receive information from the service provider	• Give their user experiences of working with services	• Exchange views and experiences, and align goals and perspectives	• Are being supported by the service provider with regard to the scope and resources for the services, but actions are minimally steered by the service provider

Legitimators

Legitimators are users who are especially concerned about the legitimacy of services. Legitimacy can be defined as 'a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions' (Suchman, 1995, 574). Legitimacy can be derived from the actual performance of services (i.e. output legitimacy), but it can also be derived from specific actions of the entity, such as the responsiveness to users' needs or the inclusion of users (input legitimacy) (Scharpf, 1999). During their interaction with the service provider, the legitimators act on behalf of the *common good*, not their individual preferences. Similar to how interest groups protect the interests of those they represent in order to increase the legitimacy, the legitimators will also aim to protect the user rights and needs. They expect that the service provider watches over the correct application of regulation, so public interests are not endangered. They interact with the service provider to provide or remove support for the services, as actively supporting services increases the legitimacy of these services (Suchman, 1995). For this, they need enough information about the service process, as they themselves are no service experts and, therefore, lack specialized knowledge. Indeed, legitimacy increases when processes are deemed transparent and open, which some authors refer to as 'throughput legitimacy' (Schmidt and Wood, 2019). Open and transparent communication and information sharing is therefore particularly important for legitimators. Because of their legitimizing function,

legitimators are not interested in an active involvement into the development of the services, and expect that this is a task of the service provider.

Customers

Customers are users who are particularly concerned with the selection and consumption of services that satisfy their *individual needs*, and expect the service provider to *respond* to these individual needs. Customer-provider interaction grows from the connection between the presence of individual needs and the responsiveness of the service provider to these needs (Greer and Lei, 2012). On the one hand, the heterogeneity of users' needs over the last decades have driven the demand for customized services (Von Hippel, 2005), for which the users are dependent on the service provider. On the other hand, the user's freedom of choice in selecting and consuming the services of the service provider stimulates competitive behavior between service providers, and prioritizes user-satisfaction (Callahan and Gilbert, 2005; Jung, 2010). As a result, users start to articulate their demands more actively, while service providers become more responsive to the wishes of these users, which stimulates the interaction between them (Alford, 2009). This interaction might be achieved by consulting the users about their preferences, but also by observing the response of users to certain services in a real-time context (Trischler and Trischler, 2021).

Partners

Partners are users who assume an active role in the service process, by *collaborating* directly with the service provider, and by sharing tasks and responsibilities with the service provider. In their interaction with the service provider, partners stand on the same level as the service provider (Torvinen and Haukipuro, 2018). This means that there is a joint decision-making regarding changes to the service process, and the service providers are not the dominant service actor. They work together during the service process, by sharing resources, but also responsibilities, which makes them highly dependent on each other (Ansell and Gash, 2007). Because of the intensive collaboration between the users and providers, users and providers can exchange new views and experiences with each other, which can lead to partnership synergies (Lasker et al., 2001). During such interactions, both the users and service providers are responsible for problem-solving activities, which they tackle through co-creation (Voorberg et al., 2017). However, such intensive interactions are only possible if the service providers are able to govern the processes within the collaboration, for instance by trying to align the different goals of the users and service providers (Klijn et al., 2010).

Self-organizers

From the perspective of the self-organizer, the service process is in the hands of the users. Self-organization refers to a situation in which higher-level order emerges out of the interaction between components at a lower level, without the need of any

interference of a central actor who coordinates these interactions (Kauffmann 1993). Although the concept stems from physics and mathematics, it has been applied to governance processes (Kooiman and Van Vliet, 2000; Nederhand et al., 2016). This mode of societal self-governance has been explored by Elinor Ostrom, who considers how physical, social and human capital are self-organized through a delicate balance between actors' interests (Ostrom, 1995). In this perspective, actors who can take decisive action (e.g. governments, service providers, etc.) are aware of the constructive capacity of the interactions between the actors at the practical level (e.g. citizen, users, etc.), and relate to these actions (Sørensen and Torfing, 2007; Nederhand et al., 2019). Self-organizers can be considered to be user-innovators, who possess specialized knowledge of the services and the service context, and are extremely motivated to innovate because they directly encounter the problems of the existing services (Baldwin and Von Hippel, 2011). This means that the actions of the self-organizer are of primary importance for the service process and the service providers align themselves to these actions by supporting and stimulating the users. The service provider adopts a 'hands-off' approach to the service process, by providing the outline, scope and resources for the services, but minimally interfering in the day-to-day activities of the service process (Sørensen and Torfing, 2009).

Research design

This article makes use of Q-methodology. In contrast to the classical R-methodological factor analysis, Q-methodology enables a researcher to factorize individuals on a population of traits, abilities or characteristics, out of which differences between these individuals arise (Watts and Stenner, 2012). In recent years, public management scholars have used the methodology to study differences in viewpoints of respondents regarding policy choices (e.g. Nederhand et al., 2019; Molenveld et al., 2019; Warsen et al., 2020) and citizen involvement in coproduction arrangements (Van Eijk and Steen, 2014; Van Eijk et al., 2017).

We refer to Watts and Stenner (2012) for a comprehensive introduction into Q-methodology. Generally, Q-methodology is conducted in four sequential steps (Watts and Stenner, 2012). We summarize these steps here, but also refer to the annex (Table A1) for a more elaborated depiction of the performed steps. First, the *Q-set* is constructed. The Q-set is composed of statements that reflect the different discourses or viewpoints present in the population. These statements are based on the interaction roles we proposed in the previous section. Hence, we employ a deductive Q-methodological approach (e.g. Nederhand et al., 2019; Warsen et al., 2020). In order to ensure that these statements accurately reflect the theoretical roles, we identified three dimensions from these roles, which can be applied on processes of user involvement in innovation partnerships, i.e. (1) the motives for the involvement of the users, (2) the activities the users expect to perform during their involvement, and (3) the role the service provider plays in these processes. We also followed standards of practice (cf. Molenveld et al., 2019; Van Eijk and Steen, 2014) by selecting different types of formulations of the statements (i.e. designative and advocative statements, see Dryzek and Berejikian, 1993). To further refine the statements,

a pilot study with similar users as in the *P*-set was conducted in one of the countries. 24 statements were eventually selected (i.e. two statements per dimension and role, one designative and one advocative) which are presented in Table 2. The specific operationalization of the theoretical roles is depicted in the annex (Table A2).

Second, the *P-set*, or set of participants, is defined. In our case, the *P*-set consists of service users that are related to processes of collaborative service creation and innovation in Europe. As the health sector is an established policy field in the coproduction literature (e.g. Van Eijk and Steen, 2014), and the partnerships that we are interested in are particularly found in the healthcare sector (Brogaard, 2021), we selected 61 users from 19 public-private eHealth collaborations, in five European countries (Belgium, Netherlands, Denmark, Estonia, Spain). We selected the European context because of its priority on technological innovation in the healthcare sector (European Commission, 2018). We selected these five countries as they depict a good representation of the European context. Indeed, these countries represent the two most dominant continental European healthcare systems (i.e. National Health Services and Etatist Social Health Insurance System, Böhm et al., 2013), and, as the government is central in regulating these systems, they also represent the most common continental European politico-administrative regimes (i.e. Nordic, Central and Eastern European, Continental and Napoleonic administrative regimes, Pollitt and Bouckaert, 2017).

All of the eHealth partnerships involved collaborations between public actors (e.g. governments, agencies, public hospitals, etc.), private actors (e.g. non-profit organizations, firms, etc.), and service users (e.g. GPs, medical professionals, representatives of patients and health professionals). As public-private collaborations can be coordinated by both the public or the private partner, both 'types' of collaborations were included in this study. Furthermore, both individual service users (i.e. GPs, nurses, physicians, therapists, etc.) and representatives of patients and health professionals were selected. Most of the partnerships involved users throughout the whole innovation process. Dependent on their profiles, different types of users were involved in different stages of the innovation process (e.g. health professionals in the conceptual phase, patients in the testing phase). Users were involved through workshops, focus groups, project teams, bilateral meetings, and experimentation and testing environments. A detailed overview of the cases, the employed user involvement, and the respondents can be found in the annex (Table A3).

Third, the statements defined in the Q-set are applied to the respondents in the P-set by conducting a *Q-sort*. During the Q-sort, the respondents rank the different statements in the Q-set according to the degree to which these statements reflect their own viewpoints. We used a fixed structure (from −3 to 3), in which the respondents could indicate if they agreed or disagreed with the statement. Flatter distributions (e.g. from −4 to 4) are often used in P-sets with a lot of knowledgeable respondents. However, as we have a mixed group of users with specialized knowledge (e.g. medical professionals) and with less specialized knowledge (e.g. patients), a steeper distribution was better suited for our P-set. We also tested different flatter and steeper distributions during a pilot testing of the Q-sorts, which revealed that indeed the −3; 3 distribution was more convenient for the respondents. The Q-sorts were conducted through the Q Method software package.

