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Challenges of Collaborative Digital Government: e-Participation, Open Government Data and Cross-Border Interoperability

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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.

Maarja Olesk

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Koostööl põhineva digitaalse valitsemise keerukus: e-osaluse, avaandmete ja piiriülese koosvõime näited

MAARJA OLESK

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List of Publications

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

I **Toots, M**. (2019) Why Do E-participation Projects Fail? The Case of Estonia's Osale.ee. *Government Information Quarterly*, 36(3), 546–559. (1.1)

II **Toots, M**., Kalvet, T., & Krimmer, R. (2016) Success in eVoting – Success in eDemocracy? The Estonian Paradox. In E. Tambouris, P. Panagiotopoulos, Ø. Sæbø, M. A. Wimmer, T. A. Pardo, Y. Charalabidis, D. Sá Soares, & T. Janowski (Eds.). *Electronic Participation: 8th IFIP WG 8.5 International Conference, ePart 2016, Guimarães, Portugal, September 5-8, 2016, Proceedings* (pp. 55−66). Lecture Notes in Computer Science, 9821. Springer. (3.1)

III McBride, K., **Toots, M**., Kalvet, T., & Krimmer, R. (2018) Leader in e-Government, Laggard in Open Data: Exploring the Case of Estonia. *Revue Française d'Administration Publique*, 167(3), 613–625. (1.1)

IV **Toots, M**., McBride, K., Kalvet, T., & Krimmer, R. (2017) Open Data as Enabler of Public Service Co-creation: Exploring the Drivers and Barriers. In P. Parycek, & N. Edelmann (Eds.) *Proceedings of the 7th International Conference for E-Democracy and Open Government* (pp. 102−112). IEEE Computer Society. (3.1)

V Kalvet, T., **Toots, M**., & Krimmer, R. (2018) Contributing to a Digital Single Market for Europe: Barriers and Drivers of an EU-wide Once-Only Principle. In A. Zuiderwijk & C. C. Hinnant (Eds.) *Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age (dg.o '18)* (Article 45, pp. 1–8). Association for Computing Machinery. (3.1)

VI Kalvet, T., **Toots, M**., Van Veenstra, A. F., & Krimmer, R. (2018). Cross-border e-Government Services in Europe: Expected Benefits, Barriers and Drivers of the Once-Only Principle. In A. Ojo, A. Kankanhalli, & D. Soares, (Eds.). *Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance (ICEGOV' 18)* (pp. 69−72). Association for Computing Machinery. (3.1)

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VII McBride, K., **Olesk, M**., Kütt, A., Shysh, D. (2020). Systemic Change, Open Data Ecosystem Performance Improvements, and Empirical Insights from Estonia: A Country-Level Action Research Study. *Information Polity* (in press, published online on 19 June 2020). (1.1)

VIII **Toots, M**., McBride, K., Kalvet, T., Krimmer, R., Tambouris, E., Panopoulou, E., Kalampokis, E., & Tarabanis, K. (2017). A Framework for Data-Driven Public Service Co-Production. In M. Janssen, K. Axelsson, O. Glassey, B. Klievink, R. Krimmer, I. Lindgren, P. Parycek, H. J. Scholl, & D. Trutnev, (Eds.). *Electronic Government: 16th IFIP WG 8.5 International Conference, EGOV 2017, St. Petersburg, Russia, September 4-7, 2017, Proceedings* (pp. 264–275). Lecture Notes in Computer Science, 10429. Springer. (3.1)

IX McBride, K., **Toots, M**., Kalvet, T., & Krimmer, R. (2018). Turning Open Government Data into Public Value: Testing the COPS Framework for the Co-Creation of OGD-Driven Public Services. In M. P. Rodriguez Bolivar, K. J. Bwalya, & C. Reddick (Eds.). *Governance Models for Creating Public Value in Open Data Initiatives* (pp. 3–31). Public Administration and Information Technology, 31. Springer. (3.1)

Author's Contribution to the Publications

The author's contribution to the papers in this thesis is:

I The author of this thesis is the sole author of the article.

II The author is the lead author, conducted the case studies on e-participation and developed the majority of the content, including the introduction, most of the empirical analysis and discussion.

III The author developed the majority of the empirical analysis and conclusions and co-wrote the methodology section.

IV The author is the lead author of the article. The author conducted the research and developed the majority of the content in the introduction, methodology, empirical analysis, conclusions and policy recommendations sections.

V The author was involved in conducting the research and was responsible for writing the introduction, methodology, the majority of the literature review, empirical analysis and discussion.

VI The author was involved in conducting the research and contributed to writing the general sections of the paper as well as the sections concerning the drivers and barriers of the once-only principle.

VII The author was involved in conducting the research and contributed to writing the methodology and case description sections and to editing other parts of the paper.

VIII The author is the lead author of the article. The author contributed to the development of the framework and helped co-write most sections of the paper in close collaboration with the second author.

IX The author was involved in conducting the research and contributed to writing and editing some parts of the paper.

1 Introduction

> *New technologies offer opportunities for information sharing, public participation, and collaboration. We intend to harness these technologies to make more information public in ways that enable people to both understand what their governments do and to influence decisions. We commit to developing accessible and secure online spaces as platforms for delivering services, engaging the public, and sharing information and ideas.*
>
> Open Government Declaration, 2011

> *By 2020, public administrations and public institutions in the European Union should be open, efficient and inclusive, providing borderless, personalised, user-friendly, end-to-end digital public services to all citizens and businesses in the EU. Innovative approaches are used to design and deliver better services in line with the needs and demands of citizens and businesses. Public administrations use the opportunities offered by the new digital environment to facilitate their interactions with stakeholders and with each other.*
>
> EU eGovernment Action Plan 2016–2020

> *In 2020, there will be a good bit more e-government, but it will not be significantly different from today. Governmental websites will be more sophisticated (mainly because of continuing innovations in IT), and they will have a better look and feel, greater ease of use, more and better-quality applications, and more information and services. But e-government will not provide a substantially greater range of transactions or a greater degree of interactivity, will not provide much more by way of e-participation or democracy, and will not have produced e-transformation.*
>
> Donald F. Norris, 2010a

The development of information and communication technologies (ICTs) since the mid-20th century has come with an abundance of expectations regarding technology's impacts on public administration and governance[1]. Technology enthusiasts, practitioners and researchers have hailed ICTs for their potential of saving public administrators' time and taxpayers' money, making government more efficient and effective (Meijer & Bekkers, 2015; Mergel et al., 2019), improving public service quality (Janssen et al., 2018; Reddick, 2011; Tambouris et al., 2012) and helping deliver user-centric and personalized services (Millard, 2011; Misuraca & Viscusi, 2015; OECD, 2003). The use of ICTs is also believed to make governments more transparent (Reggi & Dawes, 2016), open (Wimmer,

[1] Based on Walter Kickert (Kickert, 2002), this thesis uses a broad definition of 'public governance' as encompassing the functions of running the government and providing public services as well as making policy decisions and managing networks and relationships with societal actors. Kickert considers public governance to be broader than public management, associating public governance with an external orientation to the social-political context and governance of complex administrative relations and inter-organizational networks. The public sector is a key actor in public governance, but governance networks may also involve citizens and other external stakeholders.

2011), democratic (Christensen et al., 2015; Dahl, 1989; Etzioni et al., 1975; Sæbø et al., 2008), inclusive and participatory (Macintosh, 2004; OECD, 2003; Tambouris et al., 2012).

These hopes and beliefs have also shaped political agendas. In 2009, the then President of the United States Barack Obama launched the Open Government Directive, mandating government agencies to take action and use the available digital technologies to implement the principles of transparency, participation and collaboration in their relations with the public (Orszag, 2009). In 2011, the Obama administration took this initiative to the global level and initiated the Open Government Declaration (2011), today undersigned by 78 countries and 20 local administrations. By endorsing the declaration and joining the global Open Government Partnership (OGP), political leaders from all parts of the world have committed to using new technologies for "developing accessible and secure online spaces as platforms for delivering services, engaging the public, and sharing information and ideas" (*Open Government Declaration*, 2011).

Although the declaration refrains from explicitly defining the term 'open government', the text recurrently employs keywords such as *civic* or *public participation*, *citizen empowerment*, *government transparency*, *effectiveness*, *accountability* and *collaboration* when discussing its different dimensions. As understood in the declaration, the concept of government openness therefore broadly refers to the mode of a government's relationship with citizens. An open government, the declaration states, is one that "empowers and delivers for citizens". In this context, new technologies are framed as a key tool for opening up different aspects of public governance, from sharing government information to delivering public services and engaging the public in political decision-making.

In a very similar manner (and an almost identical wording), the European Union's (EU) eGovernment Action Plan 2016–2020 (European Commission, 2016) envisioned that by using digital technologies[2], European public administrations would become "open, efficient and inclusive" and provide "borderless, personalized, user-friendly" digital public services driven by the needs of citizens and businesses. The action plan emphasizes the need for governments to use digital technologies to interact with non-governmental stakeholders and with other public administrations, in particular by opening up public sector data, public services and decision-making processes to stakeholders within country borders and across the EU. The EU's approach adds another component to the idea of an open digital government that works for the benefit of citizens. In addition to governments' interaction with citizens, the EU stresses the role of digitally mediated collaboration within and between public administrations as a prerequisite for providing user-friendly digital public services to citizens and businesses.

Initiatives attempting to make public administration more open and citizen-oriented started far before the digital government era. The Freedom of Information laws adopted in many democracies over the 20th century and even earlier (Ingrams, 2020) and the New Public Management reform initiatives, such as the UK's Citizens' Charter (1991) or the Open Government White Paper (*Open Government*, 1993), have all sought to advance government openness through measures such as publishing government information or engaging users in the delivery and improvement of public services (Clark, 1996). What is new in more recent policy initiatives such as the Open Government Declaration or EU eGovernment Action Plan is their focus on new digital technologies as an agent of change and innovation.

[2] For the purposes of this thesis, the terms 'digital technology' and 'ICT' are used interchangeably.

Bekkers and colleagues (Bekkers et al., 2013) list two main ways in which the use of digital technologies can induce innovation in the public sector. On the one hand, ICTs constitute the core of many public sector innovations. On the other, digital tools can facilitate collaboration between different stakeholders and the co-creation of innovative policies and services, which in themselves may or may not involve a technological component. Examples of the latter could range from crowdsourcing citizens' input to public policy via online platforms to inviting them to co-write code for a cutting-edge open data-driven web service. Following this distinction, it is thus useful to think of digital government as including two different aspects (which naturally often occur together): 1) the digitalization of public governance 'outputs' such as public sector information or public services, and 2) the digitalization of the processes and means (including forms of communication, collaboration and participation) whereby these outputs are produced.

Reflecting the empirical patterns of ICT adoption and the emergence of new public administration paradigms such as New Public Governance (Osborne, 2006) or Digital-era Governance (Dunleavy et al., 2006), academic interest in the use of ICTs in the public sector has evolved from discussing the digitization of public sector information and internal workflows towards governments' digitally mediated interaction with external stakeholders (Freeman & Quirke, 2013; Norris, 2010b, 2010a). This increased interest in public agencies' collaboration with non-governmental stakeholders also relates to the emergence of the concept of collaborative governance. As knowledge becomes increasingly specialized and institutions more complex and interdependent, the demand for collaboration with non-state stakeholders increases (Ansell & Gash, 2008). Janowski has described this as the evolution of digital government towards greater complexity and towards an increasing impact on its external environment (Janowski, 2015).

Digital technologies are now frequently regarded as a tool for making public services and policies more responsive, citizen-centric and user-oriented (Hung, 2012; King & Cotterill, 2007; Luna-Reyes et al., 2011; Millard, 2011; Misuraca & Viscusi, 2015). An explicit or implicit belief seems to be ingrained in a lot of existing research that the application of ICTs in public administration would generate a new kind of public governance that is digital in form and citizen-centric in nature. This discourse usually boils down to three kinds of assumptions:

- Digital technologies help design public services and policies that are **driven by the problems and needs of citizens** (Dunleavy et al., 2006; King & Cotterill, 2007).
- Digital technologies enable governments to design **user-centric public services** that put user convenience first (Holgersson & Karlsson, 2014; F. Karlsson et al., 2012; Millard, 2011).
- Digital technologies help governments **engage citizens** and other types of stakeholders in the process of designing public services and policies according to their needs and preferences (Braccini et al., 2018; Lee & Kim, 2018; Lidén, 2013; Meijer, 2015; Sæbø et al., 2008; Wigand, 2010).

Yet, despite the opportunities that digital technologies create for a more responsive, collaborative and user-centric government, the development of innovative forms of public governance and new kinds of relationships between digital government stakeholders is subject to challenges. So far, academic research in the e-government field has been heavily dominated by forward-looking, normative and techno-optimistic visions of technological solutions, reference architectures and technology-driven collaboration models that are assumed to lead to an open and citizen-centric government. Much more

than studying empirical cases and practical implementation challenges, researchers have been interested in the potential of ICTs and the benefits that digital technologies are expected to produce in terms of a more open and collaborative government (Bannister & Connolly, 2012; Norris, 2010a). How and with what results such digital government initiatives have unfolded in practice is, however, an issue that merits more attention than it has been given to date. For this reason, this thesis aims to bring additional empirical and theoretical insights into our understanding of digital technologies' impacts on public governance. The thesis thereby contributes to a small but distinct stream of critical studies that discuss the barriers and challenges that seem to be hindering the development of new forms of digital public governance (Bannister & Connolly, 2012, 2018; Janssen et al., 2012; Meijer, 2015; Norris, 2010b, 2010a; Weerakkody et al., 2016).

This thesis is particularly interested in the kind of digital government initiatives that could be termed **collaborative digital government innovations** – initiatives using digital technologies in novel ways with the aim to open up public governance processes for external input and collaboration with stakeholders outside a given public sector organization. Besides reliance on *digital technologies*, such initiatives have two defining features. First, they involve a *collaborative* element, i.e. public sector officials' explicit cooperation (exchange of information or ideas, or co-creation of policies or services) with stakeholders outside their organizations. Second, they entail the potential to induce *innovation* in public governance, i.e. the concepts have been designed with an ambition to transform core public governance processes and modus operandi through the use of technology (see Section 3.1 for a more thorough discussion on public sector innovation). Aiming to understand how such initiatives have fared in practice and what factors have shaped their outcomes, the thesis started out by posing two overarching research questions:

RQ1: What challenges have collaborative digital government innovations faced so far?

RQ2: How do different barriers and enablers affect collaborative digital government innovations?

In the course of the research, it became evident that for the sake of a more meaningful analysis, it may be useful to make a distinction between the adoption and institutionalization phases of such initiatives. A third question was therefore posed, focusing on understanding why many collaborative digital government initiatives have not (yet) become institutional practice:

RQ3: Why is it difficult to institutionalize collaborative digital government innovations?

The body of this thesis builds on nine original publications published in peer-reviewed journals, books and conference proceedings. The articles study three prominent trends in digital government that exemplify public administrations' efforts towards opening up public governance processes through increased collaboration with different types of stakeholders. The articles zoom in on three kinds of collaborative digital government innovations:

1) First, the creation of new collaborative online spaces with the goal of enabling the direct participation of citizens and stakeholders in co-designing public policy

according to their needs and preferences. This trend is summarized in the concept of **e-participation** and is the focus of articles **I** and **II**.

2) Second, the publication of public sector information in the form of digital, openly accessible, distributable and reusable **open government data** (**OGD**). The availability of OGD allows the public to freely access, share and reuse public sector data to acquire information and to co-create data-driven services that provide commercial or public value (articles **III, IV, VII**–**IX**).
3) Third, public administrations' efforts towards providing user-centric digital public services by applying the **'once-only principle'** (**OOP**)[3] in collecting data from citizens and companies (**V, VI**). Since once-only data collection presumes data sharing and reuse between public sector agencies, its implementation requires **interoperability** and close collaboration between public sector agencies. As policy efforts are currently being made to scale the implementation of the OOP up to cross-border e-government services at the European level (Krimmer et al., 2017, **V)**, collaboration of an unprecedented scale and depth is required not only between public sector organizations within one country but also between national administrations.

While e-participation, OGD and OOP-driven e-services are by far not the only faces of digital government, they constitute a prominent part of governments' efforts in this regard, all featuring among the main research topics in digital government research in the past ten years (Gil-Garcia et al., 2018). All three involve opening up public governance processes that have traditionally remained within the borders of the public sector, indeed often within the confines of a single organization. All require government organizations to collaborate with stakeholders beyond organizational borders. All also hold the potential of inducing transformational change in public governance institutions that goes beyond the digitization of already existing analog processes[4]. All three concepts require public sector organizations to reorganize business processes, redistribute roles and rebuild relationships to provide public information, create public services and develop public policy in a different way. Table 1 below summarizes the key dimensions of the three concepts.

[3] The once-only principle is an emerging principle in e-government. It proposes that when citizens and companies interact with the public sector to fulfil administrative obligations or receive public services, standard information should be collected from citizens and businesses only once and reused in future transactions with the public administration. This presumes that the data are stored digitally in a public sector database and other public organizations access the data directly (within the limits of their authority) instead of turning to citizens to request the same data multiple times.

[4] Following Mergel et al. (Mergel et al., 2019), this thesis distinguishes between the term *digitization*, which is defined as a "1:1" transposition of analog services to a digital channel; *digitalization*, which refers to digitally-driven changes in work processes; and *digital transformation* – a comprehensive revision of core government processes and services, which results in broader organizational and cultural changes and transformed relationships with citizens.

Table 1. Collaborative digital government initiatives: e-participation, OGD and OOP (source: author)

	E-participation	**OGD**	**OOP**
Main idea	Public sector organizations directly involve citizens in decision-making to shape public policy according to citizens' needs	Public sector organizations provide data to citizens to co-create digital services that serve citizens' needs	Public sector organizations collaborate and share data with other public sector organizations to provide user-centric public services that serve citizens' needs
Relevant public governance realm	Policy-making	Public service provision	Public service provision
Stakeholders involved in direct collaboration	Public sector organizations, citizens	Public sector organizations, citizens	Public sector organizations
Type of interaction between stakeholders	Engagement (G2C), participation (C2G)	Co-creation (G2C, C2G)	Collaboration (G2G)
Type of information shared between stakeholders	Draft policy documents, formal and informal opinions	Aggregated sets of digital open data (often structured and machine-readable)	Individual-level, closed data
Core digital infrastructure	Online information exchange and discussion platforms	OGD portals, APIs, data processing tools	Electronic identification and interoperability solutions

Abbreviations: G2G – government to citizens; C2G – citizens to government; G2G – government to government; API – application programming interface

The concepts also have important differences. First, e-participation, as defined in this thesis, occurs as part of the policy-making process and has a more political nature, whereas OGD-driven service co-creation and the OOP relate to the more technical process of public service creation and delivery. Second, the role of digital technology is somewhat different in the three concepts. While OGD and the OOP involve the digitalization of public governance 'outputs' (such as public information and public services), e-participation involves digitalizing the process whereby public governance is exercised but not the output of the process (which is a new policy or a political decision). Third, the cases demonstrate the diversity of effects that digital technologies can have on the patterns of government-citizen interaction and power relationships. While e-participation aims to facilitate direct dialogue and partnership between government officials and citizens, OGD provides opportunities both for partnership and citizens' self-service. At the same time, the goal of providing OOP-based public services is not to open the service process for direct input from citizens or other non-governmental stakeholders. Instead, it entails setting up new forms of collaboration and coordination between public sector organizations (within and outside country borders) to share and reuse data that citizens and companies have provided to any one of the organizations. This way, intensive interaction between public sector organizations essentially allows for *minimizing* public administrations' interaction with citizens under the premise that this would increase convenience and reduce the administrative burden for service users.

In light of these similarities and differences, studying e-participation, OGD and the OOP allows us to develop an understanding of the challenges, drivers and barriers of several forms of collaborative digital government innovations. Combining insights from literature and empirical cases, the thesis puts forward empirically grounded analytical propositions that both digital government researchers and practitioners may find of use. Moreover, as so many of the challenges revealed through the research relate to the characteristics and particularities of public governance, the thesis highlights the continued relevance of public administration research (in particular institutionalist approaches) in providing analytical constructs that can help understand digital government innovation. The thesis therefore also discusses how digital government research – an inherently interdisciplinary domain at the borderline of public administration, political science, computer systems and information science – can benefit from devoting more attention to understanding the essence and dynamics of public governance.

This introductory chapter is structured into eight parts. After the current introduction, Section 2 gives a brief overview of the methodological approach used in the articles constituting the body of this thesis. Section 3 explores the importance of understanding the implementation context and dynamics involved in innovative digital government initiatives. In Sections 4–6, building on previously published findings (**I–IX**), the thesis presents the key challenges and barriers to digital government initiatives in the areas of e-participation, OGD-driven co-creation and the OOP. Sections 7 and 8 synthesize the findings and discuss how a better understanding of the contextual factors and dynamics around collaborative digital innovations could guide digital government research and practice.

2 Methodology

This thesis examines the broad phenomenon of digital government innovation by looking at the implementation and challenges of e-participation, open government data and the once-only principle. While different in their scope and approach, all three illustrate public sector organizations' use of digital technologies to "empower and deliver for citizens" (*Open Government Declaration*, 2011) through increased collaboration with different types of stakeholders. Due to the objective of this research to understand the challenges, factors and interactions that play a role in the implementation of digital government initiatives, the research relies on qualitative methods of inquiry. A qualitative approach is broadly held to be suitable for tackling research problems that are not clear-cut and require investigating processes and interactions in their natural, 'messy' context (Yin, 2003). Qualitative, especially case-study-based, approaches are common in information systems research (Recker, 2013; Van Der Blonk, 2003; Walsham, 1995) and are also becoming increasingly used in digital government research (Gil-Garcia et al., 2018). At the same time, most studies on barriers to e-government innovation have so far relied on quantitative surveys, leaving ample room for more qualitative investigations of the mechanisms at work in digital government innovation (Meijer, 2015).

The publications that constitute the body of this thesis have made use of several research methods: literature review, case study research (mostly combining document analysis and interviews as data sources), qualitative surveys, focus groups and action research. Table 2 gives a summary overview of the methods used in the publications that make up this thesis. The following paragraphs provide additional details on how these methods have been applied in the publications.

Table 2. Focus and methodology of the publications (source: author)

Article	Core concept	Level of analysis	Research methods	Research questions
I	E-participation	Project	Literature review Case study	Why do e-participation projects fail? By which process does failure happen?
II	E-participation	Country	Literature review Case study	Why has Estonia been successful in implementing e-voting but faced challenges in e-participation?
III	OGD	Country	Literature review Case study	What explains the discrepancy between Estonia's high level of government digitalization and its poor performance in OGD?
IV	OGD	Concept	Literature review Qualitative survey	What barriers hinder the supply and use of OGD for the co-creation of public services?
V	OOP	Concept	Literature review Qualitative survey Focus groups	What drivers and barriers affect the adoption of the OOP for cross-border public services?
VI	OOP	Concept	Literature review Qualitative survey Focus groups	What are the expected benefits of implementing the OOP in cross-border services? What drivers and barriers affect the cross-border implementation of the OOP?
VII	OGD	Country	Literature review Action research	How to improve the performance of Estonia's OGD ecosystem?
VIII	OGD	Concept	Literature review Qualitative survey	How can open data be used to co-create public value providing services?
IX	OGD	Concept+ projects	Literature review Multi-case study	How can open data be used to co-create public value providing services?

Literature reviews were conducted as part of exploring all core research streams of this thesis with the aim to understand how e-participation, open government data (including data-driven co-creation) and the once-only principle have been addressed in existing academic and policy literature. In addition to these specific topics, the literature review also involved broader theoretical and empirical literature on e-government, information systems and public sector innovation with the aim to identify potentially useful analytical perspectives for studying collaborative digital government initiatives. The results of literature studies have been utilized in all publications (**I–IX**).

Case study has been a core research strategy employed in this thesis due to the qualitative approach of the thesis and interest in understanding the context of digital government initiatives. Case studies have been used both in the research on e-participation (**I, II**) and OGD (**III, IX**) and been exploratory (**II, III, IX**) or explanatory (**I**) in nature. The case studies use and triangulate between a variety of data sources, including document analysis (**I, II, III, IX**), semi-structured personal interviews (**I**, **III**), participant observation (**III**, **IX**), qualitative e-mail surveys (**IX**) and workshops (**III**). Input from interviews was analyzed by creating transcripts and manually coding the text using a theme-based coding scheme.

The case studies have been conducted at different levels – project level (**I, IX**) and country level (**II, III**). Both country-level case studies focus on Estonia – **II** analyzes Estonia's progress and challenges in the area of e-participation and **III** in the area of OGD. Similarly, one of the project-level case studies (**I**) looks at a particular e-participation project implemented in Estonia (Osale.ee), while **IX** studies a pilot service implemented in Estonia as part of a multi-case study of OGD-driven public service co-creation pilots conducted in five countries. The case selection in **II** and **III** has been driven by the intriguing empirical contrast of Estonia's success in e-government implementation, in particular the high penetration and acceptance of public e-services (Kalvet, 2012; Kitsing, 2011; Lember et al., 2018) and well-developed national OOP infrastructure (Kattel & Mergel, 2019) against the country's lack of notable progress in the areas of OGD (**III**) and e-participation (Kattel & Mergel, 2019; **II)**. Articles **I, II** and **III** thus set out to ask why, against the backdrop of a flourishing digital government that goes as far as calling itself the most advanced digital society in the world (Drechsler, 2018), has the government of Estonia not seen a high level of success in adopting e-participation and OGD.

In **IX,** the examined pilot projects of OGD-driven public service co-creation conducted in Estonia, Belgium, Ireland, Lithuania and the UK were all part of OpenGovIntelligence, a research and innovation project funded from the European Union's (EU) Horizon 2020 program where the author was involved in from 2016–2019. As the pilots were implemented in countries with varying OGD maturity levels (European Data Portal, 2016) and tested the same novel process of utilizing OGD for creating services of public value, this setting provided a unique opportunity to analyze the early results of OGD-driven co-creation in different national contexts.

Qualitative surveys constitute the central research strategy in **IV, V** and **VI**. In **IV**, 63 OGD experts in six countries participating in the OpenGovIntelligence project (Belgium, Estonia, Greece, Ireland, Lithuania and the UK) were surveyed to study how experts in different sectors (public, private, non-governmental) perceive the drivers, enablers and barriers of using ODG for public service co-creation. For **V** and **VI**, a survey was conducted among the representatives of 15 partner countries participating in The Once-Only Principle Project (TOOP), an EU Horizon 2020 funded innovation action that aimed to build and test a federated architecture for the cross-border application of the OOP

between European governments. The survey participants were asked to describe the national policy context for the implementation of cross-organizational and cross-border data exchange, describe the expected benefits of the OOP and identify the main drivers and potential barriers that may affect the successful application of the OOP in cross-border e-government services. In both cases (**IV** and **V–VI**), the surveys were carried out online and mostly had open-ended questions. The survey conducted for **V** and **VI** also included a few multiple-choice questions asking participants to rate the perceived likelihood of particular barriers that may negatively affect cross-border data exchange and collaboration between public administrations. In addition to surveys, research on the OOP (**V, VI**) has also made use of focus groups with project participants. The focus groups involved semi-structured discussions around the drivers and barriers of the OOP and the findings were used to enrich the survey findings with more nuanced contextual information.

The research questions presented in Table 2 show that the articles cover several phases of digital government innovations. Articles **I** and **II** analyze the factors that affect the implementation process and outcomes of e-participation projects. Article **IV** examines the factors that affect the initial adoption of OGD for public service co-creation, while **III** looks at the phase that follows adoption, i.e. the implementation and early results of OGD in a specific national context. At the same time, **V** and **VI** analyze the factors that affect the adoption of the once-only principle in cross-border transactions. **VIII** and **IX** shift their focus away from the drivers and barriers and propose a model for the implementation process of public-service co-creation using OGD. In addition to that, **IX** also analyzes the early results of the implementation of such a process based on a study of five cases.

VII is distinct from the other articles due to taking an **action research** approach. As the author had the opportunity to work with Estonian governmental and non-governmental stakeholders in the framework of a three-year project aiming to increase the provision and use of OGD in Estonia, an action research intervention was designed with the aim to study how the performance of the Estonian OGD ecosystem could be improved. Although focusing on one particular geographical and temporal context, action research differs from more typical case studies for its pragmatic and action-oriented approach: the knowledge gained from studying a case is commonly immediately applied to improve the situation or solve a problem identified through the research (Baskerville, 1999). The action research intervention also made use of the results of **III** and **IV** for the initial mapping of the barriers and gaps in the Estonian OGD ecosystem.

A qualitative research approach, in particular one relying mostly on case studies, has natural limitations, which have implications on the interpretation of the research results. The first is the limited generalizability of case studies, in particular single case studies. At the same time, although case studies cannot reveal generalizable statistical patterns, they do offer valuable insights that can inform analytical propositions (Walsham, 1995; Yin, 2003). Furthermore, information systems researchers have also recognized the practical value of case studies as a source of guidance for practitioners who deal with technology implementation (Sauer, 1993). Therefore, the results from the case studies researched in this thesis could be regarded as a source of new (or, in some cases, the reinforcement of existing) theoretical ideas and propositions, the validation of which remains for future research. Regarding the focus of some of the articles on the case of Estonia, the quality and quantity of the empirical data that the author had access to by

virtue of conducting research in Estonia may at least partly compensate for the inescapable limitations of a single-country case study.

Nevertheless, three main kinds of measures have been applied in **I–IX** to strengthen the validity and reliability of the research. First, all research projects (and the resulting publications) combine research methods and use more than one source of data to minimize the effects of possible biases in data or methodologies. Second, the research process has always started with a thorough review of academic literature. The theoretical work has thus been built on a foundation laid by existing analytical frameworks that are accepted by scholars in the respective fields. Lastly, the articles of this thesis have taken care to explain the methodological choices and describe all the steps taken to get from data to conclusions, thereby giving reviewers and readers the option to validate, criticize or challenge the findings.

3 Context and Challenges of Collaborative Digital Government

Both digital government policy and research tend to be characterized by normative assumptions and optimistic assertions about the effects of technology on openness and collaboration. Part of this may be due to their narrow conceptualization of technology to begin with. In this stream of literature, digital technologies tend to be regarded as tools composed of software, hardware and the processes for running them. However, this view often disregards the social aspect of technology and the ways in which technology shapes and is shaped by power relations in organizations and society (see, for example, Doolin, 1998). One of the recurrent misconceptions in the techno-optimistic discourse is that digital technologies would somehow naturally make the government more open towards society, increase civic participation and induce collaboration and trust between governments and citizens (Neubauer et al., 2012; Norris & Reddick, 2013).

Over time, however, more critical research has emerged that has challenged these assumptions and turned our attention to the discrepancy between the hopes and the empirical realities of digital government implementation. Such literature brings forth two important arguments. First, while digital technologies may enable more collaboration, digital technologies may as well be used to reduce collaboration between governments and citizens. Second, even digital government initiatives that have been launched with the explicit aim of fostering collaboration may fail to do so in practice.

This first argument is succinctly illustrated in Lember et al. (2019), who show that the use of digital means does not automatically lead to increased collaboration and co-production of public services between governments and societal stakeholders. Lember and colleagues argue that although technology can augment co-production between different stakeholders, it can also diversify or even do away with co-production by enabling the provision of automated, proactive and 'invisible' public services. Similarly, digital technologies can facilitate various modes of citizen control over public governance processes. Some technological solutions (e.g. open government data) allow citizens, private companies and civil society organizations to assume full control over public service provision by creating services on their own, whilst others (e.g. automation or data exchange infrastructures) can also place citizens in the role of passive consumers of fully government-provided services (Lember et al., 2019). The once-only principle (explored in **V** and **VI**) is an interesting case in point – while it increases collaboration between public sector stakeholders, the effective implementation of the principle will reduce or even eliminate co-production between the public sector and citizens.

The second argument emerges from a number of studies that have researched the empirical implementation of digital government initiatives. We see that the adoption of digital government innovations oriented towards citizen engagement and collaboration may be slow to take off (Dawes, 2008; Norris, 2010a, **III**). Digital initiatives that aim to transform the public service delivery process often face implementation hurdles (Janssen et al., 2015; Van Veenstra et al., 2011; Weerakkody et al., 2016, **IV**, **V**). Many collaborative and participatory initiatives have not yielded the expected qualitative results nor attracted the hoped-for level of attention and use (Charalabidis et al., 2014; Chun & Cho, 2012; Kubicek & Aichholzer, 2016). Some have even been written off as failures (Chadwick, 2011; **I**, **II**).

Donald Norris, one of the most vocal skeptics in e-democracy and e-participation research, has criticized the technologically deterministic claims of many e-government proponents, which state that ICT adoption in the public sector would naturally lead to

more citizen participation, collaboration and engagement. Discussing why this had not happened by 2010, nor would happen in the near future, Norris (2010a) emphasized the importance of giving due consideration to the many barriers that exist in the organizational, institutional and human context in which technologies are implemented. Other authors, such as Chadwick (2011), have found e-participation and e-democracy initiatives to fail due to challenging combinations of institutional variables, which often outdo intentional agency. Similarly, in their study of the European Citizens' Initiative, Susha & Grönlund (2014) identified a mix of political, technological and organizational factors, coupled with problems in strategic planning and project management, which acted as barriers and contributed to the stall of the initiative's online participation tool. Others yet (Sæbø et al., 2011) have highlighted stakeholder complexity and poor understanding of stakeholders as a reason why e-participation projects fall out of use.

Similar observations about the problems of idealized thinking have been made in research on open government data (OGD). For example, Janssen et al. (2012) discussed the myths surrounding the adoption of open data, among them the belief that the publication of open data would automatically result in an accountable and transparent government. To balance the simplistic claims about the benefits of OGD that persist in literature, they interviewed public officials and identified a number of barriers that prevent the provision and usage of OGD. Such barriers pertained to task complexity, use, legislation, information quality and participation and were often found to be interrelated in practice.

Implementation difficulties have been noted for digital government projects that involve cross-organizational collaboration (Bannister & Connolly, 2012; Pardo et al., 2006) and many other types of digital government projects (see, for example, Dwivedi et al., 2015). Studying digitally-enabled public service transformation projects, Weerakkody et al. (2016) found that projects fail "if the complex institutional setting of the public sector is not comprehended in the change-institutionalisation effort". Other studies of large-scale digital transformation projects in public administration (e.g. Janssen et al., 2015; Van Veenstra et al., 2011) reveal the same pattern – in digital government initiatives that have the goal of changing business as usual, contextual factors such as stakeholder complexity, unrealistic ambitions, management errors, difficulty of organizational change, legal issues and the human factor all tend to intertwine, resulting in serious implementation problems. In their conclusions, Janssen et al. (2015) reiterate the importance of acknowledging the inherent *uncertainty* and *complexity* involved in the implementation of transformational digital government projects (Janssen et al., 2015). This is an observation that studies of information systems' failure have made repeatedly before (see, for example, Sauer, 1993).

On the one hand, therefore, we see history repeating itself and similar problems recurring in different types of digital government projects. On the other, due to the importance of institutional issues and stakeholder complexity as frequent barriers in digital government projects, there is reason to assume that the collaborative element in digital government concepts such as e-participation, OGD-driven co-creation or the OOP may be a source of specific challenges, which should be better understood to better manage their implementation.

In order to understand the prerequisites that need to be in place for the successful institutionalization of collaborative and boundary-crossing digital government initiatives, this thesis sought to follow the suggestion to study "what works and why, as well as what does not work and why not" (Bannister & Connolly, 2012). Based on the lessons learned

from previous studies, articles **I–VII** and **IX** have devoted particular attention to understanding the *context* in which digital government concepts and projects are implemented, drawing on empirical observations when possible. In doing so, the articles have built on general concepts and observations drawn from public sector innovation literature, which in turn has borrowed ideas from institutionalist accounts of public administration. These have been complemented with more specific literature relevant to the three research streams at the center of this thesis, including e-participation (and the closely related field of e-democracy), information systems management, political participation, open government data, co-production and co-creation, the once-only principle, interoperability, cross-border e-government and technology acceptance. The next paragraphs will discuss how greater attention to the characteristics and institutional context of public administration organizations can help us comprehend the implementation challenges of collaborative digital government initiatives.

3.1 The Role of Digital Technologies in Public Sector Innovation

One of the main research fields dealing with the questions why, how and with what results public sector organizations change is Public Sector Innovation (PSI). As a topic of scholarly interest, PSI is older than e-government; however, an important share of more recent PSI literature has co-existed and co-evolved with digital government research. One of the key issues that has been raised with regard to PSI research is to what extent is innovation in the public sector different from innovation in the private sector. In his overview of the evolution of PSI literature, Kattel (2015) explores this question by dividing public sector innovation research into three periods. He finds that the first, 'Schumpeterian' period in the first half of the 20th century was mostly interested in explaining innovation as a phenomenon, without going too much into the specifics of the private or public sector. The second, organizational-theory period (originating in the organizational management literature of the 1960s) focused on various drivers and incentives of change at the organizational level but, according to Kattel, almost did not distinguish public sector innovation from innovation in private companies. The third and most recent period – the so-called autochthonous-theory period – started taking shape in the 2000s and has attempted to discuss innovation specifically in public services and governance. However, as Kattel notes, even 'autochthonous' PSI literature mostly makes no conceptual distinction between public sector and private sector innovation and thus fails to fully explain how the dynamics of transformative change work in the public sector.

According to Kattel, part of the problem lies in the normative connotations that tend to shape the PSI discourse (any successful reform is labeled innovation) and the tendency to define PSI as changes in organizations' tasks that go beyond incremental improvements (Kattel, 2015). In fact, the literature review of De Vries et al. (2016) shows that most publications in the PSI field do not even distinguish between incremental change and discontinuous, disruptive change that would perhaps merit the name of innovation. Kattel, however, is critical of defining PSI simply in terms of the degree of change in tasks. Instead, he argues that public sector innovation is about evolutionary changes *in the intrinsic features of the public sector*, which have to do with authority, legitimacy, trust and the related rules, relationships and institutions. He thus encourages research to devote attention to analyzing public-sector-intrinsic constraints and enablers of innovation to understand how processes of profound change unfold in the public sector.