Table 2. The Q-set.

Dimensions/ Roles	Legitimator	Customer	Collaborator	Self-organizer
Motives to participate	1. Users should be involved primarily to create support for the innovation	7. Users want to be involved primarily to indicate what they perceive as an exquisite end product	13. Involved users especially want to be recognized as partners	19. Users should tackle user issues themselves instead of waiting for others to do it
	2. Users are especially involved to check whether the rights of those they represent are guaranteed	8. Involved users should above all check how user-oriented the innovation is	14. Users should be involved because they can have alternative views, useful for the other partners	20. Users know best how to develop and organize service delivery
Activities of involved users	3. The majority of users is there predominantly to listen to what the partners have to say	9. Involved users have to advise the partnership about how to increase user satisfaction	15. Users and the other partners should jointly define the problem and the solution	21. Users can best define problems and solutions
	4. Users best leave development of innovations to others	10. Just like a company asking its customers about its products, the partnership needs to consult the users about their preferences	16. Equal contributions of users and other partners (co-creation) is the only way to create relevant innovations	22. Users should set and guard the direction for the innovation process
Role of the service partnership towards user involvement	5. The users should be well-informed by the partnership because the innovation can then be easily accepted	11. The partnership should enable the involved users to see how the innovation works in reality	17. A crucial task of the partnership is to ensure joint decision making between the involved users and the other partners	23. The main role of the partnership is to provide the resources to develop proposals of the users
	6. The partnership actors are there to make sure that the input of the users and other actors certainly does not go against the regulative framework (e.g. legislation)	12. The principal concern of the partnership is letting involved users voice what quality they expect from the innovation	18. The partnership should primarily align the different goals of the involved users and the other partners	24. The partnership should maximally give room to the involved users to develop their own proposals for the innovation

Fourth, the Q-sorts are analyzed through Q-methodological *factor analysis* to separate the common variance between the respondents. The correlation matrix, eigenvalues and factors loadings were calculated. Subsequently, three criteria were used cumulatively to retain reliable factors. First, the Kaiser-Gutmann criterion, which advises to only retain factors with a eigenvalue of the factor loadings greater than 1, was applied (Watts and Stenner, 2012). Second, only the factors with at least two statistically significant Q-sorts (calculated by $1.96 \times 1/\sqrt{}$(Number of items), $p < 0.05$), were retained (Watts and Stenner, 2012). Third, only the factors with a explained variance of at least 7% and a cumulative variance of at least 30% were retained (Molenveld 2020). We also performed a varimax factor rotation. The factor analysis was conducted with the KenQ software package. Additionally, we checked how well the three factors were able to explain patterns of user-involvement considering the specificity of the employed P-set, in comparison to a two-factor and four-factor solution. The three-factor solution proved to be superior to the other factor solutions.

Results

Seven factors were initially retained from our analysis. After applying the three cumulative criteria described above, three factors remained. The three remaining factors explain 40% of the total variance, which is sufficient in Q-methodological research (Watts and Stenner, 2012: p. 199), and is similar to other recent empirical studies (e.g. Nederhand et al., 2019; Warsen et al., 2020; Molenveld et al., 2019). The factors are illustrated in Table 3. The three factors represent three groups of respondents that share a coherent set of statements on how users can be involved in the innovation process. These groups will be called *'empirical profiles'* in the article.

The three empirical profiles are labelled as follows: (1) users as *'service consultants'*, (2) users as *'co-designers'*, and (3) users as *'hands-off supporters'*. Note that these empirical profiles are different from the theoretical roles we constructed in our conceptual framework, which will be discussed in subsequent sections of the article. However, before we introduce the three empirical profiles, we display some of the descriptive information that may be relevant for our interpretation of the profiles. As is visible from Table 4, the majority of service consultants come from the four Spanish partnerships, while the Estonian partnerships are not represented in this profile. We see quite the reverse for the co-designers, who are well-represented in the Estonian cases, but not in the Spanish cases. In comparison to the other profiles, most of the users from the Danish cases also identify themselves with the co-designers, but none of them adhere to the profile of the hand-off supporters. Furthermore, in comparison to the other countries, Belgian cases are well-represented in the profile of the hands-off supporters. The respondents from the Dutch cases are relatively equally distributed over the three profiles. Moreover, considering that ca. one in four respondents were user representatives, only 11% of the service consultants are user representatives (e.g. representative of patient organizations, physician associations, etc.), in comparison to 40% of the co-designers and 42% of the hands-off supporters.

Table 3. Matrix of the statements and empirical profiles.

	Dimension	Statement	Factor 1	Factor 2	Factor 3
Legitimator	Motives	1. Users should be involved primarily to create support for the innovation	−1	−1	3[a]
		2. Users are especially involved to check whether the rights of those they represent are guaranteed	0	−2	−1
	Activities	3. The majority of users is there predominantly to listen to what the partners have to say	−3[a]	−2[a]	−2[a]
		4. Users best leave development of innovations to others	−2[a]	−3[a]	0[a]
	Role of service provider	5. The users should be well-informed by the partnership because the innovation can then be easily accepted	3[a]	0[a]	1[a]
		6. The partnership actors are there to make sure that the input of the users and other actors certainly does not go against the regulative framework (e.g. legislation)	0[a]	−1[a]	2[a]
Customer	Motives	7. Users want to be involved primarily to indicate what they perceive as an exquisite end product	0[a]	−1	−1
		8. Involved users should above all check how user-oriented the innovation is	1	0	1
	Activities	9. Involved users have to advise the partnership about how to increase user satisfaction	2	0[a]	1
		10. Just like a company asking its customers about its products, the partnership needs to consult the users about their preferences	2	0[a]	1
	Role of service provider	11. The partnership should enable the involved users to see how the innovation works in reality	1	1	2
		12. The principal concern of the partnership is letting involved users voice what quality they expect from the innovation	−2[a]	2[a]	0[a]

(continued)

Table 3. (continued)

	Dimension	Statement	Factor 1	Factor 2	Factor 3
Partner	Motives	13. Involved users especially want to be recognized as partners	−2[a]	−1[a]	0[a]
		14. Users should be involved because they can have alternative views, useful for the other partners	2[a]	1	0
	Activities	15. Users and the other partners should jointly define the problem and the solution	1[a]	2[a]	−1[a]
		16. Equal contributions of users and other partners (co-creation) is the only way to create relevant innovations	−1	3[a]	−1
	Role of service provider	17. A crucial task of the partnership is to ensure joint decision making between the involved users and the other partners	1[a]	2[a]	0[a]
		18. The partnership should primarily align the different goals of the involved users and the other partners	0[a]	1[a]	2[a]
Self-organizer	Motives	19. Users should tackle user issues themselves instead of waiting for others to do it	0[a]	−2	−1
		20. Users know best how to develop and organize service delivery	−1	−1	−3[a]
	Activities	21. Users can best define problems and solutions	0	1	−2[a]
		22. Users should set and guard the direction for the innovation process	−1	0[a]	−2
	Role of service provider	23. The main role of the partnership is to provide the resources to develop proposals of the users	−1[a]	0	0
		24. The partnership should maximally give room to the involved users to develop their own proposals for the innovation	1	1	1

[a]Distinguishing statements (i.e. statements that are significantly differently ranked in one factor as opposed to the other factors, with $p < 0.01$).

Table 4. Representation of countries, users, and partnerships in profiles.

	Service consultants (*N* = 18)	Co-designers (*N* = 20)	Hands-off supporters (*N* = 12)
Countries			
Belgium	16.67%	25.00%	50.00%
The Netherlands	16.67%	15.00%	25.00%
Spain	61.11%	5.00%	16.67%
Estonia	—	30.00%	8.33%
Denmark	6.00%	25.00%	—
Users			
Individual service users (i.e. health professionals) (*N* = 46)	88.89%	60.00%	58.33%
User representatives (*N* = 15)	11.11%	40.00%	41.67%
Partnerships			
All partnerships (*N* = 19)	B1, B4, N1, N2, N4, S1, S2, S3, S4, D2	B1, B2, B5, N1, N2, N4, S2, D1, D2, D3	B1, B2, B3, N1, N2, S2, E2
Excluding overlapping partnerships (*N* = 10)	B4, S1, S3, S4	B2, B5, D1, D3	B3, E2

When we consider the types of partnerships that underlie the empirical profiles, and particularly look at the partnerships that are exclusively present in one of the profiles (i.e. excluding overlapping partnerships), we also see differences between the underlying rationales for why these partnerships involved users. For instance, partnerships B4, S1, S3, and S4 are partnerships that extensively relied on the expert knowledge of the involved users, particularly in the conceptual stages of the innovation process. This might be the reason for why the large majority of involved users in this profile are health professionals. The partnerships that are represented in the second profile (i.e. B2, B5, D1, D3) are partnerships that tried to co-develop the solutions together with the users in more or less delineated phases of the innovation process. In these partnerships, not only expert users but also individuals who represented the needs of citizens, patients and professionals were involved. The partnerships in the third profile present perhaps the most interesting results, as both B3 and E2 enabled profound opportunities for user participation (e.g. adoption of users in advisory boards and other collaboration arenas), but were also met with extensive skepticism from the involved users because of negative experiences with similar collaborations on related topics in the past.