These observations lead to two suggestions for the study of innovative digital government initiatives. First, when studying the contextual factors that affect digital government initiatives (whether or not we call them innovations), there is a need to devote particular attention to studying how broad public sector-level characteristics affect these initiatives and what challenges or hurdles they pose to their implementation and diffusion. Second, to better understand why and how new digitally-enabled practices become adopted and institutionalized in the public sector (and why some do not), there is a need to examine how digital government initiatives with transformative potential affect the institutions and relationships that relate to the core characteristics of public administration. Within this study, special attention could be devoted to examining how they affect authority and power relations within and beyond the public sector.

This takes us to the still under-examined relationship (Misuraca & Viscusi, 2015) between digital technologies and public sector innovation. According to Bekkers et al. (2013), ICTs have a twofold role in public sector innovation: 1) technology can act as the key source and driver of innovation, and 2) technology can facilitate innovation by providing tools and platforms for information exchange and communication that support the exchange of ideas. So, does any novel application of digital technology in the public sector constitute public sector innovation? Here Misuraca & Viscusi (2015) offer a useful typology, although it is worth noting that their definition of innovation is looser than that of Kattel (2015) – they define "ICT-enabled innovation" simply as ICT-based applications that are used with the aim of changing and improving governance and policy-making. The value of their approach is the differentiation they make between *innovation* (the application of digital technologies) and *transformation* (the actual change in public governance mechanisms as a result of ICT-enabled innovation). They propose a typology of ICT-enabled innovations based on the scope of the innovation (whether it concerns internal governance mechanisms or external relationships) and on the innovation's impact on public governance – see Figure 1.

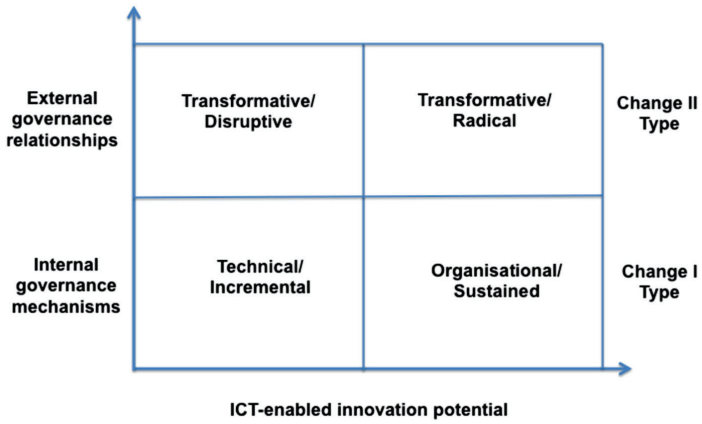

Figure 1. Typology of ICT-enabled innovations in the public sector (source: Misuraca and Viscusi, 2015, p. 308)

In this framework, Type I changes concern internal governance mechanisms and involve incremental improvements in administrative routines or gradual organizational changes where ICTs complement existing efforts to improve governance mechanisms. The adoption of social computing to interact with constituencies is given as an example

of this type of innovation. At the same time, Type II changes concern public administrations' external relationships and could produce transformative changes in public governance. The latter may range from disruptive transformations (which Misuraca and Viscusi define as using ICT to create new mechanisms for service delivery and policy-making) to radical transformations – "substantial use of ICTs outside the recognized institutional setting", which radically change governance systems or policy-making mechanisms as we know them. According to this view, the innovative application of digital technologies in the public sector may – but does not necessarily – produce transformative changes in public governance, which could qualify as public sector innovation in Kattel's terms. At the same time, Karo & Kattel (2016) note that technology-driven evolutionary changes in the public sector tend to be more profound and systemic than changes driven by factors such as ideological preferences.

We can therefore think of digital government concepts such as e-participation, OGD or the OOP as digital technology-driven innovations that seek to transform existing public governance structures and practices. Due to their transformative ambition and potential, their implementation may trigger public sector innovation of a transformative kind (i.e. profound changes in public governance systems, institutions and power relations between public and non-governmental stakeholders). However, as this thesis argues, it is by far not a given that the adoption of innovative digital government initiatives should lead to disruptive or radical transformations in public governance. In order for innovations to transform public governance, they need to become institutionalized, i.e. become incorporated into organizational structures, processes and routines (Weerakkody et al., 2016) and become widely "accepted as effective ways to achieve the agreed objectives" (Hjelmar, 2019). A distinction therefore needs to be made between initiating or adopting an innovation and its actual institutionalization as part of public governance norms and practices.

3.2 Contextual Drivers and Barriers

What, then, drives and constrains the emergence and institutionalization of digital innovations in the public sector? A large part of the 'third wave' of the PSI literature has tried to understand and systematize the factors that affect public sector innovation. One of the most comprehensive overviews is that of De Vries et al. (2016). Among other results, their literature review shows that public sector innovation is affected by contextual drivers and enablers in four main categories: (1) environmental level (e.g. regulatory and environmental pressures, participation in networks and inter-organizational relationships); (2) organizational level (resources, leadership styles, risk aversion, incentives, organizational structures); (3) characteristics of the innovation (e.g. ease of use, relative advantage, compatibility, cost, trustworthiness); and (4) characteristics of innovators (e.g. employee autonomy, tenure, mobility, knowledge and skills, creativity, commitment).

De Vries et al. (2016) find that the key drivers contributing to the generation of innovations in the public sector have to do with environmental, organizational and individual factors and not so much with the characteristics of an innovation (which, however, do play a role in the subsequent diffusion stage). At the environmental level, key drivers are seen in external pressures (from the public, political leadership or media), closely followed by participation in inter-organizational networks and somewhat less by regulatory aspects and organizational isomorphism. At the organizational level, slack resources, innovative leaders and risk-taking cultures act as major drivers, whereas at

the individual level, employee autonomy and skills were found to matter the most. Some factors, such as innovation leadership, were found to be important in all stages of innovation, from inception to diffusion. The European Commission's widely quoted report "Powering European Public Sector Innovation" (European Commission, 2013b) highlights similar categories of influential factors – enablers and impediments relate to organizations, resources, institutions, culture and stakeholders. In their literature review of public sector innovation barriers, Cinar et al. (2019) use a similar categorization but particularly highlight what they call 'interaction-specific barriers' – obstacles such as communication or trust issues that emerge in the interactions between different stakeholders involved in an innovation process.

It is a widely shared understanding that due to the functions and historical evolution of public administration, the characteristics of the public sector are different from those of the private sector. The public sector context is characterized, for instance, by the need to serve and coordinate the interests of multiple different organizations and stakeholders at once (Dwivedi et al., 2015; Janssen & Klievink, 2012; Sarantis et al., 2010), multi-rationality and ambiguity of objectives (Angelopoulos et al., 2010; Anthopoulos et al., 2016; Dwivedi et al., 2015; Osborne & Brown, 2011), organizational inertia (Sarantis et al., 2010), structural and legal complexity, susceptibility to political interests (Anthopoulos et al., 2016; Osborne & Brown, 2011; Rashman et al., 2009), regulatory barriers (Alathur et al., 2016; Berntzen & Karamagioli, 2010; Kubicek, 2010; Sarantis et al., 2010) and constraints emanating from particular institutional histories, state and governance traditions (Bekkers et al., 2013; Pollitt & Bouckaert, 2011). These features also have implications on innovation in the public sector.

A few works in the domain of PSI focus more narrowly on the drivers of *digital* innovation in the public sector. For example, based on an empirical study of the adoption of e-procurement and teleworking in six European countries, Nasi et al. (2015) found that the adoption of digital innovations is strongly driven by external forces such as legal obligation, mimetic pressures and political support, but also internal organizational factors, most notably employee initiative and top management support. For innovators and first adopters, political support is particularly important, whereas late adoption is more strongly influenced by internal organizational factors such as the presence of ICT skills and equipment. At the same time, the existing bureaucratic culture frequently acts as a barrier to ICT-driven public sector innovations (Nasi et al., 2015).

Studies of e-government innovations support these findings. Meijer (2015) cites a number of collaborative digital innovation barriers both on the government's and citizens' side, from technical to financial, legal, organizational, structural and cultural barriers. On many occasions, political will has been found to be a key driver and enabler of digital government projects, while different stakeholder agendas, political turbulence and resource issues tend to act as barriers (Angelopoulos et al., 2010; Anthopoulos et al., 2016).

Comparing the findings from PSI and e-government literature, it thus appears that the barriers and enablers of public sector innovation are rather similar for digitally driven and 'analog' innovations. The main difference seems to be the obvious relevance of the availability of different technologies for digital government innovation and the particular features of these technologies, which may shape their acceptance and usage. From PSI and e-government literature we can therefore derive a general classification of the contextual drivers and barriers that could affect the implementation and outcomes of innovative digital government initiatives. The key categories along with some examples

of factors in the respective category are summarized in Table 3. These categories have also formed the general basis for discussing the more specific context of e-participation, OGD and the OOP in **I–VI**.

Table 3. Key categories and examples of context factors of collaborative digital public sector innovation (source: author)

Technology	**Innovation characteristics**	**Public officials**	**Citizens**
Availability of hardware and software	Ease of use	Characteristics of individual innovators	Motivation to engage with government
Features of specific technologies (e.g. security)	Cost	Attitudes, beliefs	Interests
Interoperability	Compatibility	Knowledge and competences	Knowledge and competences
	Trustworthiness	Trust in citizens	Trust in government
	Relative advantage	Leadership	Time constraints
		Human error in innovation management	Perceptions (e.g. usefulness of the innovation)
Organizations	**Institutions**	**Public sector context**	**Broader environment**
Capabilities	Regulations and legal constraints	Influence of politics and political will	Public attention
Incentives	Informal norms	Stakeholder complexity, different agendas	Media attention
Financial resources	Institutional histories	Multi-rationality	Mimetic pressures
Human resources	Legal and administrative culture	Bureaucratic and democratic principles	Technological development
Organizational structures	Coordination and governance mechanisms	Organizational competition for power and legitimacy	
Organizational cultures	Existing power relations	Expanding domain of public intervention	
Resistance to change			
Top management support			
Participation in networks			

Based on: Angelopoulos et al., 2010; Anthopoulos et al. 2016, Chadwick, 2011; Cinar et al., 2019; Cordella and Tempini, 2015; De Vries et al., 2016; Dwivedi et al., 2015; European Commission 2013a; Janssen et al., 2012; Janssen et al., 2015, Meijer, 2015; Nasi et al. 2015; Osborne and Brown, 2011; Susha and Grönlund, 2014; Van Veenstra et al., 2011; Weerakkody et al., 2016.

Having established the relation of digital technology with public sector innovation and defined the main elements of the context of digital government initiatives, the next question is: how exactly does context influence the adoption and institutionalization of innovative digital initiatives?

3.3 The Institutional Context

In addition to PSI, other streams of research have explored how changes take place in public sector organizations without explicit interest in the concept of innovation. These kinds of works often use varieties of institutional theory to explain change (and continuity) in public administration. In a simplified manner, institutions could be defined as relatively stable collections of structures, arrangements, resources, processes and formal and informal norms that influence the perceptions, preferences and behavior of social actors (Bell, 2002; Lowndes, 1996; March & Olsen, 2004). Some authors prefer more specific definitions – for example, Köning (2016) defines institutions as formal and informal rules, clearly excluding elements such as ideas or political actors from the definition. As a middle-range concept, institutions are regarded as a layer that is broader than individual actors and organizations but narrower than the "broader structural factors" such as economy (Bell, 2002). North (1990) has defined institutions as "rules of the game", while organizations are the "actors" in the game. What is important for understanding innovation and change is that institutions are believed to create both opportunities and constraints for human action (Lowndes, 1996), mediating the influence of broad structural and environmental forces and conditioning the choices of individuals and organizations (Bell, 2002). At the same time, institutions can also change and be purposefully changed by agents such as organizations (North, 1990).

Institutional theory is not one coherent theoretical framework but a set of approaches that have emerged from disciplines such as political science, public administration and economics and that have a common interest in understanding institutions – including institutional change. Köning (2016) has divided contemporary 'neo'-institutionalist approaches into three broad streams: 1) historical institutionalism, which is interested in examining the historical evolution of institutions and the path dependencies emanating from existing institutional arrangements, 2) ideational (sometimes also called sociological, discursive or normative) institutionalism, which focuses on the role of ideas, attitudes and beliefs in processes of institutional change, and 3) rational/public choice theory, which is rooted in behaviorism and focuses on studying the internal motivation of actors as the factor shaping institutional behavior. All have their strengths and limitations. The value of the rational choice school is seen in its focus on studying how institutions shape actors' preferences and provide incentives for certain kinds of behavior that actors see as maximizing their utility, whereas historical and ideational/sociological approaches argue that actors are embedded in their institutional context and 'rationality' depends on a number of contextual factors that actors may not even be able to recognize, let alone act upon (Bell, 2002). It is important to note, however, that not even rationalists consider human decision-making to be perfectly rational – more often they refer to 'bounded rationality' (a concept originally proposed by Herbert Simon), which refers to human cognitive limits and the need to make decisions within the constraints of limited information (Nilsson, 2018).

Both historical and ideational institutionalism tend to emphasize the power of the existing institutional context over actors' intentional behavior. While historical institutionalists focus on the interplay between institutions and external context (Köning, 2016), the ideological/sociological stream regards ideas, values and beliefs as the central variable mediating the interaction between the external environment and institutions (March & Olsen, 1989). Due to their traditional focus on path dependencies and institutional reproduction, sociological and historical approaches have been criticized for failing to explain change as opposed to continuity (Lowndes, 1996). However, considering

recent advances in all streams of institutionalist literature, Köning (2016) argues that this criticism is no longer warranted.

The main debate between rational choice and historical/sociological institutionalisms has been framed in terms of the overarching question whether institutional change is the result of rational, strategic action or norm-governed behavior (Lowndes, 1996). Different streams of institutionalism offer different answers as to what drives actors' decisions and behavior. The rational choice stream emphasizes the 'logic of consequence' – actors take action because they anticipate this to yield certain consequences (Lowndes, 1996). Ideational institutionalists stress an alternative logic – the 'logic of appropriateness' (March & Olsen, 1989, 2004). Central to this concept is the proposition that "actors seek to fulfill the obligations encapsulated in a role, an identity, a membership in a political community or group, and the ethos, practices and expectations of its institutions" (March & Olsen, 2004). March and Olsen explain that actors' decisions and behavior are not based on a rational calculation but on their perception of what is considered 'appropriate' (good, desirable, expected) in the given institutional context.

Nevertheless, researchers are increasingly suggesting that different 'institutionalisms' are not in fact incompatible but can be successfully combined to provide nuanced explanations of institutional change (Köning, 2016). Lowndes posited that institutions are characterized both by utility-maximizing and norm-governed behavior: "strategic action plays an important role in driving institutional change, whilst norm-driven behaviour is a key force in sustaining institutional rules over time" (Lowndes, 1996). Köning (2016), on the other hand, has elaborated a model for analyzing trajectories of institutional change, which constructively combines insights from all streams of institutionalism.

Institutional approaches have driven a good deal of thinking around reform and change in public administration. One of the most frequently cited analytical frameworks in the historical tradition is Pollitt & Bouckaert's (2011) model of institutional variables that affect variance in policy reforms. Pollitt and Bouckaert regard policy reforms as processes encompassing interactions between the socio-economic environment, political pressures and characteristics of the politico-administrative system (variables such as state structure, administrative culture, relations between ministers and top administrative officials, and so on). Depending on the context, these institutional features may act as drivers or constraints to change. This is similar to Kattel's (2015) conceptualization of political, legal, institutional and administrative features of the public sector as factors that are changed through processes of evolutionary change, while acting as constraints to change at the same time.

Institutional theory has also informed part of digital government research, although several authors have argued that the relationship between digital innovations and institutional barriers should be studied more thoroughly (Chadwick, 2011; Meijer, 2015; Weerakkody et al., 2016). According to Weerakkody et al. (2016), literature on transformational digital government initiatives has paid too little attention to the ways in which external environmental influences shape the institutionalization of digital innovations. They argue that the implementation of digital technology in the public sector should be seen as more than the application of a novel tool. Instead, they view it as an integrated institutionalization process, which is affected by existing rules, norms and public organizations' competition for power and institutional legitimacy.

According to Meijer (2015), public officials' beliefs and norms often act as barriers to e-government innovation. Many of the barriers stem from officials' fears that an

innovation would challenge the existing power balance and status quo. A successful institutionalization of digital innovations thus requires changes to take place in "taken for granted activities", which involves setting up new procedures as well as the formation of new norms in order for the innovation to become routine organizational practice (Weerakkody et al., 2016).

Institutional approaches offer explanations both as to what triggers innovation and how it becomes institutionalized. Different streams of institutionalism view the triggers somewhat differently. According to Köning (2016), some streams (e.g. historical institutionalism) tend to stress external drivers of change, such as external events, large-scale developments or the influence of other institutions. Weerakkody et al. (2016) posit that digital innovations often emerge as organizations' strategic response towards normative or social pressures (conformation to certain norms), coercive pressures (political or legal pressures or pressure to meet certain standards) or mimetic pressures (pressure to emulate other organizations). Other institutionalist streams (ideational and rational choice) pay more attention to endogenous processes of the formation of new beliefs or preferences within institutions. In the case of endogenous change, institutional change is triggered by dynamic internal processes and institutions' interaction with the actors embedded in them.

However, another question is how innovative ideas eventually become institutionalized – how novel concepts become ingrained in organizational routines and how they come to change governance practices. Köning (2016) proposes a useful framework for understanding this process. An important premise of this understanding is that there is no reason to expect innovative ideas to have immediate impacts, especially if the change is driven by external factors such as technological development. As relative stability is one of the defining features of institutions (Lowndes, 1996), institutional change tends to be complicated and slow (Köning, 2016). Therefore, the institutionalization of novel practices happens through a process that involves two important elements: 1) ideational change within the actors internal to the institution (i.e. how actors evaluate existing institutions), and 2) changes in the preferences of powerful actors (i.e. whether those who have the power to change the institution consider institutional change to be in their interests). The preferences of powerful actors may change as a result of ideational change, but they may also change as a result of changes in power distribution, which create a new elite with different preferences. In any case, Köning's model suggests that there is no shortcut from the adoption of an innovation to its institutionalization – in order for real change to happen, powerful actors need to perceive the change as desirable and actively support the change. This resounds with a frequent finding in public sector innovation studies that active, purposeful innovation leadership is a key force both in the creation and diffusion of innovations (see, for example, De Vries et al., 2016).