The next sections address the characteristics of these three empirical profiles in detail. The main features of these profiles are summarized in Table 5. In order to develop a clear depiction of the three empirical profiles, we will particularly focus on the extreme and distinguishing statements, which are the statements that are significantly differently ranked as opposed to the other profiles, and whose scores deviate strongly from the scores

Table 5. Main characteristics of the identified profiles, based on the relative rankings of the distinguishing statements.

Service consultants	Co-designers	Hands-off supporters
• Users are well-informed by the partnership (+3)	• Users co-create with the partnership (+3)	• Users are involved to create support for the innovation (+3)
• Users introduce alternative ideas that are useful for the partnership (+2)	• there is joint decision-making between the users and the partnership (+2)	• the role of the partnership is …
• Users are not involved to…	• Users and the partnership jointly define the problem and solution (+2)	o to check that users' ideas do not go against regulation (+2)
o listen to the partnership (−3)	• Users voice what quality they expect from the innovation (+2)	o to align the goals of the users and partnership (+2)
o voice what quality they expect from the innovation (−2)	• Users should not leave the development of the innovation to others (−3)	• Users do not know best how to develop and organize services (−3)
o be recognized as partners (−2)	• It's not the partnership's role to check that users' ideas do not go against regulation (−1)	• Users are not best at defining problems and solutions (−2)
• It's not the partnership's role to provide the resources to develop the proposals of the users (−1)	—	• Users should not jointly define the problem and solution with the partnership (−1)

of the other profiles. This approach has been used in other Q-methodological research (see Molenveld et al., 2019), and it allows us to differentiate the core characteristics of these profiles. For this, we rely on the relative rankings of the statements, which considers the distinguishing statements that are ranked higher and lower than the statements in the other profiles. These relative rankings are visualized for each of the profiles in the annex (Table A4, Table A5, and Table A6). In order to visualize the relative importance of the different characteristics of the profiles, we indicate the scores of the ranked statements that match these characteristics between brackets. These scores can reflect positively ranked statements (e.g. +2), but also negatively ranked statement (e.g. −3).

Users as service consultants

Service consultants are involved in the innovation process because they possess valuable knowledge of and experience with the targeted service context, and can facilitate the partnership in achieving a desirable innovation. Facilitating the partnership in achieving a desirable innovation requires them to be well-informed by the partnership (+3). Probably because of their knowledge of the service context, the users in this profile are able to introduce alternative ideas that are useful for the partnership (+2). These users might want

to convey what they know about this service context, but do not perceive themselves are representatives of the larger 'user community'. As such, they are not interested in voicing what quality this user community expects from the innovation (−2). However, the users also strongly oppose the idea that they should just listen to what the partnership has to say (−3), which suggests that they want to have an active role in the innovation process. Nevertheless, this active role is *externally oriented*, as the service consultants receive a sufficiently defined, external advising 'assignment' from the partnership. Hence, the service consultant perceives himself/herself as an actor that is external to the partnership and innovation process, and is therefore not interested in being recognized as a partner (−2). Possibly because of this external and more distant role, the users in this profile do not expect that the partnership mobilizes resources to develop the users' proposals (−1).

Users as co-designers

Co-designers want to be involved in the innovation process because of their desire to be part of creating something they can use in the future. Co-creation activities, in which the users and partnership equally contribute to the innovation, are crucial for these users (+3). Related actions, such as ensuring joint decision-making between the users and the partnership (+2), and jointly defining the problem and solution (+2), are therefore also very important for the users in this profile. Co-designers co-create services because they might have a use for them in the future, which means that they are highly motivated to voice what quality they expect from the innovation (+2). Because of the emphasis on co-creation and co-development, these users are strongly opposed to statements such as "Users best leave development of innovations to others" (−3). Moreover, co-designers do not expect that the partnership is focused on ensuring that the users' input does not go against any regulation (−1), possibly because this might inhibit open experimentation and co-creation.

Users as hands-off supporters

Hands-off supporters are involved in the innovation process to give support to the innovation, but without taking on any binding responsibilities. In contrast to the other profiles, these users agree very much with the statement that users should be primarily involved to create support for the innovation (+3). Hands-off supporters position themselves at a distance from the partnership, and withdraw from any demanding commitments. Hence, they expect very much from the partnership, and very little from their own involvement. For instance, the users in this profile expect that the partnership ensures that the input of the users does not go against regulations (+2) and invests energy in aligning the differences in goals between the users and the partnership (+2). Furthermore, hands-off supporters do not believe that users know best how to develop and organize services (−3), or can best define problems and solutions (−2). They are also quite skeptical towards jointly defining the problem and solution with the partnership (−1). Interestingly, and in contrast to the other two profiles, hands-off supporters are the only users who are neutral towards the statement "Users best leave the development of

innovations to others" (0), which is very negatively ranked by both the service consultants and the co-designers (resp. −2 and −3).

Additional observations

In the previous sections, we focused particularly on the distinguishing characteristics of the empirical profiles. However, there are also some important features of the profiles that can partially overlap with other profiles, and which prevent them from being a distinguishing characteristic of the profile. Nevertheless, these features may also contain important information about the profiles. An important observation is that the users in the profile of service consultants also believe that users should be consulted about their preferences (+2), and should advise the partnership about how to increase user satisfaction (+2), which is in line with the facilitative nature of the service consultants. Furthermore, the statement that suggests that users are especially involved to listen to what the partnership has to say is ranked very negatively in all three profiles (resp. −3; −2; −2). This observation is particularly interesting in relation to the hands-off supporter, as it introduces some nuance to the supposedly passive role of these users. Notwithstanding that they are still much less active in the collaboration than the service consultants and the co-designers, they do want to have a voice in the partnership.

Discussion and conclusion

User involvement is a complex process, which demands a lot of time and energy from both the service providers and the users, without a guarantee of success. Different envisioned roles of the users lead to different expectations about their involvement in the innovation process, which might affect the process of user involvement and how successful this process will eventually turn out to be. Understanding how involved users envision their roles in the innovation process can encourage the pursuit of a more suitable alignment of the expectations and needs of the involved users and the partnership in the innovation process. Hence, this article aimed to conceptually and empirically contribute to our understanding of the roles users wish to take on during their involvement in collaborative innovation processes by proposing and testing four distinct perspectives on user involvement.

Theoretical reflections on the results

In our study, we found three empirical profiles, based on our theoretical distinction of user-provider interaction roles. The first empirical profile, which we labelled as 'service consultants', includes users who possess knowledge of and experience in the service context of the users, and who are ideally placed to advise the partnership in the innovation process. This profile matches service literature that emphasizes the importance of user knowledge for the innovation process (Simmons and Brennan, 2017). Indeed, seminal work of von Hippel in the 1980s shows how users are able to innovate services on their own because of their knowledge about the service context. Users have information about

the demands and expectations of the user community, know what does and doesn't work because of their experience in the service system, and are ideally positioned to detect new trends in this service system (Von Hippel, 1986, 2005). Von Hippel (1994) calls this information 'sticky information', because it is challenging to access, transfer and use in a new context. Service consultants know they possess this sticky information, and, through their involvement in the innovation process, can mobilize this information to help create service innovation. This is confirmed by the case information of the partnerships, as the large majority of the involved users were health experts and the partnerships depended on their knowledge to innovate their services.

The second profile depicts users as 'co-designers', and includes users who want to co-create services with the partnership, which they might also later use in practice. The case information of the partnerships in this profile indicates that both individual users (i.e. health professionals) and user representatives co-develop with the service providers in order to produce desirable solutions. These characteristics relate to literature on open collaborative innovation (Baldwin and Von Hippel, 2011; Sørensen and Torfing, 2018), in which users are involved in innovation processes of service providers or partnerships because they want to co-develop services they might later use. During co-design, users are intentionally involved in the innovation process to jointly develop the innovation with the service providers (Trischler et al., 2019). This leads to a win-win situation in which the users acquire additional resources and capabilities, and the partnership is able to access sticky information (Von Hippel, 1994). Additionally, and in contrast to private partners, users are also less interested in shielding the innovation from competitors or in commercializing the innovation for their own gain, which is beneficial for the partnership as this simplifies the implementation and diffusion of the innovation (Roszkowska-Menkes, 2017).