In a simplified manner, the interactions between innovative digital government concepts and public governance are summarized in Figure 2. On the one hand, collaborative digital government innovations seek to alter the rules, structures, practices and relationships that make up public governance institutions. On the other, features of the public sector, its existing institutions and governance system act as drivers of digital government innovation (e.g. by creating pressure or providing resources for innovation) and as constraints to innovation (e.g. by being a source of complexity, organizational resistance or cultural impediments to change). Individual public sector organizations are often regarded as the central actors in public sector innovation. The institutionalist view

reminds us that organizations do not act in a vacuum but are embedded in the broader institutional context, which shapes organizational responses to innovation. At the same time, organizations, institutions and technological innovations are all affected by the broader structural environment (e.g. technological developments, international pressures, political agendas, economy) and the behavior (leadership, resistance, indifference) of powerful stakeholders. The latter in turn is also influenced by the norms and beliefs embedded in the institutional context.

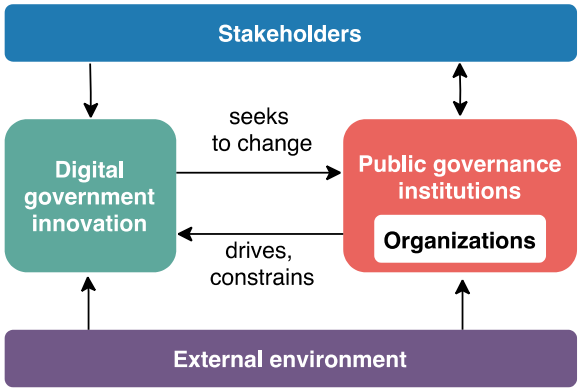

Figure 2. Relationship between digital innovations and public governance (source: author)

In sum, public sector innovation literature and institutionalist approaches to public administration research provide a helpful framework for analyzing digital government initiatives as they emphasize the need to:

1. acknowledge the **complex interactions** between (technological) innovations, public sector organizational and institutional context and broader environmental factors;
2. pay attention to how the institutional context **creates incentives** for public sector organizations to adopt innovation and how it **constrains** the adoption and institutionalization of innovation;
3. study what **motivations drive actors' behavior** related to innovation adoption and institutionalization and how norms, ideas and culture shape these actions.

Based on the findings of **I–IX**, Sections 4–6 will go into more detail and elaborate on the contextual factors and dynamics that have driven and challenged the implementation of three types of digital innovations in the public sector – e-participation, OGD and the once-only principle.

4 Citizens' e-Participation in Public Policy Making

One of the areas of public governance that has seen almost extreme digital optimism in theory and implementation problems in practice is ICT-enabled citizen participation in policy-making. Once the Internet and e-government technologies started to rapidly spread around the 1990s and early 2000s, many researchers and democracy enthusiasts predicted an impending revolution of participatory democracy characterized by ICT-mediated citizen participation in political decision-making (e.g. Coleman, 1999; Tambini, 1999; Tat-Kei Ho, 2002). The use of ICTs has been regarded as a means of lowering barriers to inclusion and strengthening citizens' political participation (Lidén, 2013). Compared to traditional 'offline' civic participation, e-participation has been seen as a way for broadening public participation and involving a much wider group of people in the policy process (Macintosh, 2004).

Over the last two decades, many governments have created e-participation platforms and launched digital initiatives to engage citizens in policy processes. However, their results have at best not quite met stakeholders' expectations and at worst been described as failures (**I**). Articles **I** and **II** of this thesis ask why e-participation initiatives have not managed to attract the expected take-up (Epstein et al., 2014; Glencross, 2009; Tambouris et al., 2012) and produce the desired results (Charalabidis et al., 2014; Chun & Cho, 2012; Kubicek & Aichholzer, 2016; Osimo et al., 2010; Prosser, 2012; Quittkat, 2011). To this end, **I** and **II** focus on examining what contextual factors and interactions affect the implementation and outcomes of such initiatives.

Before getting to the research findings, some clarifications of terms are in order. The terms e-participation and e-democracy are often used interchangeably in literature and are indeed closely interrelated, both referring to the usage of digital technologies for political communication between government decision-makers and citizens or societal groups. However, while the focus of e-democracy research has been on the usage of ICTs for achieving democratic goals, the e-participation research domain tends to have a more instrumental focus on the usage of ICT tools for participation in a variety of areas, which may not necessarily be related to political decision-making and democracy (Susha & Grönlund, 2012). Due to this, e-participation research has been more occupied with issues such as the design and usability of participation tools, while e-democracy research has paid more attention to studying the political impacts and democratic effects of using ICTs for citizen participation (Susha & Grönlund, 2012). At the same time, neither domain can easily be limited to a certain set of technologies or tools – both have been interested in a number of different technologies, tools and their combinations that facilitate citizen participation (Medaglia, 2012; Sæbø et al., 2008). The applications of digital technology studied in e-democracy and e-participation research have ranged from e-voting to e-consultation and e-petitioning and from specific e-participation platforms to the use of existing online forums and social media sites to mine citizens' ideas and input.

As this thesis started out of a specific interest in the usage of government-led online participation spaces to facilitate citizen participation in policy-making, the term 'e-participation' was adopted as the central concept. In defining the term, the thesis built on the widely used definition of Macintosh (2004), who relates e-participation to online consultation and dialogue between government and citizens and distinguishes e-participation from other e-democracy instruments, such as e-voting in elections. In **I** and **II**, the study of e-participation has been further narrowed down to e-participation projects where a new information system (IS) has been developed to facilitate

government-wide consultation and dialogue with citizens in the policy-making process. Unlike participation in public service creation and delivery, participation in policy-making is a process of a more political nature. As will be argued below, this political nature is a source of challenges when it comes to the adoption and institutionalization of e-participation by governments.

E-participation and e-democracy research have been criticized for their inclination towards techno-optimism, sometimes even techno-utopia, and limited motivation to understand the practical complexities involved in implementing e-participation tools and systems (see, for example, Steinbach & Süß, 2018). The normative bias and tendency to present the positive and transformational impacts of digital technologies on participatory democracy as a given was particularly prominent in the early works of the field, which are well summarized by Norris (2010a). However, over time, more sober voices have emerged that have critically reviewed the impacts of technology on democratic participation and deemed many claims about the e-democracy revolution to be premature and unfounded (Albrecht, 2006; Bannister & Connolly, 2012, 2018; Norris, 2010b, 2010a; Norris & Reddick, 2013). In light of the empirical results of e-participation initiatives, the question emerges: What explains the implementation challenges and lack of impact that often characterize these undertakings?

I and **II** argue that one of the reasons is the tendency towards techno-utopia itself – stakeholders' expectations towards e-participation systems and initiatives may simply be overly ambitious and unrealistic given the complexity of their context and the high uncertainty about how such novel processes are actually going to work. The many goals that e-participation is expected to achieve include increasing citizens' participation in political decision-making (Macintosh, 2004; Sæbø et al., 2008; Tambouris et al., 2012), increasing public trust (Warren et al., 2014; Wirtz et al., 2018), enhancing the legitimacy of democratic processes (Christensen et al., 2015; Prosser, 2012), improving the quality and success of policies (Reddick, 2011; Tambouris et al., 2012; Wirtz et al., 2018), and so on. Besides delivering a functional technical tool for political dialogue, e-participation projects may be expected to mobilize active users from different stakeholder groups in order to achieve their goal of creating dialogue between policy-makers and citizens (**I**). Things get even more complicated as e-participation projects frequently seek to engage diverse stakeholders (citizens, public administrators, politicians), who may have different needs and conflicting expectations towards e-participation tools (**I**).

While the development of digital technologies creates opportunities and high expectations for citizen participation, the implementation of digital technologies for democratic participation is hindered by the complex context in which these initiatives are implemented. **I** shows how e-participation initiatives are affected by three overlapping contextual layers: 1) the context of technology implementation and information system management, 2) the characteristics of the public sector, and 3) the specific context of democratic participation and dialogue. Just as other digital innovations, e-participation initiatives are subject to barriers that affect ICT implementation, such as technical complexity, management errors resulting from human cognitive limits and the uncertainty and complexity of IS projects (Dwivedi et al., 2013; Goldfinch, 2007; Hughes et al., 2016; Janssen & Klievink, 2012; Nelson, 2007; Sauer, 1993). However, the public sector context adds another layer of complexity. As outlined in Section 3.2, the public sector is characterized by stakeholder multiplicity, multi-rationality, institutional and organizational inertia, structural and legal complexity and the enormous importance of politics. These have implications on the implementation of technological innovations as

these variables affect both the emergence of innovative ideas and their acceptance and institutionalization (Meijer, 2015).

The third contextual layer is related to the nature of e-participation initiatives as democratic tools and their objective of bringing citizens into a political dialogue with public sector stakeholders. The process of e-participation is regarded as more complex than other e-government processes such as online service provision (Chadwick, 2011; Norris & Reddick, 2013; Sæbø et al., 2011). **I** and **II** demonstrate how this specific objective indeed creates additional complexity. **I** outlines a number of factors that act as enablers or barriers to the adoption and institutionalization of e-participation. Among others, these factors relate to the importance of political support or resistance to e-participation (Mahrer & Krimmer, 2005; Panopoulou et al., 2014), the impact of civic participation culture and trust in political institutions on citizens' motivation and capacity to participate (*Electronic Democracy*, 2009; Freeman & Quirke, 2013) and the citizen-side barriers, including the socio-demographics of political participation (M. Karlsson, 2012; Lidén, 2013; Navarro & Font, 2013).

The democratic dialogue related objectives of e-participation also create specific expectations and requirements for the design of the e-participation process (**I**). One of the key reasons why e-participation initiatives have not achieved the expected impacts is their weak integration into existing policy-making procedures and routines (Freeman & Quirke, 2013; OECD, 2003; Panopoulou et al., 2010). Prior studies have found that an effective e-participation process requires involving decision-makers and users from the outset (Edelmann et al., 2008; Scherer et al., 2010), providing clear information about the goals, mandate and limitations of the participation process (*Electronic Democracy*, 2009; Panopoulou et al., 2010; Susha & Grönlund, 2014), giving regular feedback to participants (Medaglia, 2012; OECD, 2003) and demonstrating the impact of citizens' contributions on policy outcomes (Lackaff et al., 2014; Panopoulou et al., 2010; Porwol et al., 2013; Scherer & Wimmer, 2012). The democratic dialogue related objectives of e-participation also generate specific requirements for the design of the technical systems used for e-participation. In addition to adapting to technological developments (Panopoulou et al., 2010), e-participation systems are often expected to enable online deliberation (Lidén, 2013) and moderation of discussions in order to ensure the quality of the dialogue (Coleman, 2004; Talpin, 2013).

Combining literature on political participation, e-participation and e-democracy, public sector innovation and information systems, it is possible to uncover the multitude of factors that may affect the implementation of e-participation initiatives. However, what e-participation literature tends to lack is more sophisticated analytical frameworks that would allow for developing a more nuanced understanding of how these contextual factors exert their influence. To fill this gap, **I** uses the existing process-oriented model of information system failure proposed by Chris Sauer (1993) as the basis of constructing an analytical framework for studying the implementation and outcomes of e-participation projects. Sauer's model conceptualizes ICT projects as *innovation processes* that are characterized by uncertainty about the eventual outcomes and susceptibility to changes in their environment. The model involves two main actors: the project organization (the information system's managers) and supporters (users and other stakeholders). The actors and the system are interdependent (see Figure 3): while stakeholders need the managers to develop the system according to their interests, the managers need stakeholder support to innovate the system. At the same time, all are affected by context – external factors that may pose problems to the system, constrain the innovation

process and influence the availability of support. Sauer emphasizes that context does not have an immediate effect on the system – its influence is mediated by the project managers' decisions and actions. As argued in **I**, this separation of contextual enablers and barriers from the stakeholders and processes that mediate their impacts is what permits us to better understand the process by which e-participation initiatives come to succeed or fail. The outcomes can be seen as a function of the interplay between the stakeholders of an innovative initiative, the technological system at its core, the innovation management process and contextual variables.

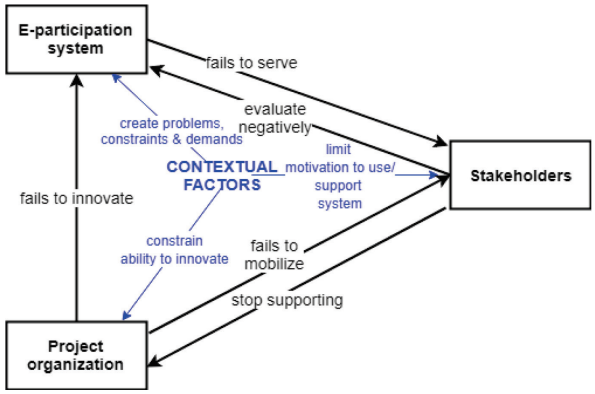

*Figure 3. Failure process of e-participation systems (source: **I**)*

The empirical case study of the Estonian e-participation initiative Osale.ee described in **I** demonstrates the utility of this approach. Osale was launched in 2007 by the Estonian Government Office as an e-consultation platform for engaging citizens in commenting on draft legislation and policies and as an agenda-setting tool for crowdsourcing new policy proposals from citizens. It continued and expanded on the functions of its predecessor TOM (*Täna Otsustan Mina*), Estonia's first e-participation platform, which had been declared a failure barely three years after its launch (**I**). Osale, however, met the same fate. Although Osale still exists in 2020, stakeholders and researchers deemed it a failure long ago, and the system has practically fallen out of use due to its inability to meet stakeholders' expectations (**I**, **II**). Applying the process model of failure to the study of Osale, **I** identifies a number of contextual factors that have contributed to its failure. These are summarized in Table 4.

*Table 4. Contextual factors in the failure of Osale.ee (author, based on **I**)*

Information systems' implementation context	**Public sector context**	**Context of democratic participation**
Cognitive limits and human error in project management	Ambiguity of objectives	Lack of political support
Structural arrangements (shift between units)	Multiple stakeholders and needs	Weak culture of civic participation
Resistance from users	Complexity of organizational and institutional change	Limited demand and interest from citizens
Competing platforms	Regulatory context (unclear mandate of e-participation in policy-making)	Limited participation capacity
Technological changes	Importance of innovation champions among officials	Specific requirements for system and process design
Lack of top management support		

As can be seen from Table 4, many of the factors that adversely affected Osale had to do with the public sector context. Due to the number of stakeholders involved in the design (the Government Office, civil society organizations, public engagement coordinators in different ministries) and the diversity of users that the system intended to engage (public sector officials, citizens, interest group representatives), the system's objectives were unclear and contested from the beginning. The findings also pointed to public sector organizations' resistance to adopting new policy-making practices. In fact, because of lacking legislative basis and limited efforts of central coordination, the use of Osale (in particular its agenda-setting function) remained largely unintegrated with existing policy-making procedures. Political interest in the system was entirely absent (**I**).

This points to the difficult relationship between innovative initiatives and the public sector institutional context. It is likely that the lack of interest and resistance to using Osale had to do with Osale's ambition of transforming the existing relationships between citizens, public administrators and politicians. By yielding some of the agenda-setting and decision-making power from the government to citizens, the institutionalization of e-participation entails considerable changes in public administrations' tasks and presumes changes in public officials' perceptions of their role in public governance processes.

However, even more importantly than identifying the contextual constraints, the case study of Osale reveals the complex dynamics of contextual factors and their interactions with the e-participation system. The model described in Figure 3 suggests that the effects of contextual factors are mediated by the way project managers conduct the innovation process. Examining what, when and how Osale's managers did to sustain and develop the system, the article found that (with the exception of the first few years), the innovation management process was largely passive, reactionary and clearly suboptimal with regard to Osale's goal of creating a political dialogue between non-governmental stakeholders and policy-makers. Many of the contextual barriers were present in the system's environment since its inception but were ignored in the management process.

Therefore, Osale's failure could be seen as the sum of the following interactions: 1) contextual factors posed challenges to Osale and limited its possibilities to mobilize active use and achieve the intended impacts; 2) managers did not pay sufficient attention to the context and made no effort to adapt and align the system to stakeholders' needs; 3) due to flaws in the system and lack of attention to stakeholders, Osale became to be assessed negatively and quickly lost support (**I**). This started a cycle of decline that eventually became extremely difficult to reverse. What happened to Osale as a result of the interactions between stakeholders and the system resembles a vicious circle that is difficult to break (Figure 4). Initial low use of the system by public officials and citizens led to the system being perceived as unable to provide useful input for stakeholders. This decreased their motivation to use the system, which in turn led to even lower use and further decreased the perceived utility of the system for users.

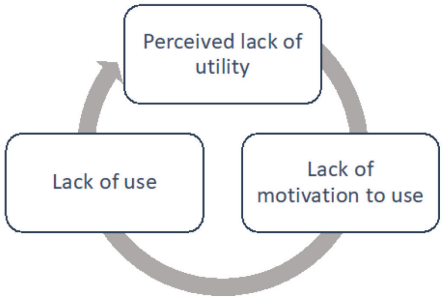

Figure 4. Vicious circle of e-participation platform use (source: author)

II puts Osale's failure into a broader national context and suggests that implementation difficulties have not only accompanied Osale but also other e-participation initiatives in Estonia. This creates an interesting contrast to Estonia's success in introducing another e-democracy instrument – e-voting, or remote internet voting in legally binding national elections (Solvak & Vassil, 2016; Vinkel, 2015). **II** argues that despite the apparent similarities (the use of digital technologies to support democratic participation), e-voting and e-participation are very different processes. Whereas e-voting digitalizes a process that already exists offline, e-participation requires both policy-makers and citizens to learn a new process where in principle any citizen has the opportunity to individually contribute to policy-making on a regular basis. This concept is especially new in young democracies, such as Estonia, and is quite different from offline participation, where – for obvious limitations of space and time – the public sector's dialogue partners tend to be limited to selected representatives of organized interest groups. Another difference between e-voting and e-participation is the clarity of the costs and benefits of each. In the case of e-voting, the initial adoption barriers in Estonia could be overcome by demonstrating the benefits in terms of voters' convenience and time savings (**II**). In fact, recent research into the costs of e-voting show this to be the most cost-efficient voting channel also in terms of costs for the electoral administration (Krimmer et al., 2020).

Due to the different nature of regular dialogue between citizens and public sector organizations, the benefits of e-participation are much more obscure. ICT-mediated collaboration in public governance processes requires both sides to acquire new roles. Politicians and public managers need to step into the role of advice-seekers, partners and "meta-governors" of collaborative arenas, while citizens become partners and cocreators (Hartley et al., 2013). As e-participation systems often seek to enable citizen participation at a massive scale, the level of change in the division of responsibilities and power that is really required for e-participation to be institutionalized in public governance processes should not be underestimated. According to Steinbach & Süß (2018), the e-participation innovation process is characterized by a struggle between the reform logic of e-participation and the strongly institutionalized bureaucratic-legalistic logic of public managers. They suggest that time and effort is required to resolve the conflicts that arise from the institutional complexity of e-participation innovations. Since the perceived effort of making e-participation work is high and the benefits may not be evident, the limited use of e-participation systems such as Osale may at least partly be explained by the discrepancy between the unclear benefits and the high perceived effort of engaging in e-participation, both for governments and citizens (**II**).