The third profile, which we labelled the 'hands-off supporters', is characterized by users who want to create support for the innovation, without adopting any demanding responsibilities in the innovation process. The fact that these users lack commitment to fully engage in the innovation process might have something to do with the complexity of the innovation subject in the studied cases (i.e. eHealth innovations). Service research indicates that involving users in the creation of technically complex and radical innovations often leads to a more passive role of the users, because the users lack the required knowledge to feel comfortable advising and co-designing with the service provider (Lettl, 2007). The specific innovation context and the self-awareness of the users about their own capabilities might therefore have influenced the viewpoints of these users. However, case information of the partnerships also revealed that some of the involved users were rather skeptical about their involvement due to their negative experiences with similar collaborations in the past. These experiences might have influenced their viewpoints on user involvement, and can reduce the levels of trust and commitment in these collaborations (Ansell and Gash, 2007).

Additionally, we observe a difference between how much users adhere to specific profiles dependent on the countries in which their partnerships are established. Whereas service consultants are particularly found in the Spanish partnerships, and the co-designers in Estonian and Danish partnerships, the hands-off supporters are especially

identified in the Belgian cases. Although we lack the comparative data to thoroughly substantiate these claims, these differences might result from cultural differences between the countries, regarding how they perceive user involvement. For instance, due to the Napoleonic politico-administrative tradition in southern European countries such as Spain, (but also Belgium, which legal tradition and administrative culture resemble the Napoleonic tradition), these countries have a larger power distance between governments (i.e. service providers) and citizens (i.e. users) (Pollitt and Bouckaert, 2017). This might result in viewpoints that are more conservative as to the degree to which users can fully engage in the partnerships. Nordic countries such as Denmark (and partially the Netherlands), however, have an egalitarian system with a pronounced citizen and user participation (Pollitt and Bouckaert, 2017). Similarly, in recent decades, Estonia has introduced various initiatives to foster participation and engagement (e.g. e-participation, Åström et al., 2013; Randma-Liiv, 2022), which might have influenced the viewpoints of the users. Again, these are only tentative findings, which require further investigation using a larger sample of respondents and explanatory research methodologies (e.g. regression analyses).

Hybridity of the empirical profiles

Our findings indicate that none of the empirical profiles perfectly matches the theoretical roles out of which the Q-sort statements were derived. Although the service consultants have much in common with the customers, the co-designers share important features with the partners, and the hands-off supporters are quite similar to the legitimators, there are still a lot of statements from the other theoretical roles combined in the respective profiles. Still, we yield quite well-defined and delineated, but also *hybrid* empirical profiles from these statements. The explanation for this hybridity of the profiles might be broken down into three arguments, which can reinforce each other.

First, the theoretical roles are useful to depict the general modes of interaction between the service providers and the service users, but may also need additional refinement when applied to service innovation processes in public-private collaborations. For instance, we see important similarities between our results and the empirical results of Torvinen and Haukipuro (2018) and Callens (2022) on PPPs and PPIs. The authors identify comparable user roles, such as the consumers, cooperators and collaborators (Torvinen and Haukipuro, 2018), and the advisors and co-designers (Callens, 2022). Hence, the modes of interaction might provide us with a general theoretical framework from which context specific roles of user involvement can be constructed. This would also be the reason why our profiles match well with service management literature on user involvement in collaborative innovation processes (e.g. Baldwin and Von Hippel, 2011; Sørensen and Torfing, 2018).

Second, the hybridity of the profiles might also mean that the viewpoints of the users in the studied innovation processes are different from their actual role in the innovation process, on which the theoretical roles were based. This argument is particularly supported by the surprising fact that the self-organizer role is totally absent in our empirical profiles. None of the distinguishing statements were positively

ranked in all three the profiles, and even the non-distinguishing statements were either neutral or negatively ranked. This is remarkable because both Torvinen and Haukipuro (2018) and Callens (2022) found a similar role to the self-organizer in their studies, i.e. resp. the 'controller' and 'user-innovator'. Furthermore, a significant part of the innovation literature emphasizes the importance of the role of such a 'user-innovator' in service design processes (Oliveira and Von Hippel, 2011). User-innovators are on the leading edge of new trends, have knowledge and experiences about the local implementation context, and often innovate on their own (Oliveira and Von Hippel, 2011), which resembles features of the self-organizer role, and relates to the innovation projects we studied.

The absence of a profile that relates to the self-organizer should not necessarily mean that self-organizers are absent in these processes. It might also mean that self-organizers are too dependent on the partnership to develop the innovation, and their viewpoints are therefore captured by the co-designer or even the hands-off supporter profile. Regarding the latter, we have some tentative case evidence that some of the partnerships in the hands-off supporter profile actually established important opportunities for user involvement and collaboration, but past experiences with similar collaborations might have negatively influenced their viewpoints. Hence, these users could perceive user involvement as a process that is largely guided by the partnership, and that they are not able to significantly shape the course of the innovation process, even when they have all the features of self-organizers. This is actually confirmed by Callens (2022), who shows that the user-innovators are more likely to collide with the design framework (and corresponding rules and procedures) of the partnership, which hinders them in fully implementing their own ideas. This also implies that features of the partnership (e.g. set-up of the user involvement or past collaboration experiences) might influence the viewpoints of the users, which might be why we observe hybrid empirical profiles.

Third, the hybridity of the profiles might also mean that we have discovered a underlying theoretical mechanism that is more suitable to separate the different types of users. Indeed, one key element distinguishes the three empirical profiles: whether the users view themselves as *external stakeholders* who observe the innovation process at a distance (i.e. service consultants and hands-off supporters), or as *internal stakeholders* who are part of the innovation process (i.e. co-designers). Users who see themselves as external stakeholders will be motivated by the prospect to contribute to the innovation process, without being responsible for the outcome, while users who view themselves as internal stakeholders will be motivated by the prospect to influence the innovation as they see fit. We see this somewhat reflected in the differences between the countries, where respondents from countries with a larger power distance (i.e. Spain and Belgium) view themselves more as external stakeholders at a distance from the service provider (i.e. service consultants or hands-off supporters), while respondents from countries with a stronger tradition of user participation (i.e. Denmark and Estonia) view themselves more as internal stakeholders, which are closely involved in the collaboration (i.e. co-designers).

Practical implications and future research

The findings suggest that service providers who want to engage users in the innovation process should recognize the differences in how these users envision user involvement. Network management strategies directed towards the exploration and connection of these perceptions might help to increase the performance of user involvement as expectations of the service providers and users become better aligned (Klijn et al., 2010). Similarly, process agreements which depict in advance what the service provider wants to accomplish with the user involvement and what role users can play in the innovation process might help in communicating the expectations of the service provider and clearly establishing the role of the users during the innovation process (Klijn et al., 2010).

Furthermore, project coordinators should be aware that there can be differences between the roles the users adopt in the innovation process. Indeed, users that see themselves as service consultants might also act as consultants, which means that the user might expect to be guided by the partnership. In contrast, co-designers perceive themselves as an inherent part of the collaboration, and might be given more responsibilities. Project coordinators should recognize these differences, and manage the user involvement process accordingly.

Our research design and methodology has several advantages, but also comes with some limitations. The value of this study was its wide scope with regard to the collaborative innovation processes and user groups that are involved. We considered (similar) eHealth collaborations between public and private actors in five European countries, and we also looked at a realistic group of users, including both individual service users and user representatives. This approach helped us to formulate conclusions that are relevant for other European countries and innovation projects. However, less homogeneous samples also introduce more degrees of freedom to explain patterns, which makes a thorough explanation of the found patterns challenging. Moreover, the complexity of the selected policy sector (i.e. eHealth sector), might have influenced the perspectives of the respondents (i.e. users). Furthermore, Q-methodology is in essence a descriptive tool and not a method that allows researchers to explain patterns, which means that future quantitative and qualitative research should investigate these patterns in more detail.

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Supplemental Material

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5. The coordination of digital government platforms: the role of administrative tradition and collaboration history

Jessica Breaugh and Steven Nõmmik

INTRODUCTION

Collaboration within the context of digitalisation processes represents opportunities to break down organisational silos that hamper bureaucratic public organisations, while at the same time offering a new way of approaching public service provision through streamlined services. It is also an essential component of public sector digitalisation approaches (Gil-García, 2012), both as a factor defining the change management process and a factor shaping the outcomes of this change given the new organisational structures that emerge from digitalisation processes (Kuipers et al., 2014; Orlikowski, 2007). In many cases, the process of digitalisation fundamentally changes the way both internal and external processes are conducted. With the introduction of digital platforms as well as the necessity for cross-governmental collaboration many challenges naturally arise. The challenges originate from both the siloed nature of administrative systems as well as the complex digitally specific context of increased power, complexity, and risk (Rackwitz et al., 2020).