5 Open Government Data and Co-creation of Public Services

Open government data (OGD) is a digital government concept that bears many similarities to the idea of e-participation. The concept emerged in the 2000s as a digital continuation of the 'analog' efforts to enhance government transparency. Until the 20th century this had mostly meant the adoption of Freedom of Information (FoI) legislation that gave citizens the right to obtain information from the government through FoI requests (Ingrams, 2020).The digital revolution of the 1990s–2000s and the increasing digitization of public sector data drove the idea that government information should be made available to citizens in a digital form. The idea was promoted on the one hand by businesses that were interested in the commercial reuse of public sector information and on the other by open government and FoI activists who saw it as a public transparency and accountability tool (Davies, 2010).The ethos of the free and open source software movement has further shaped the discourse of public sector data as knowledge or information commons that should be available for the public to share and reuse (Barns, 2016; Kostakis & Giotitsas, 2013).

The concept of OGD gained worldwide traction with the adoption of President Obama's Open Government Directive (2009) and the global Open Government Declaration (2011), which included OGD as one of the cornerstones of the aspirations toward greater government transparency. In Europe, the publication of OGD has been further fostered by the 2003 European Directive on Public Sector Information ('PSI Directive'), especially its 2013 revisions, which introduced the 'open by default' principle and required EU governments to publish public sector information in open data formats whenever legally and technically possible.

Although many definitions of OGD exist, the main elements of OGD are captured in the Open Knowledge Foundation's Open Definition, which states that open data must be available in a convenient, modifiable and preferably downloadable form, freely accessible to anyone and provided under an open license permitting reuse and redistribution (Open Knowledge Foundation, n.d.). The main difference of OGD from other formats of public sector information is its focus on reusability – i.e. the possibility to use the data for purposes different from the purpose for which the data was originally collected. Reusability presumes the availability of 'raw' digital datasets under an open license (Davies, 2010), preferably in a structured, machine-readable format that would allow for easy data processing (Sunlight Foundation, 2010).

Research has associated OGD with many potential benefits. These pertain to transparency and other open government values but also economic growth, innovation, new business models, technological development and public value (Zuiderwijk et al., 2014; **III**, **IV**). OGD is increasingly regarded not only as a tool for public information provision but also a key ingredient in novel data-driven services and a driver of the participation of societal actors in service creation (**IV**). Whereas the earlier discourse of OGD emphasized its reuse potential for creating commercial data-driven services (Davies, 2010), the potential for using OGD to create public services is becoming increasingly acknowledged (**IV, VIII, IX**). In 2013, the European Commission issued a vision paper on the future of public services, suggesting that open access to data, along with facilitating technologies, would in principle allow traditional government tasks to be performed by citizens, companies, non-governmental organizations and other stakeholders (European Commission, 2013a). The European Commission thus proposed to redefine the concept of 'public service' as a service "offered to the general public

and/or in the public interest" with the purpose of developing "public value" (defined as the total societal value shared by all actors in a society), regardless of the role that the public sector plays in the delivery of these services. This public value-centric definition of public services is rather different from the more traditional view of public services as services provided or organized by the public sector. Due to its novelty and alignment with the logic of OGD, the Commission's definition was also adopted as the basis of a conceptual model of OGD-driven co-creation of public services elaborated in **VIII** and **IX**.

The involvement of citizens and non-governmental actors in the initiation, planning, design and implementation of public services has become called co-production or co-creation; the two terms are often used interchangeably (Brandsen et al., 2018). While co-creation is more frequently used in relation to co-creation of value and co-production more in the service delivery context (Osborne et al., 2016), both essentially refer to a similar idea – engaging (non-governmental) stakeholders in the process of producing something of value, most often by way of developing or delivering a service jointly with users. Brandsen & Honigh (2018) propose to make a clearer distinction between co-creation and co-production, suggesting that "when citizens are involved in the general planning of a service – perhaps even initiating it – then this is co-creation, whereas if they shape the service during later phases of the cycle it is co-production".

While both OGD and co-creation/co-production have gained attention as research topics in public administration literature, they have been less frequently discussed in the context of turning OGD into services that create public value (**IV**). One of the first authors to discuss this relation was Linders (2012), who regarded OGD as part of the 'Government as a Platform' model of interaction between governments and citizens. Linders sees the provision of OGD as one of the means whereby the public sector can give some of their traditional caretaking and service-providing responsibilities away to citizens, acting as a platform that enables and facilitates the creation of services and other public value generating activities by citizens. Later, Foulonneau et al. (2014) discussed the role that OGD could have in service innovation, while Nambisan & Nambisan (2013) defined four main roles for citizens in OGD-driven public service co-creation: co-discovering problems, co-initiating solutions, co-designing services and co-implementing services. However, due to the gaps in the theoretical understanding of the possibilities and challenges of transforming the public service provision process through the use of OGD, this PhD research has sought to further understand the contextual factors that affect the co-creation of OGD-driven public services in practice. Hence, **IV** zooms in on the enablers and barriers of OGD-driven co-creation based on a literature review and an expert survey, while **VIII** and **IX** develop a conceptual model for the co-creation of OGD-driven public services.

IV found a number of barriers that challenge and hinder the use of OGD for public service co-creation. These are summarized in Table 5.

*Table 5. Barriers to the use of OGD for public service co-creation (author, based on **IV**)*

Technology	Stakeholders	Public sector organizations	Legal, political
Availability of OGD Limited data quality Lack of metadata Data fragmentation Missing technical infrastructures	Lack of OGD awareness Unclear benefits of OGD Lack of understanding of co-creation Missing skills Lack of trust Limited collaboration experience Fears of security and privacy breaches (incl. misperceptions of legislative barriers)	Revenue models based on selling public data Organizational processes incompatible with co-production Resistance to change Lack of feedback loops Inadequate resources Limited innovation orientation Lack of incentives to provide and use OGD	Lack of political priority Gaps in legislation on licensing Limited legal obligation to publish OGD

Apart from specific technical issues, many of the barriers are similar to those discussed earlier in Section 4 in relation to e-participation. Barriers on the side of stakeholders, the difficulty of integrating new collaborative and digitally-enabled practices into existing public governance processes, organizational resistance to change, lack of incentives to do things differently, limited understanding of the idea of co-creation and benefits of collaboration, lack of mutual trust, the importance of the legislative framework and lacking political priority all resemble typical barriers to e-participation as well as public sector innovation more broadly. For OGD, a frequent user-side barrier appears to be the low availability of open data, which hinders citizens' ability to create useful data-driven applications and services. At the same time, public sector organizations explain their limited provision of OGD with lacking OGD usage and lack of evidence of the benefits of publishing OGD. This relationship of mutual negative reinforcement between these factors can be summarized as another vicious circle: lack of OGD limits data use; limited use leads to lack of empirical OGD use cases; as long as real-life applications of OGD are lacking, evidence of the benefits of OGD remains limited; this in turn decreases data holders' incentives to invest in providing OGD (see Figure 5).

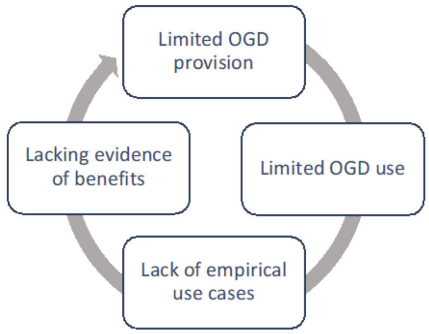

Figure 5. Vicious circle of OGD provision and use (source: author)

In **III**, these findings are further elaborated and expanded based on the case study of OGD implementation in Estonia. As Estonia's performance in the release and use of OGD has been surprisingly poor given its global reputation of an e-government champion, **III**

asks what barriers have prevented Estonia from taking full advantage of the idea of OGD and what explains the lack of progress in the area. The findings show that despite the adoption of a legislative and policy framework due to informal and formal pressure from the Open Government Partnership and the European Commission's PSI Directive, a number of impediments exist in the Estonian OGD landscape. These include, most importantly, lack of understanding of the concept and value of OGD, resource constraints, concerns about data quality, lack of political priority and the unclear utility of OGD *vis-à-vis* existing data sharing solutions such as the national data exchange infrastructure X-tee (formerly also called X-Road[5]).

An interesting finding was the data providers' view of Estonia as too 'small a market' for OGD, which makes the 'business case' for releasing public data in open formats unclear for data providers. Instead of proactively releasing open datasets, public sector organizations have preferred responding to individual FoI requests as they come in. In some cases, data has also been published via public sector organizations' own applications. However, these often constrain data reuse by requiring the prior identification of users and lacking download and data processing opportunities. Discussing why public sector organizations' efforts to publish OGD have been modest, **III** suggests that limited resources have caused policy-makers to prioritize activities whose benefits have been better understood. This is related to the low political priority and leadership of OGD in Estonia. Previous works have noted that in Estonia political support has been higher in those areas of e-government where the expected gains have coincided with politicians' goals to build a lean government and efficient bureaucracy; this has most clearly been the case for e-services (Kitsing, 2011). The lack of political interest in OGD can thus be explained by OGD being regarded as a transparency tool instead of means for increasing government efficiency (**III**).

However, it is interesting to note that the political priority of OGD in Estonia seems to have begun rising very recently, and the reason is the government's interest in promoting the development and use of Artificial Intelligence (AI) (**VII**). For example, in an op-ed piece in March 2019, the government's Chief Data Officer (CDO) declared the government's interest in becoming a leading country in the use of AI, adding that "since AI applications are based on data, the government of Estonia has set the goal of promoting the use of open government data, so that businesses could effectively use the data to create AI applications" (Velsberg, 2019). A report of the government-assembled expert group on the adoption of AI published in May 2019 reiterates the goal of increasing OGD availability as an enabler of the development of AI solutions (Riigikantselei & Majandus- ja Kommunikatsiooniministeerium, 2019). This raises the question why the development of AI has met a great deal more enthusiasm among Estonian policy-makers than OGD. The answer, again, likely lies in the perceived benefits associated with AI. When discussing the benefits of AI, the expert group's report (2019) refers to the widely shared expectation that AI-enabled process automation and innovation would generate cost savings and human resource savings, increase process efficiency and effectiveness and stimulate the creation of products, services and business

[5] Until 2018, the Estonian data exchange layer was named X-tee in Estonian and X-Road in English. However, since the newly founded Nordic Institute for Interoperability Solutions (NIIS) assumed the responsibility for the development of the core technology in 2018, the X-Road became a registered trademark of the technology, while the Estonian interoperability infrastructure that uses the X-Road technology became called X-tee both in Estonian and English. See https://www.ria.ee/en/state-information-system/x-tee.html for more information.

models that produce more added value. The main benefits expected from the use of AI in Estonia are clearly of economic nature (Männiste & Masso, 2020) and well in line with the Estonian public administration's prevailing orientation towards efficiency (Kitsing, 2011) and lean state (Sarapuu et al., 2015).

The findings of **III** imply the importance of both broader structural factors and institutional variables in shaping the adoption of digital innovations. First, small states, such as Estonia, tend to be characterized (and largely defined) by financial and human resource limitations. Limited resources create a strong pressure for the public administration to prioritize, due to which the public administration's scope of activities tends to be much more limited in smaller than in larger states (Sarapuu, 2010). Second, the case study points to previous institutional choices and path dependencies as a factor conditioning the adoption of (digital) innovations. In Estonia, the existence of the national data exchange layer X-tee since the beginning of the 2000s acts as an alternative to (although not a substitute for) OGD. The X-tee comprises a technical infrastructure but also a set of agreements and well-defined processes that facilitate interoperability between databases, allowing public sector organizations to meet their data needs by transferring data online via a secure infrastructure on the basis of agreements and authorizations. Since the X-tee has become widely used for data exchange within the public sector, public sector organizations have been reluctant to invest additional resources into publishing OGD on the national OGD portal or other open repositories where it would be available to anyone. Therefore, the X-tee, often regarded as one of the key pillars of Estonian e-government (Kalvet, 2012), interestingly turns out to be a barrier to the adoption of OGD (**III**). It is worth emphasizing that it is not the technical infrastructure as such that acts as a barrier but the way in which the habit of using the X-tee shapes public officials' perception of the value and utility of adopting OGD.

To a considerable extent, the challenges revealed in **III** and **IV** can be related to public sector actors' inherent resistance to the ambition embedded in the idea of OGD to transform public governance practices and the relationship between governmental and non-governmental stakeholders. Janssen et al. (2012) argue that OGD drives the creation of an open government "in which the government acts as an open system and interacts with its environment" (Janssen et al., 2012). They state that by releasing data in open data formats, the government gives up control over the use of the data, creating a new situation where stakeholders external to the government become part of the data creation and processing system – stakeholders who stand "outside the organizational boundaries and outside the control of the hierarchy" (Janssen et al., 2012).

The transformation from a closed to an open system has important implications on the management and governance of OGD initiatives. As open systems depend on unpredictable external factors, they cannot be managed through central planning and control the same way closed systems can (Janssen et al., 2012). Mergel et al. (2018) argue that open data practices require the adoption of new kinds of steering mechanisms to succeed: for example, governments may need to pay more attention to fostering internal innovation by 'socializing' open data initiatives across departmental silos, adopting agile and user-centric innovation approaches and demonstrating and communicating the public value of OGD-driven innovation within and outside the government. Moreover, Janssen et al. (2012), Mergel et al. (2018) as well as **III, VII** and **IX** reiterate the argument that focusing on data supply alone does not produce public value. In order to support the creation of public value out of OGD, governments need to take an active role in fostering the usage of OGD by external stakeholders – for example by creating infrastructures

(data portals, APIs) for the use of OGD, lowering usage barriers (Janssen et al., 2012), promoting the available datasets, engaging citizens (Mergel et al. 2018) and focusing on building stakeholder communities around open data (**III, VII**).

The recent developments in the Estonian OGD landscape described in **III** and **VII** show how engaging civil society stakeholders in the implementation of the OGD policy may be a helpful first step in reorienting the focus from adopting policies and guidelines towards developing a functioning OGD ecosystem – an integrated system of open data providers, users and intermediaries, their interactions and interdependencies and the supporting infrastructure (Zuiderwijk, Janssen, et al., 2014). In 2018, the Estonian Ministry of Economic Affairs and Communications (the government body responsible for the national OGD policy) contracted Open Knowledge Estonia, a civil society organization, to help advance the provision and use of OGD in Estonia in the years 2018–2020. Even if the decision to engage an external partner was initially driven by human resource constraints in the public sector rather than the explicit goal of bringing new approaches into the OGD policy, the strategic partnership between government authorities and civil society has already yielded interesting outcomes. The joint project took an explicitly ecosystem-driven approach with the aim to strengthen the core elements and feedback loops in the OGD ecosystem. As a result, the number of available OGD datasets has grown several times, the use of OGD has increased and communication between data providers, users and other OGD stakeholders has become more active both in online and offline channels (**VII**). This suggests that active work both with data supplier and user communities may be a way for breaking the vicious cycle of low provision, low use and low perceived benefits. However, as **VII** notes, emerging political priority has had an important role in facilitating the developments and shaping stakeholders' positive perception of OGD.

6 The Once-Only Principle and Collaboration between Public Sector Organizations

Unlike e-participation and OGD, the once-only principle (OOP) is a digital government concept that essentially aims to reduce interactions between citizens and governments. It is driven by the goal of designing user-centric public services and reducing the administrative burden of citizens and businesses when fulfilling government-imposed administrative requirements and consuming public services (Gallo et al., 2014). In order to reduce the administrative burden, public administrations aim to minimize the instances in which citizens and businesses need to provide data to the government. To this end, public administrations aim to replace requesting data from citizens with machine-to-machine data exchange and reuse of the data that has already been stored digitally in public sector databases, hence allowing citizens to provide data to the government "only once" (**V, VI**). By focusing on decreasing the number of direct contacts between citizens and public sector organizations, the OOP is a good example of how digital technologies can effectively reduce – and not increase – co-production between governments and citizens (Lember et al., 2019).

At the same time, the OOP is very much a case of collaborative digital innovation since it heavily relies on close cooperation between public sector organizations (more rarely also private and non-governmental organizations who may hold certain data). In order to put the OOP into practice, various organizations need to collaborate to develop technical, semantic, organizational and legal interoperability (European Commission, 2017). Ensuring technical interoperability requires adopting common technical specifications and building infrastructures that enable linking systems to securely exchange data between information systems. Ensuring semantic interoperability requires agreeing on common data formats and developing vocabularies to allow the communicating systems to understand the meaning of the data in the same way. Organizational interoperability involves aligning and integrating the business processes of various organizations and setting up new processes to enable cross-organizational (and cross-border) data exchange. Legal interoperability means the need to align the data sharing conditions and legal frameworks of different jurisdictions to legally allow data sharing between various parties; this becomes particularly important in cross-border data sharing. Lastly, organizations need to collaborate to develop user interfaces to provide "once-only"-based digital public services in a joined-up manner. Increased alignment and interaction between public sector organizations thus serves as a mechanism for minimizing direct interaction with citizens and other types of public service consumers, such as businesses.

Although the OOP is not yet a widespread practice in European countries (Cave et al., 2017; Gallo et al., 2014), the European Commission has recently taken major policy steps to promote and adopt the OOP at the European level with the aim of developing cross-border e-government services for European citizens and businesses (**V**). As an important milestone, the European Commission and 21 European countries launched a large-scale European interoperability initiative – The Once-Only Principle Project (TOOP) – in 2017. TOOP aims to enable a European-wide OOP by developing a federated technical architecture that is able to interconnect databases and data exchange layers in different countries. The project also runs pilots to technically test data exchange between different countries in three domains (business mobility, e-procurement and online maritime certificates; see Krimmer et al. (2017) for more information on the

pilots). Since cross-border OOP is an emerging concept that has not yet been widely discussed in literature, a survey and focus groups conducted with the public sector officials involved in the TOOP piloting exercises provided valuable empirical information for this thesis on policy-makers' perceptions of the enablers and barriers of the OOP in Europe[6].

The study of the TOOP pilots found that the adoption of the OOP at a cross-border scale is not a high priority in most countries, even those that are among the frontrunners in applying the OOP within their national public administrations (**V**). One of the main drivers of cross-border data exchange was seen in the expected benefits of the OOP for citizens and public administrations: the participating public officials expected the OOP to lead to administrative simplification for citizens and businesses, as well as improved public service quality, administrative efficiency and better public governance on the government's side (**VI**). However, because the OOP is not yet a reality at the European level, the lack of evidence of these benefits was viewed as a barrier to the widespread adoption of the OOP by public sector organizations and countries beyond the early champions involved in TOOP. The second most important driver was perceived to be legal obligation: many participants shared the view that setting up a national – or European-level – legal obligation to implement the OOP would act as a crucial driver in pressuring countries to adopt the OOP, even in the absence of clearly perceived benefits (**V**). Some also saw prior experience in implementing the OOP at the national level as a driver of public administrations' interest in data sharing and reuse at the cross-border level.

Apart from the few enablers and drivers, the study yielded a long list of perceived barriers, which are summarized in Table 6. The key barriers concern the perceived legal impediments to cross-border data sharing, resource constraints and the cost and complexity of developing technical and organizational interoperability. Compared to barriers that commonly affect the implementation of the OOP at the national level (Gallo et al., 2014), the barriers are rather similar in a cross-border setting, pertaining to privacy and data sharing constraints, implementation costs, departmental silos and the scope of changes required in organizations and working practices. However, participants suggested that in the case of cross-border data sharing, the barriers are more pronounced. The cross-border implementation of the OOP requires alignment between a number of organizations and the consolidation of processes and policies that have so far been implemented in a highly heterogeneous manner. The presence of heterogeneous ICT systems, data handling systems, service provision processes, OOP policies and regulations in various organizations and various countries generates complexity that is simply more difficult to manage. As previous research has suggested, the complexity "appears to increase proportionally with the number of boundaries crossed, the number and type of information resources to be shared, and the number of technical and organizational processes to be changed or integrated" (Pardo et al., 2010). Therefore, the adoption of the OOP at the European level is a highly complex process where a number of stakeholders need to change a number of systems and processes in order to move towards a shared goal.

[6] Since the pilots had not yet started at the time of data collection, the research was limited to the perceived enablers and barriers and not the enablers and barriers that actually affected the piloting process – the latter could only be established after the end of the pilot implementation period. See **V** for more information on the methodological approach and limitations.

*Table 6. Barriers to cross-border OOP (based on **V**)*

Stakeholders	Organizational, institutional	Legal	Technology, interoperability
Lack of OOP awareness Unclear perceived benefits of the OOP Unclear motivation to adopt the OOP Caution about cross-border data sharing	Organizational silos Complexity of organizational change Resource limitations Cultural resistance Lack of political priority	Legal restrictions on data sharing Data protection and confidentiality requirements Absence of legal basis for cross-border OOP Lacking legal validity of evidence exchanged	Heterogeneous ICT systems Heterogeneous data handling approaches Legacy systems Data fragmentation Differences in data quality Limited availability of digital data

One issue that became evident in the qualitative survey and reemerged in the TOOP focus groups was the question of public administrations' motivation to invest their resources in adopting the OOP at a cross-border level. Participants reported only lukewarm political interest in their countries in cross-border interoperability, especially in light of many countries still struggling with data sharing within their national or federal public administration. Lacking political priority, in turn, was viewed as negatively affecting public sector organizations' motivation to invest in enabling cross-border OOP. As with e-participation and OGD, the results of **V** point to a kind of a self-reinforcing 'vicious circle' between low political interest, limited adoption and lacking evidence of benefits, which creates doubts about whether the benefits exist at all. This is summarized in Figure 6.

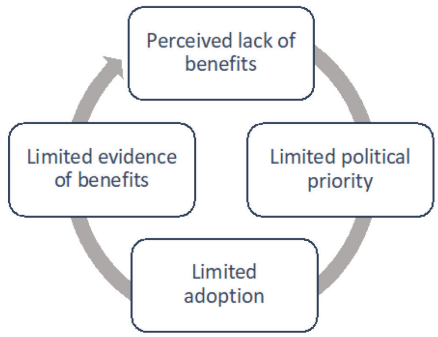

Figure 6. Vicious circle of OOP adoption at the cross-border level (source: author)

Stakeholders involved in TOOP suggested that weak political interest can best be increased by showcasing empirical success stories that are able to demonstrate the actual benefits of cross-border integration. However, they noted that in the absence of empirical evidence, political priority at the national level can also be pushed by introducing an EU-level legal obligation to apply the OOP in cross-border administrative transactions (**V**). In this context, the European Commission's leadership was perceived to be crucial in promoting the OOP and providing financial and political incentives for developing interoperability at the European level.

The question of organizational and political motivation for cross-organizational and cross-border collaboration can perhaps be further illuminated by examining the adoption of the OOP in Estonia within and beyond the country borders. The Estonian government started working on enabling national-level public sector data reuse already at the end of the 1990s. To facilitate data sharing, a standardized national data exchange infrastructure, the X-tee, was developed at the beginning of the 2000s, which would later constitute the core enabler of adhering to the OOP in public service provision. Previous studies have found that the Estonian government's efforts to develop national-level interoperability were not driven by the goal of administrative simplification for citizens – "once-only" data collection had not yet even emerged as a principle (Puusaar, 2019).

According to Puusaar (2019), information integration in the public sector was driven, above all, by the chronic scarcity of financial resources in the Estonian public administration, which created strong incentives for cutting costs, reducing the inefficiencies related to duplicate data collection and reducing the transaction costs involved in setting up numerous bilateral data exchange agreements between organizations. Other drivers included previous data security incidents, which created a demand for secure data exchange and a wish to reduce the confusion related to the same data being stored in different databases in different points in time. The main incentives for data sharing and collaboration between public sector organizations were thus grounded in the public officials' practical need for secure and efficient data exchange to meet their organizations' needs, whereas the provision of better services to citizens and companies was hardly on anyone's mind at the time.

Despite the X-tee now being promoted as an Estonian e-government success story (Kattel & Mergel, 2019), it initially also met resistance from public officials due to limited understanding of its benefits, officials' reluctance to change their work routines and fears of possible errors in data being exposed to other organizations and citizens (Puusaar, 2019). However, the resistance gradually decreased due to facilitating factors, in particular active coordination and promotion, continuous technical improvement of the system, prototyping and piloting that demonstrated the system's usefulness, and high level of political support, which largely emerged from the ruling politicians' shared ICT-enthusiasm and prioritization of cost-efficiency (Puusaar, 2019).The implementation of X-tee in Estonia thus demonstrates, first, the role of the needs and preferences of public officials and organizations as a driver of innovation and, second, the importance of political interest in facilitating widespread innovation acceptance. Furthermore, the case also points to possible drivers of political interest. In this case, the drivers were not only related to political leaders' values and attitudes (enthusiasm about ICT) but also pragmatic interests (saving costs).

Has political interest been as high in cross-border data sharing? Not universally. While Estonia has actively promoted and championed setting up cross-border data exchange with the neighboring Finland ("Estonia to export its Data Exchange Layer X-Road to Finland," 2013; Pau, 2015), political interest in European-level data exchange has been slightly more limited. In the survey of the TOOP pilots, the participating Estonian public sector organizations described the political priority of European-level OOP as "moderate" in Estonia. In fact, the respondents did not view cross-border integration as much of a political issue at all, emphasizing practical need as the key driver of interest in this context: "*Practical implementations always depend on the use case. Implementing OOP (meaning exchanging data between organisations) is not an end in itself but a tool to save on costs, provide a better user experience on public services and to fulfil*

government tasks better." The respondents stressed that the practical need for the OOP is the clearest in sectors that are the most affected by cross-border mobility, such as transport, energy, studying abroad, and so on. In short, the main trigger of interest and investment in cross-border collaboration seems to be organizations' perceived need for sharing data with particular countries or organizations. This need, in turn, is related to cross-border mobility flows of citizens and companies between particular countries (Cave et al., 2017) and the overall level of international linkages within a particular sector. This could perhaps provide possible explanations as to why Estonia is leading the TOOP cross-border data sharing exercise in the maritime domain but has not joined the pilots related to exchanging company data between European public administrations.

Another factor that distinguishes Estonia's bilateral data sharing initiative with Finland from the European-level initiative is the technical interoperability solution used in either case. Both Estonia and Finland already use solutions based on the X-Road technology for cross-organizational data exchange at the national level. As the data exchange between Estonia and Finland is being developed upon the same technical infrastructure (*X-Road History*, n.d.), cross-border integration with Finland only requires minimal adjustments from Estonian public sector organizations and almost no additional technical investments. At the same time, the European-level data exchange within TOOP relies on a different set of digital service infrastructures, which are not used in internal interactions within the Estonian public administration.

7 Explaining the Challenges

The findings discussed in Sections 4–6 imply that the adoption of collaborative digital government concepts such as e-participation, open government data and the once-only principle has not been a smooth sailing for public administrations. Based on the experience of Estonia, but also several other European countries, all initiatives have faced hurdles, and all have been subject to the influence of a complex set of factors internal and external to public sector organizations.

While **I** demonstrated the complexities involved in the adoption of e-participation at the level of one particular project, **II** suggested that the challenges are not specific to that one initiative but have been present in most e-participation initiatives in Estonia. In light of institutional theories, the challenges uncovered in **I** and **II** could be interpreted as stemming from the pressure to change that the concept of e-participation puts on the public sector, which conflicts with organizational resistance and public governance institutions' disposition to maintain the status quo. The institutionalization of e-participation as an integral part of the policy-making process would not only require changes in public organizations' work processes (which itself is complicated) but also adopting a different view of the process of policy-making and the roles of governments and citizens in it. Moreover, barriers are also there on the citizens' side – despite the provision of online participation opportunities by governments, citizens' interest in engaging in a digitally mediated dialogue with the government has been mostly lukewarm so far (**I**). The findings suggest that this is related to the novelty of the practice of collaborative policy-making for both public officials and citizens as well as stakeholders' uncertainty about the impact of e-participation in contrast to the perceived effort involved.

Similar barriers have affected the adoption and institutionalization of OGD. This can be concluded both from studies of stakeholders' perceptions of OGD covering several countries (**IV**) and the case study of OGD in Estonia discussed in **III** and **VII**. Despite international organizations' and community movements' pressure to open up public sector data to foster democratic transparency and socio-economic development, impediments to the supply and use of OGD exist even in countries that are considered technologically advanced (**III**, **IV**). One of the central issues is related to stakeholders' perceptions of the value of OGD (**IV**). Turning government information into open, reusable, human-understandable and machine-processable datasets is associated with high costs in terms of technical work and legal compliance. These costs need to be borne immediately, while the economic and social benefits of open data will often only manifest in the future, with no certainty that the benefits will outweigh the costs.

VII–IX state that the value of OGD does not lie in releasing open data as such but in value-generating services and applications built on top of the data. Furthermore, the open nature of OGD enables and stimulates the co-creation of OGD-driven services, giving any actor within or outside the public sector the opportunity to generate ideas for new services to respond to societal needs or participate in their development in collaboration with other stakeholders (**VIII**, **IX**). In this co-creation process, the government's role can be limited to that of a data provider, but it can also extend to active collaboration with non-governmental stakeholders. The research underlying this thesis shows that both OGD and co-creation are new concepts whose value is still poorly understood in the public sector. Due to this, both face resistance and perceptual barriers,

which add up when it comes to embracing the co-creation of OGD-driven public services as a new way in which public services could be created.

Despite its slightly different nature and its focus on government-to-government collaboration, the implementation of the OOP in European countries has met the same kind of challenges. Apart from specific legal and technical hurdles that arise from the difficulty of harmonizing heterogenous data management systems and approaches, many of the barriers to adopting the OOP at the European level seem to boil down to the perceived high costs of interoperability, integration and inter-organizational collaboration *vis-à-vis* the unclear benefits of cross-border OOP for citizens and public administrations. Public officials from a number of European countries regard the current lack of evidence of the benefits of cross-border OOP as one of the causes of governments' reluctancy to invest resources in cross-border data exchange (**V**). They suggest that high-level political interest in cross-border OOP could be created by two main mechanisms: empirical demonstration of the benefits or top-down legal obligation at the EU level. As long as these drivers are not present, the priority of cross-border OOP remains low, which in turn hinders its empirical implementation and, hence, prevents the emergence of more empirical evidence of the benefits.

Such self-reinforcing negative feedback loops or 'vicious circles' appeared in all three types of collaborative digital government innovations explored in this thesis – e-participation, OGD and the OOP. These start from the unclear perceived benefits of the innovation in the eyes of the stakeholders in a position to implement it. An unclear value proposition leads to low political interest in the innovation, which leads to little or no resources being allocated to implementing the innovation. This in turn prevents the generation of benefits and fuels further doubts about the value of the innovation. Such vicious circles can be discerned at several levels – project (**I**), country (**III**) and broader studies of stakeholders' perceptions of digital government innovations (e.g. **IV**–**VI**). In a way we thus see public sector actors performing a sort of a cost-benefit calculation in determining their response to public sector innovations. However, just as institutional frameworks suggest, this calculation is based on stakeholders' subjective *perceptions* of the costs and benefits within the constraints of their bounded rationality and on their perceptions of what is appropriate and fitting in the given institutional context. In other words, actors' behavior regarding the adoption and institutionalization of innovations seems to be shaped both by the logic of consequence and logic of appropriateness. Three brief examples about Estonia serve to illustrate this proposition.

First, as discussed in **I** and **II**, Estonia's very first e-participation portal TOM was launched in 2001 but declared a failure barely a couple of years later. TOM provided citizens the opportunity to submit spontaneous policy ideas to the government but soon became criticized for the low quality of the proposed ideas, which policy-makers regarded as unusable in their work (**I, II**). Despite the perceived failure of TOM, a deliberate choice was made in 2007–2008 to maintain its crowdsourcing function in its successor Osale.ee. The reason for continuing a practice of dubious utility was not based on a rational assessment of the costs and benefits involved but the government's wish to avoid implying that citizens' ideas were not welcome any more (**I**). This e-participation opportunity still exists in 2020 despite having had no impact on policy decisions. The choice to keep it alive can therefore be associated with the logic of appropriateness and the cultural norms shaping public administration in Estonia: at the time of making the decision, regular citizen engagement had not yet become institutionalized in practice but was already recognized as a legitimate policy-making principle (**I**).

The second example regards the adoption of OGD in Estonia. As a response to international policy pressures and civil society demand, a policy framework and basic infrastructure for publishing OGD was developed between 2012–2014. However, this was followed by a long period of extremely limited data publication activity and public organizations' lack of compliance with the adopted rules (**III**). As discussed in Section 5, this can be attributed to the low perceived value of publishing OGD as opposed to the perceived costs involved, but also to Estonia's previous choices regarding its digital government architecture, which relied on the national data exchange infrastructure X-tee. In the case of OGD, we could posit that Estonian public sector actors' decisions have been shaped by a mix of rationales – the norm-based decision to adopt OGD as a principle, the path dependency related to the existing digital government infrastructure and the more rational calculation of the costs and benefits involved in publishing OGD and interacting with data users. At the same time, the perception of costs and benefits itself has likely been shaped by historical choices (existing digital infrastructure) and cultural norms (efficiency orientation) prevailing in public administration (**III**).

The third example concerns Estonia's choices regarding the application of the once-only principle in cross-border e-government services. Section 6 discussed how Estonian public sector organizations and politicians have actively worked to promote cross-border data exchange with Estonia's neighbor Finland but taken a more modest role in advocating for data exchange at the European level within interoperability initiatives such as TOOP. The different level of interest may, among other possible causes, be explained by Estonia's high level of cross-border mobility with Finland, which clearly increases the perceived value of data exchange with Finland compared to other countries. The difference may also relate to the fact that the data exchange initiative with Finland uses the X-Road technology, which is native to Estonia and widely used in the daily work of public sector organizations, while European-level data exchange would require adopting a different set of architectural building blocks that are not commonly used in Estonia. This suggests that both path dependency and the perceived cost-benefit ratio of engaging in cross-border collaboration have had a role in shaping the public administration's decisions. However, regardless of the lower political priority of cross-European data exchange, the Estonian government has still decided to participate in European-level OOP initiatives such as TOOP. One might ask, could the decision to be involved be related to the perceived normative implications of Estonia's image as a leading digital government in Europe – *noblesse oblige*? The importance of the logic of appropriateness for small states has also been highlighted in previous studies. For example, Sarapuu (2010) suggests that due to the specific characteristics of small states, the influence of values and informal structures may have a bigger explanatory power of political-administrative choices in small states than the logic of consequence.

The findings of this thesis point to the value of contemporary neo-institutional approaches in providing useful guidance for understanding the challenges of digital government innovation. Models integrating insights from several streams of institutionalist literature, such as the integrated model of institutional change proposed by Köning (2016), are particularly useful for at least two reasons. First, they provide plausible explanations to the logic of public sector actors' decisions and behavior and suggest that different logics can and do intertwine in practice due to the power of both ideas and interests over actors' behavior. Second, their value lies in their focus on the *process* whereby institutional change takes place and the due consideration they give to

the endogenous and exogenous context of public governance institutions in understanding how the process unfolds.

This brings us to an important proposition that often seems to be neglected in digital government literature: digital technology-driven innovations do not have an immediate impact on institutional change. Despite our tendency to expect digital technology to transform organizations and institutions, new technologies could be regarded as a driver of innovation and a potential trigger of institutional transformation. However, their eventual impact is mediated by the existing context, the institutional environment and the ideas, beliefs, preferences and interests of key stakeholders (politicians, top officials, idea champions) who have the power to change public governance institutions. In short, institutional change only occurs if the opinions and ideas prevailing among the actors operating within the institutional context propel them to support the change and if the preferences of powerful actors stimulate them to actively work for implementing the change. In fact, the discussion of the e-participation project Osale.ee in Section 4 showed that a similar mechanism can also be witnessed at the level of an individual innovative initiative – the institutionalization of a technology-driven public sector innovation could be described as a function of how contextual enablers and barriers interact with stakeholders' perceptions and preferences and the actions of powerful actors.

In this light, collaborative digital government initiatives, i.e. digitally driven innovations of public governance that presume close collaboration between different types of stakeholders, are especially challenging because they seek substantial change in existing institutions, power relations and public governance structures. As these pertain to the core characteristics and tasks of public administration, such initiatives are likely to face institutional constraints and resistance from those holding power. When analyzing the implementation of collaborative digital government innovations, it is therefore important to distinguish between the emergence and adoption of innovative ideas and their eventual institutionalization in public governance practices. The former has happened in public administrations all over the world at a relatively rapid pace. The latter, however, is a much slower process. The findings of this thesis give no reason to expect that the basic logic of institutional change would be somehow fundamentally different for public sector innovations of digital vs. 'analog' nature – there does not seem to be a shortcut around the complexities involved.

What, then, would be needed to develop a more realistic outlook on collaborative digital government innovations? This thesis argues that digital innovations could be conceptualized as *processes* of institutional innovation, characterized by unavoidable uncertainty and high susceptibility to the influence of contextual drivers and barriers. Due to being implemented in a context of bounded rationality and imperfect information, uncertainty about the context and outcomes of digital government innovations is built into their very essence. Strategies of implementing digital government innovations therefore need to take this uncertainty explicitly into account. In this regard, an incremental approach to implementing and testing out collaborative digital government concepts seems to be a more reasonable strategy than expecting fundamental changes to happen just by way of introducing a new technological solution in a public sector organization. Instead of regarding launching a new e-participation system, open data portal or data exchange infrastructure as the goal of digital government innovation, actors leading the innovation could see this as the first step.

The institutionalization and diffusion of digital government innovations requires changes in government practice. Due to this, innovation managers should develop good

awareness of the context in which new practices are expected to take root. They should foremost focus on fostering ideational change and relationships among key stakeholders, in particular between advocates of new ideas and those in control of actual institutional change. According to Meijer (2015), few stakeholders are motivated by technological innovation as such – in order to increase public officials' and citizens' interest in e-government innovations, innovations should be foremost framed in terms of their contribution to society and practical value for officials' daily work. The focus on ideational change and forming new stakeholder relations could help develop feedback mechanisms that allow different stakeholders to better understand each other's positions, needs and limitations and slowly prepare the ground for changes in the preferences of powerful actors. This may – but will not necessarily – induce actual institutional change.