Although technology implementation has been perceived as a technical exercise (for example, Kapoor et al., 2021), its introduction occurs in an institutional environment that considerably shapes its realisation (DeSanctis and Poole, 1994). This appears in goals set out in official strategic documents and the interpretation of these documents occurring from design to implementation. These variations emerge from varying cognitive frames of stakeholders who are embedded in different institutional environments (Orlikowski and Gash, 1994). With the increased role of government collaborative digitalisation projects, the potential challenges from the varying cognitive frames increase, with each actor bringing their own sets of goals and objectives, including protecting their own identities, processes, and approaches to service provision.

Despite this, however, research on collaboration in the context of government digitalisation is only just emerging (Costumato, 2021). Even fewer studies exist that examine intra-government collaboration from a comparative perspective (for example, Breaugh et al., 2023). A failure to compare collaborative approaches across different governments, and different types of projects, however, results in a lack of understanding of the role of context, or the forces external to digitalisation projects that play an essential role in how they develop and are ultimately implemented. According to Granovetter (1985), context is paramount to understanding behaviour and the outcomes.

Context can take on many meanings, however, as a starting point of comparative analysis two critical components emerge. First is the role of the *institutional environment*. Administrative tradition is useful for understanding the institutional environments that impact project dynamics and thus provides a method for studying the system context of projects (Breaugh and Hammerschmid, 2020; Painter and Guy Peters, 2010a). The second component is the role of *collaboration history*. Collaboration history in this context refers to the networks and relationships built in previous collaborations, which offer opportunities for knowledge sharing to initiate innovation (Damanpour and Schneider, 2006). This provides a method of understanding how relationships influence collaborative approaches. Therefore, the overarching question explored in this chapter is the influence of the institutional environment (understood through the concept of administrative traditions) and collaboration history (with a focus on pre-existing relationships) in the perceptions of power, complexity, and risk in digitalisation projects. This will be accomplished through an analysis of five case studies of collaborative digitalisation projects at the national level – all working on topics related to digital platforms linked to the European Union (EU) single digital gateway legislation.[1]

The organisation of the chapter is as follows. We will begin by outlining the concepts of power, complexity, and risk identified as common challenges that emerge in government digitalisation projects (Rackwitz et al., 2021). We then develop six propositions regarding how administrative traditions and collaborative history could be related to these challenges. We then present and discuss our analysis of the five case studies.

CHALLENGES OF DIGITAL COLLABORATION

While the uptake of collaborative solutions for large-scale government digitalisation projects is growing, three challenges are often highlighted in the literature that hamper and deter the collaborative process – particularly in a public sector context. These are power, complexity, and risk (Ansell and Gash, 2008; Crosby and Bryson, 2010; Osborne and Brown, 2011; Torfing, 2019). These will be explored in this section.

The first challenge to be discussed is power. Power is a Multi-faced concept reflecting the capacity to influence, control, or resist the activities of others (Purdy, 2012). The capacity derives from resources, formal structural positions, perceived importance as well as day-to-day activities (Choi and Robertson, 2014). While variations in power are inherent to multi-actor collaborations, its perceived misuse can create perceptions of power imbalances that hamper collaboration (Hartley et al., 2013; McGuire and Agranoff, 2011). Within collaborative initiatives, power can be used in different areas. These include deciding who is at the table, the design of the project itself, and what the governance structures used to manage it will be. The stakeholders included in the decision-making process affect the variation of perspectives available for defining the problem and choosing the solution (Ansell and Gash, 2008). Power imbalances may lead to the adoption of approaches from the more powerful members limiting a mutual understanding of the problem and the possible solutions (Bryson et al., 2006; McGuire and Agranoff, 2011; Wegrich, 2019). This can limit the capacity of less powerful members to contribute to the initiative (Jones and Hooper, 2017). More powerful members may also opt towards governance structures oriented in self-interest that ensure their resources and minimise risks (Wegrich, 2019). This is subject to constant shifts throughout the deliberative process, with the change in the relevance of individual stakeholders' goals, resources, and positions (Choi and Robertson, 2014). Within the context of digitalisation, power is open to further shifts concerning technological capacity itself. Technological capacity reflects the ability of an organisation to explore, develop, and/or adapt new technological solutions in public service design, delivery, and evaluation (Lember et al., 2018). Within a collaboration, actors with higher technological capacity are less dependent on collaborative functions, and thus yield considerable power in their levels of engagement and final adoption of the product.

The second challenge to discuss is complexity. Complexity is multi-dimensional, encompassing both the specific collaborative process as well as the wider administrative structure through substantive, strategic, and institutional facets (Klijn and Koppenjan, 2016). *Substantive complexity* refers to the complexity that arises from differences in perceptions of problems, goals, and foreseeable solutions within a collaboration project. This can be particularly acute in digitalisation projects encompassing many different service areas. The complexity surfaces both on the technical level with the interoperability of different digital solutions in a cross-organisational context and the semantic level with a shared understanding of work language (Gil-García and Sayogo, 2016; Pardo, 2010; Picazo-Vela et al., 2018). Each collaboration partner is likely to have different goals for a particular digital product, and thus propose very different solutions. *Strategic complexity* refers to complexity related to varying strategies used by actors within a collaboration to handle

conflicts. Existing organisational goals and values guide the actors towards behaviour that leads them towards a desirable goal (Klijn and Koppenjan, 2016; Raadschelders and Whetsell, 2018). These values originate from personal beliefs, organisational, and professional culture as well as society guiding an individual participant towards a specific choice (Raadschelders and Whetsell, 2018). Varying strategies can lead to uncoordinated actions, further diverging the project outcomes from their intended goals. Finally, *institutional complexity* reflects the institutional context in which a collaborative project is embedded, including formal and informal traditions, laws, and regulations.

The third and final challenge for collaboration is risk. Public sector organisations have a reputation for being risk averse. Risk aversion comes from several factors – from a lack of resources to a very limited tolerance for failure (Flemig et al., 2016). Furthermore, risk perception is contingent on the organisation's previous history of reforms and the capacities (including technological capability) developed during reform phases that affect the ability to evaluate risk with an initiative (Kattel et al., 2020; Torugsa and Arundel, 2017). From a single-actor perspective, engaging in a collaborative project opens the risk of losing control of their autonomy, a loss of legitimacy and resources, or creating the fear of blame for potential failures (Hinterleitner and Sager, 2015). It may also result in a lack of engagement from critical actors. Within the context of digitalisation projects, an elevated level of uncertainty due to the high financial costs, accountability, and knowledge asymmetries elevate these risk perceptions (Mergel, 2016; Neumann et al., 2019). Therefore, the challenge becomes how to manage risk perceptions, rather than the risk itself (Timeus, 2018; Timeus and Breaugh, 2020). Having explained three core challenges related to collaboration within a digital context, the discussion will now shift to understanding how contextual factors of administrative tradition and collaboration history are linked to these challenges. These will be explored in the next section.

SYSTEM CONTEXT AND COLLABORATION CHALLENGES

Two aspects of system context relevant to digitalisation are the *institutional environment* of the projects, defined using the concept of administrative tradition, and *collaboration history*, defined as the pre-existing relationships apparent at the onset of a collaborative project. In this section, we develop argumentation regarding how these aspects play a role in understanding the differences in the challenges (i.e., power, complexity, and risk) present in collaborative digitalisation projects.

Administrative Tradition

Although the design and implementation phase of digitalisation initiatives possess an important role in shaping the final adoption and diffusion, the initial steering originates from the facilitating and constraining role of the underlying structures within the environment (Barrett et al., 2013). This is concluded within both the broader public sector innovation literature (for example, de Vries et al., 2016) and the digital innovation literature (for example, Nasi et al., 2015). With considerable perceived differences present in existing administrative systems, administrative traditions provide a good heuristic tool for detailing this context. Administrative traditions refer to a way of classifying public administrative systems based on social and political institutions vis-à-vis society, the history of a particular system as well as the legal and regulatory systems (Painter and Guy Peters, 2010b). Research in this area has suggested that traditions can and do explain differences in state behaviours, including the legal and/or cultural constraints of individual government actors when they collaborate with one another. Depending on the administrative tradition present, the stakeholders may be predisposed to several values related to efficiency, effectiveness, and quality (Guy Peters, 2021). Anglo-Saxon traditions tend to be characterised as non-legalistic, pragmatic, and pluralist, with a strong centralist governance structure (Huxley et al., 2016; Painter and Guy Peters, 2010a). The Continental tradition is characterised by a strong legal basis for governance and as interventionist in their approach to society as well as a strong hierarchical governance approach (Meyer and Hammerschmid, 2010). They also have a clear separation of federal and regional powers, characterised by a strong adherence to the principle of subsidiarity (Benz and Zimmerman, 2011). Finally, the Scandinavian traditions appear to be a mix of both Anglo-Saxon and continental approaches. On the one hand side, they have a strong legal tradition as a basis for understanding the state and a consensus-oriented approach (Huxley et al., 2016), but on the other hand side, they mirror the centralist structures of the Anglo-Saxon models with a stronger corporatist structure (Meyer and Hammerschmid, 2010). Based on these characterisations, we would expect to see differences in how the projects are designed and managed that reflect, in part, administrative and cultural traditions in the given country. We propose six propositions to aid in this analysis.