A stakeholder-centric perspective on digital government innovation could also help turn around the 'vicious circles' examined above. The metaphor of a 'vicious circle' is not meant to imply that the negative feedback loops are impossible to stop but that reversing them may require deliberate action and addressing the underlying problem from several angles at once. For example, the action research intervention discussed in **VII** tried to invigorate Estonia's OGD ecosystem by simultaneously working with data providers and users and explicitly focusing on fostering communication between the variety of stakeholders in the OGD ecosystem. While building a strong ecosystem is a long process, the first results show some progress both in terms of the supply and use of OGD (**VII**).

Nevertheless, there is no escaping the role of coordinators, facilitators, innovation champions and political leaders. What the results of **I–VII** suggest is that any technology-driven change requires strong political and administrative will, active innovation management and active coordination of stakeholder communities. In case of public administrators' limited interest in innovation, non-governmental stakeholders and international organizations can act as a source of pressure in the innovation adoption phase (**III–VII**). However, based on the cases studied in this thesis, there is no evidence to propose that without eventual buy-in from public administrators and politicians there would be a way for external stakeholders to transform public governance institutions from the outside.

8 Conclusions and Implications

The thesis posed three research questions about collaborative digital government: 1) What challenges have collaborative digital government innovations (e-participation, OGD and the OOP) faced so far?; 2) How do different barriers and enablers affect collaborative digital government innovations?; 3) Why is it difficult to institutionalize collaborative digital government innovations?

A simplified answer to the first question can be given in three parts. First, attempts to adopt collaborative digital government initiatives have been made in many parts of the world, but in many cases these innovations have not yet been fully embraced and institutionalized as public governance practices. Second, such initiatives have faced manifold challenges, which have to do with the complexities of technology implementation, public sector innovation and collaboration between different types of stakeholders. Third, the results have varied in different contexts, but the challenges often seem to boil down to public sector actors' limited interest in change in light of unclear benefits and high perceived effort involved in the innovation.

Regarding the second question, this thesis sought to develop a better understanding of the factors that influence the implementation of collaborative digital government innovations by examining three types of public sector innovations, all driven by digital technologies and involving a collaborative element. The thesis found that collaborative digital government initiatives are subject to the influence of a number of factors in their context. These factors are related to technology and innovation, stakeholders (characteristics, beliefs and behavior of public officials and citizens), organizational and institutional context, public sector particularities, and developments in the broader environment. While some of the factors (e.g. innovation championship, political will or favorable regulatory environment) serve as drivers and enablers of innovation, many others (e.g. stakeholders' beliefs, organizational resistance to change, resource limitations) tend to pose constraints and barriers to the adoption and institutionalization of innovative public governance practices. Whereas differences exist in the factors that affect e-participation, OGD and the OOP, the results suggest that some of the common barriers are connected to the stakeholder multiplicity, multi-rationality and other specific characteristics of the public sector, complexity of organizational change, cultural resistance, lack of incentives and limited political interest in adopting new practices.

Coming to the third research question, the institutionalization of collaborative digital government initiatives seems to be challenging because such initiatives seek to alter public governance institutions, structures and power relations. As these pertain to the core characteristics and tasks of the public sector, they face institutional constraints and resistance from actors who benefit from the existing power structures. Compared along the degree of change to existing public governance practices and power relations, the OOP seems to entail the fewest changes, as public sector organizations remain in the familiar role of service providers and citizens in the role of service users. E-participation requires both governments and citizens to learn new roles and interaction practices. OGD lies somewhere in between, depending on whether the government puts itself in the more familiar role of data provider or becomes an active co-creator of OGD-driven services in collaboration with citizens, which constitutes a more substantial change to public sector organizations' work practices. In both cases, citizens need to assume the previously unfamiliar role of service co-creators. Despite the differences between different types of collaborative digital government innovations, their institutionalization

follows a similar process – the findings suggest that transformational change only happens if the ideas and interests of powerful actors drive them to actively support the innovation.

This thesis aims to make a contribution to digital government literature by linking research on e-participation, OGD and the OOP to broader discussions about public sector innovation and institutional change in the public administration field. The individual publications that form the core of the thesis have, to a large extent, made use of the research findings from specialized literature of e-participation, OGD and the OOP. This specialized literature has been useful in helping to understand the barriers and challenges that commonly occur in the three domains. However, what digital government literature often lacks is explanations as to *why* these challenges exist and what it is about collaborative digital government innovation that makes its implementation complicated in practice. The thesis argues that the institutional frameworks commonly employed in the public administration field – especially more recent accounts that combine insights from different streams of institutionalism – provide a useful generic framework for understanding the mechanisms and dynamics of change in the public sector. An institutionalist perspective on digital government innovation allows us to take a step further from identifying the barriers to particular digital government concepts and develop analytical propositions about the underlying challenges of collaborative digital government innovation and the limitations of technology-driven change. The findings of this thesis could thus be summarized as six propositions:

1. Digital technology serves as a driver of public governance innovations, which may trigger institutional change. However, digital technology driven innovations do not have an immediate impact on institutional change. Their impact is always mediated by the existing institutional context and the ideas, beliefs, preferences and interests of stakeholders who have the power to change institutions.
2. Collaborative digital government innovations should not be conceptualized as ICT projects with a fixed timeframe and end result. Instead, they could be regarded as longer *processes* of institutional innovation and adaptation, characterized by uncertainty and susceptibility to the influence of context.
3. When analyzing the implementation of collaborative digital government innovations, it is therefore important to distinguish between the initial adoption of technology-driven innovations and their eventual institutionalization in public governance practices.
4. Since collaborative digital government innovations seek to change existing public governance institutions, practices and power relations, their institutionalization is likely to face challenges and resistance from stakeholders.
5. Public sector actors' response to innovations seems to be shaped by a mix of self-interested cost-benefit calculations and institutional influences, including stakeholders' norms and ideas, perceptions of the value of the innovation, previous institutional choices and path dependencies. Therefore, understanding how and why digital technologies can transform public governance requires research to focus on studying the behavior of people and organizations and the formation of political preferences around digital innovations.
6. The novelty, uncertainty and lack of demonstrated benefits that are characteristic to collaborative digital government innovations may lead public sector actors to give more importance to the costs and efforts involved in

innovation, which need to be carried here and now, while potentially underestimating the benefits, which may only appear in the future. This can become a source of the so-called 'vicious circles' where the lack of evidence of the innovation's benefits leads to low political interest in implementing the innovation, which further hinders the generation of benefits.

These propositions could also inform future research agendas. The results of this thesis clearly point to the value of strengthening the analytical base of digital government literature by grounding it more firmly in the public sector specific constructs and frameworks present in public administration literature. For example, in order to understand how digital government innovations get adopted, it could be useful to research how individual public sector actors at different levels make decisions about innovative ideas that challenge the status quo: what rationales and contextual influences drive their decisions? Attention could also be devoted to studying how political will is formed around digital government innovations: what forces shape political attitudes to digital government initiatives that involve citizen participation, co-creation or collaboration with different types of stakeholders? How do these forces differ in different organizational, national, cultural and temporal contexts?

Another set of interesting research questions concerns the process of innovation adoption and institutionalization in the public sector. This thesis discussed the interaction between digital government innovations and public governance institutions at a general level. Future research could examine how processes of innovation adoption and institutional change unfold at the level of a single department, a public sector organization or a public administration. Empirical studies of these processes at the micro and meso levels could potentially result in the development of more sophisticated process-centric analytical models of institutional change.

Lastly, the findings of this thesis raise the question: What kind of management and coordination processes could support an effective institutionalization of innovative public governance practices? Questions that could drive further research include but are not limited to the following: What strategies could be implemented to best account for the contextual barriers and capitalize on the contextual drivers of change? How can innovation managers build functioning stakeholder communities and innovation ecosystems around collaborative digital government initiatives? What factors help generate mutual trust between public governance stakeholders and reduce fears related to changes in the existing constellations of power?

Based on the results of this thesis, some recommendations could also be given to digital government practitioners for steering collaborative digital government innovations. First, it may be reasonable to abandon a project-centric view on digital government innovations and manage such initiatives as incremental processes of learning and institutional change. This means acknowledging the uncertainty involved in the process and being ready to constantly adapt the approach to changing circumstances and feedback from stakeholders. Second, to support the institutionalization of innovative public governance practices, digital government practitioners' focus should shift from designing the perfect technological tool towards understanding the needs, ideas and preferences of stakeholders who can influence the institutionalization of novel practices. A large part of the public sector's resistance to new collaborative forms of policy-making and public service provision could be attributed to the level of change that these new forms seek to bring about in norms, practices and power relations. Therefore, innovation managers could take particular care when addressing stakeholders' fears of change.

This may require a step-by-step approach to building more trusting relationships between stakeholders with limited previous collaboration experience.

The cases discussed in this thesis suggest several ways for fostering stakeholder relationships, which may be worth testing in other contexts. In the e-participation field, this could be done, for example, by involving citizens and representatives of non-governmental interest groups in the design of e-participation initiatives from the very first steps and adopting an incremental approach to developing e-participation platforms (**I**). Instead of attempting to build an e-participation tool fit for all purposes, the development of e-participation tools should rather be designed as a modular and piecemeal process of trial and error, learning and adaptation. First steps towards cooperation between public administration and non-governmental stakeholders could be taken through initiating fixed-term collaboration projects with community organizations. This has worked, for example, as a way of involving civil society in the implementation of the national open data policy in Estonia (**III, VII**).

Estonia's experience in the area of OGD also highlights the value of creating common discussion spaces between data providers and users (**VII**). Using existing platforms such as GitHub, users and developers could suggest improvements to the functions of OGD portals, request specific datasets from public sector organizations (**III**) or help co-create user requirements for pilot services using OGD (**VIII**, **IX**). These could be supplemented by face-to-face stakeholder meetings to foster mutual interactions and learning (**VII**).

Collaborations could also be nurtured through conducting pilot projects. In the domain of cross-border data exchange, the TOOP project has been able to bring together innovation champions and is hoped to demonstrate first tangible results to attract further adoption (**V, VI**). Initial funding to such pilots from bodies such as the European Commission could help mitigate the risks for early adopters and reduce the costs for public sector organizations who might otherwise be reluctant to invest in innovations with unknown results. Above all, however, it is important to give time for new modes of collaboration to gradually take shape.

In conclusion, what do the challenges – as well as the small successes – discussed in this thesis tell us about the current state of collaborative digital government in 2020? Governments have indeed made efforts to open up government information and public governance processes for scrutiny and input from external stakeholders. There is indeed a lot more of e-government in various shapes and sizes. However, transformational changes in public governance and stakeholder relationships have not yet happened, at least on a substantial scale.

This thesis suggests that in order to understand why digital technologies have not had the hoped-for impact on public governance, we need to start from analyzing the role of technology in digital government innovation. The availability of a new technology may indeed act as a driver of innovation, but the institutionalization of technology-driven innovations is always mediated by the existing context and the ideas, beliefs, preferences and interests of the stakeholders holding the power of institutional change. Hence, in order for the adoption of digital innovations to lead to more open and collaborative public governance, both favorable context and powerful actors' support to change are needed. Since collaborative digital government innovations often seek to reshape existing patterns of interaction and power relations, the question how digital technology can lead to transformations in public governance warrants taking more interest in the behavior of people and organizations and the formation of political preferences around digital innovations in particular institutional contexts.

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Abstract

Challenges of Collaborative Digital Government: e-Participation, Open Government Data and Cross-Border Interoperability

The evolution of information and communication technologies (ICTs) and public administration paradigms such as New Public Governance or Digital-era Governance have given way to expectations that new technologies would somehow naturally make public service creation and policy-making more collaborative and open towards input from external stakeholders. However, empirical studies suggest that the development of innovative forms of public governance and new kinds of relationships between public governance stakeholders has not happened at the expected pace. This thesis seeks to explore and explain the discrepancy between the expectations and empirical realities. As digital government research has so far shown more interest in the potential than the actual outcomes of using ICTs in public administration, this dissertation contributes to a small stream of digital government research interested in studying the challenges and barriers that affect the implementation of novel digital government initiatives.

Based on nine peer-reviewed research publications, this thesis brings additional empirical and theoretical insights into our understanding of digital technology-driven innovation in public governance. It does so by examining different types of collaborative digital government innovations, i.e. initiatives using novel digital technologies with the aim to introduce new collaborative models of public policy-making and public service creation. The thesis focuses on three types in particular: 1) e-participation – the creation of new collaborative online spaces with the goal of enabling citizens and interest groups to participate in co-designing public policy; 2) open government data (OGD) – the publication of public sector information in the form of openly accessible and reusable datasets, which allows the public to co-create data-driven services that provide commercial or public value; and 3) the once-only principle (OOP) – reducing the administrative burden for citizens and companies through interoperability, collaboration and data sharing between public sector organizations. Building on research in these three streams, the thesis examines three main research questions:

1. What challenges have collaborative digital government innovations faced so far?
2. How do different barriers and enablers affect collaborative digital government innovations?
3. Why is it difficult to institutionalize collaborative digital government innovations?

Due to the nature of the research questions, the dissertation applies a qualitative research approach mostly based on case studies, qualitative surveys among experts and practitioners and, in one case, action research. The research findings show that despite many countries' attempts to adopt collaborative digital government concepts such as e-participation, OGD or the OOP, these innovations have often not yet been institutionalized as common public governance practice. Collaborative digital government innovations tend to face manifold challenges and are subject to the influence of a number of factors related to technology, stakeholders, organizational and institutional context, public sector particularities and forces in the broader environment. While some of them serve as enablers, others tend to pose barriers to the adoption and institutionalization of innovative public governance practices. The results suggest that

some of the common barriers relate to the specific characteristics of the public sector, complexity of organizational change, cultural resistance, lack of incentives to adopt new practices and limited political interest in changing the status quo. Furthermore, the novelty and lack of demonstrated benefits of new collaborative digital government concepts may lead public sector actors to give more importance to the immediate costs of implementing the innovations than their potential benefits, which may only appear in the future. This can become a source of so-called 'vicious circles' where lacking evidence of benefits decreases political interest in implementing the innovation, while limited implementation efforts further hinder the generation of benefits.

The thesis suggests that the institutionalization of collaborative digital government initiatives is challenging because of the tension between these initiatives' ambition to alter public governance institutions and stakeholder relations, and the constraints emanating from the existing institutional context and the beliefs and interests of powerful actors. Collaborative digital government innovations not only entail changes in public sector organizations' work processes but also require the public sector to assume the unfamiliar role of advice-seeker, partner, co-creator and collaborator in public governance. As these changes pertain to the core characteristics and tasks of the public sector, innovative initiatives may face institutional constraints and resistance from actors who benefit from the existing power structures. Due to mutual dependencies between collaborative digital government innovations, the institutional context and powerful stakeholders, transformational change in public governance is only possible if the institutional context is favorable and powerful actors support the innovation.

This thesis aims to make a contribution to digital government literature by linking research on e-participation, OGD and interoperability to broader discussions about public sector innovation and institutional change in the public administration field. The thesis argues that the institutional frameworks commonly employed in public administration research provide a useful framework for understanding the dynamics of digital technology-driven change in the public sector and the underlying challenges of collaborative digital government innovation. The research findings imply that digital technology could be regarded as a driver but not a panacea for public governance innovation – its impact on institutional change is not direct but mediated by the existing institutional context and the beliefs and interests of stakeholders who have the power to change institutions. For this reason, collaborative digital government innovations should not be conceptualized as ICT projects with a fixed timeframe and end result but as longer processes of institutional innovation, adaptation and learning. Due to the complexity and political nature of the public governance context, understanding how digital technology can transform public governance requires research to focus more on the stakeholders of public governance. Digital government research could therefore benefit from taking a step into the classical public administration domain and studying how ideas and political preferences around digital government innovations are formed in particular institutional contexts.

Lühikokkuvõte

Koostööl põhineva digitaalse valitsemise keerukus: e-osaluse, avaandmete ja piiriülese koosvõime näited

Info- ja kommunikatsioonitehnoloogia (IKT) ning uute avaliku halduse paradigmade areng on tekitanud ootusi, justkui muudaksid uued tehnoloogiad avalike teenuste loome ja poliitikakujundamise kuidagi loomupäraselt koostööpõhisemaks ja avatumaks avaliku sektori väliste osapoolte panusele. Empiirilised uuringud näitavad aga, et riigivalitsemise uuendused ja uut laadi suhete kujunemine avaliku halduse osapoolte vahel on toimunud loodetust aeglasemalt. Selle doktoritöö eesmärk on uurida ja selgitada erinevust nende ootuste ja empiirilise tegelikkuse vahel. Kuna digitaalse valitsemise teaduskirjandus on seni huvitunud rohkem IKT kasutamise potentsiaalist avalikus halduses kui selle tegelikest tulemustest, panustab töö digitaalse valitsemise vähem levinud uurimissuunda, mis vaatleb uuenduslike digitaalse valitsemise algatuste elluviimise empiirilisi raskusi ja takistusi.

Töö pakub üheksa eelretsenseeritud teadusartikli põhjal uusi empiirilisi ja teoreetilisi teadmisi digitaalsetel tehnoloogiatel põhineva innovatsiooni kohta riigivalitsemises. Selleks uurib doktoritöö digitaalse valitsemise algatusi, mis kasutavad digitehnoloogiaid eesmärgiga arendada uuenduslikke koostööpõhiseid mudeleid poliitikakujundamises ja avalike teenuste loomes. Töö keskendub kolmele koostööpõhise digitaalse valitsemise suunale: 1) e-osalus ehk uute veebikanalite loomine, mis võimaldavad kodanikel ja huvirühmadel poliitikakujundamises kaasa rääkida, 2) avaandmed ehk avaliku sektori teabe avaldamine laialt kättesaadavate ja taaskasutatavate andmehulkadena, mis võimaldavad kodanikel ja ettevõtetel luua ärilist või ühiskondlikku väärtust pakkuvaid andmepõhiseid teenuseid ning 3) andmete ühekordse küsimise põhimõte ehk kodanike ja ettevõtete halduskoormuse vähendamine avaliku sektori asutuste omavahelise koostöö, koosvõime ja andmevahetuse kaudu. Tuginedes uurimistööle neis kolmes valdkonnas, püstitab doktoritöö kolm peamist uurimisküsimust.

1. Millised raskused on ilmnenud koostööl põhinevas digitaalse valitsemise innovatsioonis?
2. Millist mõju avaldavad erinevad toetavad ja takistavad tegurid koostööpõhistele digitaalse valitsemise algatustele?
3. Miks on koostööpõhise digitaalse valitsemise innovatsiooni institutsionaliseerimine keerukas?