With the centralised governance structures present in Anglo-Saxon countries, there is a larger tendency towards asymmetrical power balances with the leading organisation(s) controlling stakeholder activation (Huxley et al., 2016). This is compared to the Continental and Scandinavian contexts, where power is more multi-lateral with more limited shifts to alternative power positions due to a stronger adherence to established processes (Bach et al., 2017). With stronger asymmetries present, there may be a higher tendency

towards negative responses due to perceived power imbalance that can lead to a reduction in commitment and turf protection strategies from actors who are perceived to have a limited voice. Proposition one (P1) therefore argues that there will be a stronger perceived power imbalance within the Anglo-Saxon countries compared to Continental and Scandinavian traditions.

Our second proposition (P2) focuses on the concept of complexity. As actors face differences in understanding technical solutions as well as semantics from professional language, complexity can increase. The administrative structure within the Continental tradition focuses on a balance between procedures and rules, maintained through public officials, trained typically as lawyers, within the policy fields, leading to challenges in the initiation of boundary-spanning initiatives (Pollitt and Bouckaert, 2011). In some cases, complexity may be heightened due to the necessity for legal frameworks to be developed alongside the projects in the Continental countries, while the pragmatism of the Scandinavian and Anglo-Saxon traditions could limit the plurality of perspectives in favour of cost-efficiency, therein reducing the substantive and strategic complexity. We, therefore, propose (P2) more decentralised and shared governance structures, for example, seen in the Continental tradition, can increase substantive and strategic complexity.

Our third proposition (P3) focuses on risk. A general aversion to risk in the public sector is quite well established in the literature (Chen and Bozeman, 2012). However, scholars have noted the role that socio-political institutions play in risk perception (Slovic, 1997). We, therefore, suggest that administrative traditions with more ministerial independence and pragmatist approach, like the Anglo-Saxon tradition, may experience more risk perceptions with stakeholders being more risk averse to participate in collaborative initiatives. The combination of ministerial independence, lack of legally binding contracts, and pragmatism lead stakeholders to an increased perception of the possible losses to other stakeholders from failure, thus affecting their calculations. With the silosation present, the mitigating factors from the past collaboration are limited due to limited connections. On the other hand, the continental European traditions, characterised by a more strict socio-legal order may perceive digitalisation projects as riskier in general as many disrupt the stability of a legal state – often pushing for reforms and change at a faster speed than the administration can process.

Collaboration History

Next to the institutional perspective of administrative tradition, the collaboration history of stakeholders provides additional contextual factors facilitating or hindering collaborative initiatives. Based on previous research, it is evident that relationship building is a critical component in collaboration projects

and is linked to the performance of the collaboration in general (Chen et al., 2019; Luna-Reyes et al., 2007). With an increased level of social capital, project norms and behaviours develop much faster, increasing the probability of developing clear converging goals, as well as active and effective decision-making strategies (Fedorowicz et al., 2014). This provides stakeholders access to a more informal environment, where formal rules are of lesser importance, thus facilitating more knowledge sharing (Lewis et al., 2018). Collaborations that start with successful collaboration history are more readily able to function due to the activation of social capital (Granovetter, 1973). Successful collaboration history facilitates the pre-eminence of personal relationships over formal role relationships, which affect the evaluation of benefits and the assignment of obligations for different stakeholders (Ring and de Ven, 1994). This is underscored by Dawes and Pardo (2002), who note that collaboration history impacts the way new projects emerge and develop. In the context of digital collaborations, previous interactions may result in a better understanding of the digital infrastructure of potential partners as well as in initial compatibility between the solutions (Kattel et al., 2020). If the past was positive, it makes relationship building easier as there is already a base level of trust and understanding.

Past relationships may increase the acceptance of created asymmetries with stakeholders improving mutual understanding and actions to reduce the distance (McGuire and Agranoff, 2011). With the social capital present, the possible negative perceptions of power imbalances are appeased. Within digital initiatives, stakeholders have adopted a common language and better comprehend the underlying technical infrastructure stakeholders possess providing a better idea of the possible solutions (Pardo et al., 2010). Therefore, our fourth proposition (P4) argues that past successful collaboration history reduces negative perceptions of power imbalance.

With the increased mutual understanding from previous collaborations, it is easier for stakeholders to comprehend the technological capacity and goals of stakeholders (Chen and Lee, 2018). Through a common language, the stakeholders are better able to perceive the differences in interests, resources, and competencies (Quick and Feldman, 2014). This streamlines the process that stakeholders would otherwise utilise for getting to know each other. Therefore, projects that have actors with a positive collaborative history perceive substantive issues more compared to stakeholders without a collaborative history. With a lack of past collaborative history, the stakeholders assume a position based on their existing role within the administrative structure and are more rigid towards adjustments (Alford and O'Flynn, 2012). The appeals to existing strong relations result in the stakeholders perceiving strategic and institutional issues less acutely. Therefore, our fifth proposition (P5) is that collaborations with positive past relationships predominantly perceive substantive complex-

ity, whereas stakeholders lacking past relationships perceive strategic and institutional complexity more strongly.

Moving to the concept of risk, high levels of trust and the predictability of other stakeholders' actions lead other partners to be more confident in committing resources and more flexible towards any potential shifts in role requirements from the initial agreed setup, thus reducing the effect of challenges (Alford and O'Flynn, 2012; Edelenbos and Klijn, 2007). Past positive relationships improve the feeling of continuity and provide a shared understanding of the group and therefore limit the perception of risk (Joffe, 2003; Noteboom et al., 1997). If the past was negative, however, it could make the starting conditions more complex and induce higher risk perceptions. The lack of past interactions results in stakeholders being more cautious when engaging with stakeholders (Bryson et al., 2006). Negative interactions limit the willingness of actors to engage in trust-based agreements and make them rely more on existing institutional design (Nooteboom et al., 1997). Based on past failures, stakeholders perceive a higher risk of potential resource loss (Verhoest et al., 2007). Therefore, our sixth proposition (P6) is that past positive relationships would reduce the negative perceptions of risk.

CASE STUDY INTRODUCTION

The cases included are key national projects within the EU's Single Digital Gateway (SDG). The SDG focuses on the digitisation of public services across the EU. They all represented key administrative traditions in Europe (based on the classification from Meyer and Hammerschmid, 2010). The SDG not only provided specific targets but also outlined principles in which this should be undertaken. These include the once-only principle and being user-centric. Because most citizen services cross organisational boundaries – especially to achieve the once-only principle – collaboration is at the forefront in terms of how projects are designed, built, and ultimately implemented. A total of 36 interviews across the five cases inform the empirical analysis of this chapter. There were between six and nine interviews per case, where at least one senior manager, consultant, and programme manager were interviewed. For more information about the cases, see Breaugh et al. (2023). All interviews were transcribed and coded (by coders in their original language). Each interview was coded by one person and reviewed by a second. The coding scheme was developed by a main coding team, and several training sessions were held for the coders for each case study. The coding scheme was based on a combination of concept-driven and data-driven approaches. Coders were instructed to highlight segments of interviews when the interviewee discussed aspects related to risk, complexity, and power imbalances based on a clear coding book and framework based on Rackwitz et al. (2020). The interview questionnaire

Table 5.1 Case characteristics

Country	Belgium	Denmark	Estonia	Germany	United Kingdom
Administrative Tradition	**Continental**	**Scandinavian**	**Scandinavian**	**Continental**	**Anglo-Saxon**
Project	**Civil Registry**	**eIDas Regulation**	**Employment Registry**	**Online Access Act (OAA)**	**Government as a Platform (GaaP)**
Project duration	2010–19	2013–ongoing	2013–ongoing	2017–22	2011–ongoing
Main goal	Moving the decentralised Civil Registry to a central online database/ mandatory	Implementing electronic identity verification/ voluntary	Creating a centralised digital solution for the collection and storage of all employment data	Offering all public services online via a joint portal/ mandatory	Introducing GaaP as an overarching platform principle/ voluntary
Key Lead	Administrative Simplification Service	Agency for Digitalisation	Estonian Tax and Customs Board (ETCB)	BMI/it-PC	Government Digital Services (GDS)

Source: Adapted from Breaugh et al. (2020).

included questions about power, complexity, and risk, enabling the authors to identify the relevant themes in the interview data. Periodic quality checks, including different coding exercises, were undertaken to encourage consistency among the coders (for more information regarding the coding process, see Breaugh et al., 2023). Table 5.1 presents the characteristics of each of the cases.

FINDINGS

Administrative Tradition and Collaboration Challenges

Overall, it was clear that the institutional environment played a role in if and how decisions were made. Exploring the proposition of power imbalances (P1), interviewees from all the cases highlighted perceiving power imbalances. However, based on the coded data, this was perceived most acutely within the UK case, where the context had a contributing role to the perception of challenges. The key project coordinator, the Government Digital Service

(GDS), faced obstacles related to the voluntary nature of the project. With the surrounding context of strong ministerial prerogative (a clear attribute of the Anglo-Saxon tradition), budgetary framing, and silosation, the stakeholders perceived the initiative as a shift in status quo towards GDS obtaining a more asymmetrical position at the expense of their resources that led to confrontations.

> … GDS, when it first started, grew up in opposition to the other departments because, essentially, building GOV.UK took capabilities that other departments had, and centralised them outside of those departments. (UK SDG 2, Pos. 36)

The asymmetrical position formed was related to challenges within their administrative tradition – with the necessity to break down hierarchical structures within the ministries. This led to cross-organisational engagement being affected by the existent structure.

> The truth is that there are some problems with collaborating with departments if you think about them in terms of departments because departments are run in a top-down way by people that in the civil service often have highly politicised careers where they're trying to get promoted. They have their own power struggles. So, actually dealing with departments from the top down is, I think, a really difficult and problematic way to transform government, because the people at those top levels don't actually … They're so far removed because of the way the civil service is structured in terms of its hierarchy. They're so far removed from the needs of the people doing the work of delivering services at the front line that they make bad decisions for them. (UK SDG 2, Pos. 43–44)

While there were power struggles present with the other cases and traditions, they weren't perceived as the most important challenge. Within the Continental traditions, the context provided measures for mitigating perceived challenges. The German and Belgium cases were legally mandated which shaped the dynamics from power imbalance to power management because stakeholders *had* to engage with the process and it was clear from the onset, through legal mandates, the roles and responsibilities of the actors. This limited the opportunities to exercise power for the creation of asymmetries. Furthermore, the federal structures present in both Belgium and Germany also meant that power was more dispersed between the partners (regardless of size), which meant that leaders needed to engage in more negotiation and mediation. In the German case, for example, stakeholders even began to align with the departments' objectives to be able to receive support.

> In the past, there were always laws, I would say from the Federal Ministry of the Interior for the internal issues. Then there were laws, you can think of the examples at will, quasi-always laws from the corresponding ministry for this specialist

> context, but very rarely only cross-cutting. And the OZG is something cross-cutting, which also pushes us in particular in our federalism. (DE SDG 2, Pos. 29)

With the Estonian and Danish cases, the coordinators possessed a considerable number of resources and an asymmetrical position like the UK case. This was manifested in the control of the interaction arenas (regarding stakeholder activation as well as the agenda) and resources (funding, personnel, knowledge). However, the engaged stakeholders perceived limited challenges from power imbalances. The context of both countries possessed a role, as informality, high levels of trust, merit-based system, and low levels of politicisation led to both countries framing the initiative from a technical perspective.

To explore proposition 2 (P2), we examined the impact of administrative traditions on complexity. The German and Belgium cases, representing the Continental tradition, highlighted the importance of the legal basis for providing the necessary authority and the frame of reference for enacting the change. This limited substantive complexity. Both cases, however, noted a challenge in strategic complexity through issues of interoperability of the digital architecture between the individual ministries. In the German case, this was the result of the heterogeneity of the existing functionalities of the actors and the challenges of funnelling them into a joint portal. In the Belgium case, heterogeneity was also present through the varying capacities and IT systems present in local municipalities. However, due to the digitalisation of a previously physical process, the decentralised digital infrastructure possessed a limited role, with the strategic complexity originating more from the deep-seated identities and silos of government ministries.

With the Scandinavian tradition, through the Estonian and Danish cases, there were certain similarities as well. The focus on limited politicisation, professionalisation, pragmatism, and informal environment streamlined the process, limiting the perceptions of complexities to a primarily substantive level. The substantive complexity of the initiatives was perceived in both cases with differences in operational logic leading to miscommunication regarding functionalities and opportunities. Both initiatives highlighted the importance of perceiving the process as a technical challenge rather than a political one. This was achieved through the framing of the technical capabilities of the coordinators, with both the Danish Agency for Digitisation and the Estonian Tax and Customs Board utilising similar measures (i.e., existing resources and past experiences). The engagement within the Estonian and Danish cases highlighted some elements of corporatism. The Danish case highlighted attempts to engage as many public sector actors as possible with the scope and design of the Gateway with a strong mutual understanding regarding the possible efficiency wins through the initiative. Within the Estonian case, through mutual recognition of the problem and the administrative burden, the stakeholders

attempted to engage not only the public but also interest groups within the private sector to build mutual understanding regarding steps forward. Informal networks were used between middle and top-level managers of the respective agencies with the initiative reaching the political level. The broad level of engagement contributed to the substantive complexity with stakeholders possessing challenges even with the use of proper professional language. For example, in Estonia, one interviewee noted,

> The main differences were with regards to the level of detail in the registry entries and the classification to be created next to it. Whether the dataset that was being entered was sufficient and mutually understood. For instance, there was even a very large debate with regard to employment contracts and the use of the term contractor, which is completely unacceptable to us. As the employment contract can be only between an employee and an employer with contractors being covered through the Law of Obligations Act. … Devil is in the details. These tiny details would sometimes make us argue for hours and reaching a common understanding in these instances was difficult. (EE SDG 3, Pos. 103)

In the UK case, the connections between administrative traditions and complexity were less pronounced. The interviewees highlighted the challenges with complexity originating from the complicated UK administrative structure with the taxonomy of services delivered and the people responsible obfuscated. In conjunction, a rotating of leaders and personnel (also a typical characteristic of Anglo-Saxon states) meant that the complexity of the project was strategic – including convincing individual ministries to become engaged in the project (thus giving up their resources). These issues started right from the beginning, with the GDS's struggles with identifying key stakeholders.

> I think you need to have all the people that matter in the room at the start. Very often we would start with the first person we found, which was because we were under time pressure, which is the wrong way to go about it. You need to bring people together, get all the people in the room that need to be there to start with, to start together. Starting together is really important for collaboration. (UK SDG 2, Pos. 165)

However, hierarchical governance was present through the GDS, who used their asymmetrical position to determine the products to be developed as well as the stakeholders to be involved in new initiatives.

With proposition three (P3), the connections between administrative traditions and risks remained ambiguous. The Estonian and Danish cases highlighted the role of corporatism and the consensus-oriented approach. While the Estonian and Danish cases relied on pre-existing positive relations, the interviewees perceived important risks at the different stages of the initiatives. Within the Estonian case, the engagement of different stakeholders led to an

increased perception of risks regarding efficient service provision due to differences in operational logic and standards.

> If insurance is missing, they will call us [Estonian Health Insurance Fund]. If they start checking an individual for health insurance that should already exist but hasn't been established due to technical reasons, then the individual has to pay for their health care service on their own, which they shouldn't need to do. (EE SDG 5, Pos. 59)

The risks regarding effectiveness and compatibility between processes and digital solutions were also reflected in the Danish case. This was highlighted by the aim of the stakeholders (i.e., Tax Agency) to keep digital development to a minimum to avoid either duplication or conflict with existing information systems. Furthermore, the consensus-building environment amplified perceptions of risks from time pressure for the Estonian case, as there were disagreements regarding the legal framework between actors (i.e., Ministry of Justice and Tax and Customs Board).

In the UK case, the perceived risks had similarities with the Danish and Estonian case reflecting the similarities between the respective traditions. The UK case reflected risks regarding effectiveness with stakeholders concerned about the productiveness and sustainability of the technical solutions for which individual ministries would remain responsible. The pragmatist and centralist-oriented structure created further perceptions of risk. For interviewees, this manifested with the perceived risk of GDS's reputation and the ability to manage expectations and narratives with issues of overpromising and balancing between meeting desired goals and implementing the solution promptly.

> The story of GOV.UK Verify is one where the concerns about risks of the viability of the product, on the side of customers in government, government service teams, departmental leads, whoever it is, in terms of those actors, has meant that there is a narrative around the product. Which is that it is troubled, it doesn't work, it's a problem, etc., etc. And partly that's a symptom of it being such a high-profile thing. (UK SDG 1, Pos. 121)

Many of the organisations seeking digital solutions saw the processes as risky because they did not have long-term funding for the maintenance of the programmes, especially coming from outside their ministerial prerogative.

In the Belgium and German cases, both cases perceived risks of failure and loss of resources and authority. With the pressure to standardise, the decentralised structure provided a space for increased perceptions of risks with uncertainty regarding the resource allocation moving forward. In the German case, the risk aversion behaviour entrenched within the administrative culture

became a considerable obstacle. This stemmed from attempts to maintain the resources available to organisations due to the perceived risk of being transferred through digitalisation as well as the reputational damage due to the potential failure. While Belgium also had perceived risks linked to the decentralised structure and the dispersion of resources, the bigger risks lay in the resistance by the Ministry of Internal Affairs and the Ministry of Justice.

Overall, the first two propositions concerning administrative traditions and power and complexity (P1, P2) received support with the cases highlighting the impact of the unique factors within different administrative traditions related to the digitalisation initiative. The silosation and decentralisation of competencies present in the Continental tradition resulted in power games as well as perceptions of strategic complexity through goal conflicts with stakeholders. This was contrasted by the Scandinavian tradition, where a combination of professionalisation, pragmatism, and informality led to stakeholders viewing the process through a lens of technical issues rather than political ones, leading to challenges of substantive complexity. The final proposition regarding administrative traditions and risk (P3) receives limited support. Although all of the cases reported risk, the sources of this perceived risk differed (perceived loss of resource, reputation, power, etc.). For example, the Scandinavian perceptions derived from compatibility while the Continental tradition derived more strongly from turf protection, and the Anglo-Saxon tradition risks were more concerned with ministerial independence. It was clear that during a digitalisation process, the administrative tradition can amplify potential collaborative challenges, but also mitigate them or provide context-specific intervention measures.

Collaboration History and Collaboration Challenges

The second research question examines the role of collaboration history. Propositions four to six (P4–P6) proposed that positive collaboration history would influence how power, complexity, and risk are perceived in the projects. To explore proposition four (P4), we focus on the links between power imbalances and collaboration history. Within the Estonian case, the interviewees emphasised the considerable role of collaboration history in accepting power imbalances. For example, despite stakeholders possessing asymmetric positions within the initiative (with available resources as well as organisational priorities), the stakeholders were accepting of these disparities. The interviewees noted several interconnected factors (i.e., the technical capability of the coordinator, past successful initiatives, access to increased resources, and trust

of individuals connected to the initiative) with some of the factors being based on interdependencies from previous collaborations:

> As I said before, the reason why the ETCB came to us, was because of our very good working relationship. We used a lot of their data in certain activities. The use of the data also meant that the system was interfaced. We had already developed a good working relationship and I would also point that out as far as the ministries were concerned. (EE SDG 3, Pos 9)

This was utilised by the coordinator to frame the project as a technical rather than political project despite the shifts in power positions following implementation. The Denmark case utilised a similar framing with power imbalances present, but not perceived as a significant challenge. However, the interviewees did not highlight the role of collaboration history, but rather the technical capability and past successful initiatives of the coordinator as key. The Belgium case also utilised technical capability to reduce perceptions of power imbalances with a weaker past collaboration history with the stakeholders. However, a lack of collaboration history meant that the project leaders had to spend more time and effort to establish themselves and their own perceived legitimacy. This was also like the UK case, in that the legitimacy of the project leaders needed to be established. The German case reflected an antithetical case with considerable fragmentation and heterogeneity resulting in clear power imbalances that led to impediments with active participation by the stakeholders with a stronger power position. The aforementioned examples highlight the impact of collaboration history on power imbalances. It is clear that collaboration history has ameliorating effects in accepting the power imbalances of the collaboration projects, while the administrative traditions have a closer link to understanding how power imbalances emerge in the first place.

Proposition 5 (P5) focused on the connections between collaboration history and complexity. The German case highlighted complexity as the most perceived challenge for the initiative. However, while the fragmented institutional environment inhibited considerable pre-existing collaboration ties, the interviewees did not highlight weak collaboration ties as a factor. In the UK case, with a lack of strong collaboration history, the coordinator was initially unaware of the additional resource required for mapping the necessary stakeholders and services due to institutional complexity.

> In some cases, quite high-profile services … we went round in circles, cats from team to team, to team, to team. In the end, we couldn't find someone, who was responsible for it, so it wasn't included in the research. … it wasn't always easy to find the actual responsible party for it. (UK SDG 1, Pos. 38)

The Belgium case also had a limited collaboration history, and they also experienced significant institutional complexity. This resulted from the varying capacities of the municipalities as well as the legislative framework that needed to be complied with. The interviewees for the Estonian case didn't perceive complexity as a prominent challenge with past collaboration highlighted as a reason for only minor substantive complexity being present. Within the Danish case, substantive complexity was also highlighted as a minor challenge. This was mainly to do with user definition and subsequent development. However, the Danish case had a limited collaboration history between the stakeholders. While collaboration history can have ameliorating effects regarding the overall perception of the challenges from complexities present, the administrative traditions help to comprehend the type of complexities the stakeholders perceive as most acute.

Proposition six (P6) focuses on the link between collaboration history and risk. For the Estonian case, there was very limited risk perceived, and it was clear that past successful collaboration history was a reason for this. The interviewees from the Belgium case were more positive with risks being of limited importance. The main risks were the tensions between the National Register and Civil Registry and between the Ministry of Internal Affairs and the Ministry of Justice. For the German case, the fragmentation was reflected in the perceived risks regarding technical challenges with the creation of a joint portal in the context of heterogeneity. The interviewees also noted that there was an intra-organisational risk averse culture that affected decision-making. A lack of previous collaborative experience meant that in both cases, the senior leaders had to spend time and effort to solve these challenges and build their legitimacy. In Denmark, the collaboration history did not appear to impact risk perceptions per se as this was overshadowed by technical issues. In the UK case, the interviewees perceived several risks. The lack of collaboration history was reflected in uncertainty regarding the capabilities and achievability of goals and overpromising issues. Overall, we appear to have only limited support for collaboration history and risk perceptions, following similar findings with administrative tradition.

Overall, the analysis of connections between collaboration history and challenges (P4–P6) highlighted certain tendencies. The analysis provided the strongest evidence for P4, with the existence of strong collaboration history enabling stakeholders to utilise the established relationships for idea creation and conflict resolution to streamline interactions between stakeholders. Within the Estonian case, it was an essential component for the success of the initiative. For the UK, the lack of strong collaboration history resulted in GDS needing to put considerable effort into engaging stakeholders and determining the relevant stakeholders from both the top and bottom of the hierarchies. With regards to P5, while collaboration history was reflected by the stakeholders

related to complexity in the Estonian and Belgium cases, there was only limited support for the propositions. Although the Estonian case highlighted substantive complexity and its limited challenge, the Danish case highlighted perceiving similar challenges with limited collaboration history, making it difficult to make any conclusions regarding the connections between collaboration history and complexity. For P6, the findings indicate that the previous collaboration history ameliorates the perceived possible risks, but the evidence is limited and not consistent across the cases.

CONCLUSION

The purpose of this chapter was to examine the collaborative dynamics of, power, complexity, and risk in large-scale digitalisation projects across different administrative traditions with different histories of collaboration. To do so, we add to the literature that examines cases in the context of institutional embeddedness. We proposed six propositions, organised between the themes of administrative tradition and collaboration history and their link to common collaborative challenges. The findings show full support for P1, P2, and P4 and limited support for P3 and P5. This means that there is evidence to suggest that administrative traditions can be linked to how power and complexity are established in collaboration, and a strong collaborative history may be linked to more acceptance of power imbalance. Due to the ambiguity in defining risks, P6 focusing on collaboration history and risks did not have sufficient findings to make any conclusions.

In all, our findings show certain behavioural clustering related to differences in administrative traditions such as pragmatism, legal culture, level of formality and hierarchy which did play a pivotal role in the perception of project challenges. This was most visible with the Continental and Scandinavian traditions, which represented contrasting findings with challenges from political aspects more relevant for the former and technical aspects for the latter. However, similarities did emerge in the context of actually managing the projects, which weakens the applicability of administrative traditions for evaluating challenges. Collaborative history between actors within a digitalisation project appeared to be the strongest regarding the threat posed by power imbalances. It did not appear to be as consistent concerning risk or complexity. Future research should go more in-depth into the specific administrative traditions. With a limited number of cases, the possible inferences remain limited. Furthermore, throughout the study, the interviewees reflected on the mitigating role of strong leadership alongside pre-existing relations. While this study focused on the latter, the former went beyond the scope of the current study and is a key research topic for the future. It also enables us to learn more about the applicability of administrative traditions. To conclude,

as digital solutions become the default approach to government modernisation and change, government collaboration in this field will also change and adapt to balancing both the need for collective and interoperable digital solutions, while also taking into consideration the unique needs and logic of individual actors and environment during the process.

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Publications

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