Uurimisküsimuste iseloomust tulenevalt on doktoritöö uurimismeetod kvalitatiivne, tuginedes peamiselt juhtumianalüüsidele, kvalitatiivsetele ankeetküsitlustele ekspertide ja praktikute seas ning ühel juhul ka praktilisema suunitlusega tegevusuuringule. Uurimistulemused näitavad, et vaatamata paljude riikide püüetele võtta kasutusele koostööpõhiseid digitaalse valitsemise uuendusi, nagu e-osalus, avaandmed või andmete ühekordse küsimise põhimõte, ei ole need uuendused sageli veel riigivalitsemise praktikana institutsionaliseerunud. Koostööl tuginevad digitaalse valitsemise algatused seisavad silmitsi mitmete raskustega ning neid mõjutab hulk tegureid, alates tehnoloogiast, kaasatud osapooltest, organisatsioonilisest ja institutsionaalsest kontekstist kuni avaliku sektori eripärade ja laiemate keskkonnateguriteni. Kui mõned neist teguritest ergutavad ja soosivad innovatsiooni, siis teised pigem takistavad innovaatiliste avaliku halduse praktikate kasutuselevõttu ja institutsionaliseerumist. Töö leiud viitavad sellele, et peamised barjäärid on seotud avaliku sektori eripärase

toimeloogikaga, organisatsioonilise muutuse keerukusega, kultuurilise vastuseisu, puuduvate stiimulitega uute praktikate kasutuselevõtuks ning vähese poliitilise huviga muudatuste vastu. Veelgi enam, kuna sedalaadi algatused on oma olemuselt uuenduslikud ning tõendeid nende kasulikkusest on veel vähe, võivad avaliku sektori otsustajad omistada rohkem tähtsust uuenduste rakendamisega kaasnevatele kohestele kuludele kui neist tekkida võivatele hüvedele, mis ilmnevad alles tulevikus. See võib viia n-ö nõiaringini, kus vähesed tõendid innovatsiooni kasulikkusest vähendavad poliitilist huvi innovatsiooni kasutuselevõtu suhtes ning piiratud kasutuselevõtt omakorda takistab hüvede ilmnemist.

Doktoritöö leiud viitavad, et koostööpõhiste digivalitsemise algatuste institutsionaliseerumine on keeruline, kuna nendega kaasnev ambitsioon muuta riigivalitsemise institutsioone ja osapoolte vahelisi suhteid põrkub olemasoleva institutsionaalse kontekstiga ning mõjukate osapoolte hoiakute ja huvidega. Koostööpõhised digitaalse valitsemise uuendused ei too muutusi üksnes avaliku sektori organisatsioonide tööprotsessidesse, vaid eeldavad avalikult sektorilt ka uue rolli võtmist nõu küsija, kooslooja ja koostööpartnerina riigivalitsemises. Kuna need muutused puudutavad avaliku sektori põhiolemust ja -ülesandeid, kipuvad institutsionaalsed tegurid ning olemasolevast võimujaotusest kasu saavate osapoolte vastuseis innovatsiooni juurdumist pärssima. Digitaalse valitsemise innovatsiooni, institutsionaalse konteksti ja mõjukate osapoolte omavaheliste vastastiksuhete tõttu saavad sügavamad muutused riigivalitsemises toimuda aga üksnes juhul, kui olemasolevad institutsioonid ja mõjukad osapooled innovatsiooni toetavad.

See töö annab panuse digitaalse valitsemise teaduskirjandusse, sidudes e-osaluse, avaandmete ja koosvõimealase uurimistöö laiemate diskussioonidega avaliku sektori innovatsiooni ja institutsionaalse muutuse üle avaliku halduse kirjanduses. Doktoritöö näitab, et avaliku halduse valdkonnas laialt kasutatavad institutsionaalsed teooriad kujutavad endast sobivat raamistikku ka avaliku sektori digitaalse innovatsiooni dünaamika ja keerukuste mõistmiseks. Töö leiud viitavad, et digitaalne tehnoloogia on küll oluline riigivalitsemise innovatsiooni stimuleeriv tegur, aga mitte võluvits – tehnoloogia mõju institutsionaalsele muutusele ei ole kunagi vahetu, vaid sõltub olemasolevast institutsionaalsest kontekstist ning institutsionaalseid muutusi mõjutavate osapoolte hoiakutest ja huvidest. Sel põhjusel ei ole ka otstarbekas käsitada innovaatilisi digitaalse valitsemise algatusi kindla ajakava ja tulemustega IT-projektidena, vaid pigem pikaajalise institutsionaalse innovatsiooni, kohanemis- ja õppimisprotsessina. Kuna avaliku halduse kontekst on loomupäraselt kompleksne ja sõltuv võimusuhetest, tuleks digitaalsete tehnoloogiate mõju mõistmiseks riigivalitsemisele pöörata rohkem tähelepanu avaliku halduse osapoolte uurimisele. Seega oleks digitaalse valitsemise uurijatel soovitav astuda samm klassikalise avaliku halduse uurimisvaldkonna suunas ning lähemalt vaadelda, kuidas kujunevad osapoolte arusaamad ja poliitilised eelistused digitaalsete valitsemise uuenduste suhtes konkreetsetes institutsionaalsetes kontekstides.

Appendix: Publications I–IX

Publication I
Toots, M. (2019) Why Do E-participation Projects Fail? The Case of Estonia's Osale.ee. Government Information Quarterly, 36(3), 546–559.

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Why E-participation systems fail: The case of Estonia's Osale.ee

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ABSTRACT

Despite the hopes that information and communication technology (ICT) would revolutionize democratic participation, evidence suggests that e-participation systems designed for consultation and dialogue between citizens and governments often fail to achieve the expected objectives and levels of take-up. E-participation research has identified a number of success and failure factors but lacks analytical frameworks explaining why and how failures occur. Such frameworks are available in information systems (IS) literature but lack an account of the particularities of e-participation. Combining insights from both domains, this paper proposes to conceptualize e-participation systems as innovation processes characterized by uncertainty and change, and to focus on studying systems' interactions with their context and stakeholders to understand why certain outcomes occur. Applying this approach to the case study of the Estonian e-participation portal Osale.ee, the paper concludes that e-participation systems face three-fold challenges: those typical to IS projects, those emerging from the public sector context, and specific challenges that emanate from the complex context of democratic participation. This complexity makes e-participation systems prone to fail and requires them to be managed as a process of learning and adaptation rather than a static technological product.

1. Introduction

Visions of technology-driven citizen participation have been here for a while – take, for example, the 1970s' idea of democratic dialogue via teleconferencing (Etzioni et al., 1975) or Dahl's (1989) proposal for ICT-enabled deliberation among '*mini-populi*'. The rapid development of e-government in the 1990s and early 2000s brought a surge of optimism among democracy enthusiasts concerning the impending revolution of citizen participation thanks to ICT, but so far, such techno-deterministic pipe dreams have proven unfounded (Norris, 2010). Firstly, it was only recently that e-democracy and e-participation secured a more prominent place in the e-government policy agenda (Freeman and Quirke, 2013). Secondly, despite the recent burgeoning of e-participation projects at all levels of government (Medaglia, 2012), such initiatives are mainly regarded as having failed to deliver the expected outcomes (Ostling, 2010; Prosser, 2012), mobilize users (Epstein et al., 2014) and fulfill the hopes of engaging the disengaged members of society (Karlsson, 2012; Lidén, 2013). It is thus important to learn why e-participation projects tend to fall through and how failures could be avoided.

This paper follows the widely accepted definition by Macintosh (2004), who relates e-participation to the use of ICT for online consultation and dialogue between government and citizens, distinguishing e-participation from other e-democracy instruments such as e-voting. While the so-called first generation of e-participation in the early 2000s was based on the provision of official e-participation spaces by the government, the emergence of Web 2.0 technologies ushered in a second generation focusing on the use of social media, and more recently a third generation which combines a complex mix of advanced technological solutions for collecting policy input from citizens (Charalabidis et al., 2014). E-participation has so far been dominated by 'first-generation' top-down government-led initiatives (Medaglia, 2012) providing information, deliberation and consultation facilities to citizens (Panopoulou et al., 2014). Such government-run e-participation systems have been criticized for limited results and acceptance (Charalabidis et al., 2014; Chun and Cho, 2012; Kubicek and Aichholzer, 2016; Quittkat, 2011). However, the reasons of their failure are still not fully understood and warrant taking stock of before we try to apply the next technological fix to the problems of online democratic participation.

The issue of failure has received abundant attention in information systems (IS) literature, evolving into a research stream in its own right. While definitions of failure vary, there is a common understanding that the failure rates of IS projects are high globally (Dwivedi et al., 2015; Goldfinch, 2007), amounting to up to 85% of all projects according to some estimates (Thomas and Marath, 2013). Since failure comes at a high price in terms of wasted resources, missed opportunities, unrealized benefits and loss of trust (Heeks, 2003), it is vital to devote our

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attention to understanding "what does not work and why not" (Bannister and Connolly, 2012). It is also important to comprehend the process by which failure occurs to address problems before they result in failure (Sauer, 1993). This said, although a number of e-participation studies discuss the contextual factors that affect e-participation systems (e.g. Medaglia, 2012; Tambouris et al., 2012; Panopoulou et al., 2014; Zheng et al., 2014; Kubicek and Aichholzer, 2016), the field suffers from a lack of theoretical models explaining how contextual factors exert their influence and cause projects to fail.

Given these gaps, this paper contributes to advancing the theoretical understanding of failure in the context of e-participation, focusing specifically on government-initiated systems for democratic consultation. As e-participation involves more complex processes and dynamics than other e-government projects (Reddick and Norris, 2013; Sæbø et al., 2011), the factors that can explain failure in the context of online democratic engagement likely differ from those that matter for other types of e-government projects (Chadwick, 2011). This paper addresses these considerations by integrating insights from e-participation, IS, e-government and public sector innovation research and by proposing a conceptual framework for researching e-participation failure that focuses on the specific *context* of e-participation and the *process* whereby contextual factors interact with the system and its stakeholders. A benefit of this approach is that it also allows us to understand what can and cannot be done to avoid failure.

This framework is empirically tested on a case study of Estonia's e-participation portal Osale (also known as Osale.ee and Osalusveeb). Osale was initiated by the Estonian government in 2004 as a one-stop e-participation portal with two main functions: (1) engaging citizens in e-consultations on draft legislation and policies and (2) crowdsourcing new policy proposals from citizens. Osale was expected to fix the many faults of its predecessor and possibly the best known Estonian e-participation project TOM (*Täna Otsustan Mina*), but failed according to most accounts. At the time of writing this paper, Osale is still live but expected to be terminated in the near future. While a number of studies have referred to Osale's failure in terms of under-use, unattained goals and lack of impact (e.g. Kalvet et al., 2013; Kitsing, 2011a; Praxis and Pulse, 2015; Runnel et al., 2009), none of them has undertaken a systematic analysis of its reasons for failure. This paper also aims to address this empirical gap.

The case of Osale is interesting because its perceived failure poses an intriguing contrast to Estonia's carefully crafted position of an e-government role model (Drechsler, 2018), its success in introducing e-voting (Toots et al., 2016) and high use of e-government services (Kalvet, 2012). Against the seemingly favorable backdrop of a highly techno-enthusiastic and digitized society where 30% of voters participate in elections via the Internet (Statistics about Internet Voting in Estonia, 2017) and 95% of tax declarations are filed online ("Business and Finance", 2019), an inquiry into the failure of a key e-participation project can be particularly illuminating: what makes e-participation different from other e-government processes?

To start the discussion, the next sections give an overview of related research and propose a conceptual approach to studying the failure of e-participation systems. Thereafter, Section 4 presents the methodology of the empirical study, Section 5 outlines the history of Osale and Section 6 discusses its outcomes in light of the conceptual framework. Lastly, Section 7 concludes the findings and provides some recommendations for research and practice.

2. Background

2.1. Defining success and failure: the particularities of e-participation

In order to understand why e-participation systems succeed or fail, it is useful to consider the dual nature of e-participation systems as socio-technical information systems and as instruments for democratic dialogue between citizens and governments. A similar conceptualization has been proposed by Porwol et al., 2013, who discuss e-participation systems from the aspects of a project, a platform, and a democratic process. From a socio-technical system point of view, success is often associated with project management aspects, such as the delivery of the system on time and on budget and meeting the desired requirements (Thomas and Marath, 2013). Although no universal definitions of success exist (Hughes et al., 2016), widely used measures of success include the quality of the system, information and service, usage level, user satisfaction and net benefits (Delone and McLean, 2003). Definitions of failure appear to be more mixed, from abandonment before project completion to failing to live up to stakeholders' expectations (Anthopoulos et al., 2016; Lyytinen and Hirschheim, 1987). Janssen et al., 2015 suggest regarding failure as a scale that ranges from "not delivering the required functionalities to complete failure in which almost all efforts and funds are wasted". Most often, failure is defined as a gap between the actual and required performance (Dwivedi et al., 2015).

However, as instruments for democratic dialogue, e-participation systems are expected to fulfill a number of ambitious objectives besides delivering a functional system. These include facilitating a deliberative dialogue between government and citizens (Macintosh, 2004), increasing citizens' participation in political decision-making (Macintosh, 2004; Sæbø et al., 2008; Tambouris et al., 2012), increasing public trust (Warren et al., 2014; Wirtz et al., 2018), enhancing the legitimacy of democratic processes (Christensen et al., 2015; Prosser, 2012), improving the quality and success of policies (Reddick, 2011; Tambouris et al., 2012; Wirtz et al., 2018), etc. These objectives are quite different from the service-related objectives of 'typical' e-government systems (Sæbø et al., 2011) and can be a source for high expectations from stakeholders. For example, as the legitimacy of democratic processes is associated with broad-based citizen participation (Council of Europe, 2009; OECD, 2003), e-participation systems may be expected to be able to mobilize a large or at least a representative group of citizens in order to fulfill the expectation of enhancing legitimacy (Karlsson, 2012). Furthermore, stakeholders may also have conflicting expectations. Stakeholder multiplicity is characteristic both to e-government projects (Dwivedi et al., 2015; Sarantis et al., 2010) and e-participation projects (Macintosh, 2004; Sæbø et al., 2011). This puts e-participation systems under pressure to satisfy the interests of a number of stakeholders (citizens, interest groups, civil servants, politicians) simultaneously. In literature, the success/failure criteria of e-participation projects most often concern the level and quality of participation (Panopoulou et al., 2014). However, due to the evaluative nature of 'success' and 'failure' (Walsham, 1995; Fincham, 2002; Janssen et al., 2015), any measure of e-participation success should also consider stakeholder satisfaction with the system (Sauer, 1993; Walsham, 1995) and the system's salience for stakeholders (Sæbø et al., 2011).

2.2. Explaining failure: research approaches and gaps

Why, then, do so many e-participation systems fail to achieve the expected outcomes and level of use? Existing studies in the e-participation field give only part of the answer. Compared to IS research, which has produced a number of analytical frameworks trying to explain why and how systems succeed or fail (Fincham, 2002; Dwivedi et al., 2015; Hughes et al., 2016), much fewer explanatory frameworks are available in e-participation literature (Panopoulou et al., 2014). Many studies analyze the factors that contribute to the success or failure of e-participation projects (e.g. Macintosh, 2004; Smith et al., 2011; Tambouris et al., 2012; Zheng et al., 2014; Panopoulou et al., 2014; Parycek et al., 2014) but take less interest in explaining the mechanism whereby these factors actually lead to certain outcomes. Some of the few existing explanatory models, such as that of Sæbø et al. (2011), tend to be limited to explaining particular aspects of e-participation projects (e.g. usage). At the same time, more comprehensive frameworks (e.g. Aichholzer and Westholm, 2009; Loukis and Xenakis, 2008;

Macintosh and Whyte, 2008; Panopoulou et al., 2014; Parycek et al., 2014; Tambouris et al., 2012) mostly focus on providing standard criteria for describing, evaluating and comparing different dimensions of e-participation projects but lack an explanatory component that would help understand why particular outcomes occurred in a particular case. Notable exceptions here are Chadwick (2011) and Susha and Grönlund (2014), who devote particular attention to explaining failure by undertaking detailed explorations of the interplay between different factors and agents in e-participation projects. One way to further enhance this stream of research is to learn from analytical models in the IS field and adapt them to the specifics of e-participation.

Existing theoretical models of IS failure can be divided into three strands (Fincham, 2002): rationalistic approaches (e.g. DeLone and McLean, 1992, 2003; Lyytinen and Hirschheim, 1987), interpretive/social constructivist perspectives (e.g. Fincham, 2002) and socio-technical/process views (e.g. Sauer, 1993). Whilst rationalists aim to identify 'failure factors' that can be causally linked to failure, interpretivists see failure as a subjective social construct, and socio-technical approaches do something in between, viewing failure as an outcome of complex socio-technical interactions that affect innovation in a given context. Rationalistic factor-based approaches are dominant in literature but have been widely criticized for 'black-boxing' categories of explanations (Dwivedi et al., 2015), for their inability to provide coherent explanations for failure (Fincham, 2002) and lack of guidance on avoiding failure (Goldfinch, 2007). Some authors, e.g. Anthopoulos et al. (2016), have proposed more nuanced approaches based on a distinction between failure *factors* (external forces in the project ecosystem) and failure *reasons* (events that appear in the project organization during the project life-cycle) but by reducing project management to a set of factors and reasons, they still fail to give guidance to project managers on whether or how failure could be avoided.

Due to the shortcomings of factor-based analyses, alternative approaches that focus on the *context* and *process* of failure are gaining prominence in IS literature (Dwivedi et al., 2015). Such socio-technical approaches are considered capable of providing a more realistic understanding of failure because of their focus on the process whereby different factors and agents interact in a given context (Kautz, 2013). Researchers have highlighted the value of regarding IS implementation as part of broader organizational processes (Dwivedi et al., 2015) and pointed to the need to develop more "comprehensive conceptualizations of how the project unfolds and results in failure" (Janssen et al., 2015, 27).

Interestingly, the process-oriented IS failure model developed by Chris Sauer (1993) two decades ago is still deemed to be one of the most comprehensive frameworks (Fincham, 2002; Kautz, 2013). The continued utility of his conceptual approach has been demonstrated by several more recent studies (e.g. Hughes et al., 2016; Van Cauter et al., 2015; Wilson and Howcroft, 2002). One of the main values of Sauer's model is the representation of IS as an *innovation process* which takes place in an environment of *uncertainty* and *constant change*. According to this model, systems see survival as their goal and their success depends on their ability to serve stakeholders' (changing) needs. The model involves two main agents: the project organization and supporters (i.e. users, funders, and other stakeholders who support the system at any given time). These agents and the system are connected through a 'triangle of dependencies': while stakeholders need the project organization to develop the IS according to their interests, the project organization needs stakeholder support to innovate the system. At the same time, all are affected by *context* – a broad range of exogenous factors that may pose problems to the IS, constrain the innovation process and influence the availability of support. As Sauer stresses, context does not have an immediate effect on the system; the effects are mediated by the project organization's innovation process. Such separation of contextual factors from their effects on failure is a useful distinction that factor-based IS failure models miss.

Sauer defines failure as system abandonment due to stakeholder dissatisfaction. He regards failure as the outcome of the *interplay* between context, innovation process and support – flaws occur if context is inadequately addressed in the innovation process, and if flaws accumulate, the system loses support and faces the risk of failure. In order to prevent failure, Sauer recommends project organizations regularly analyze the system's context, assess the level of stakeholder support and consciously manage support, for example by involving stakeholders in the innovation process.

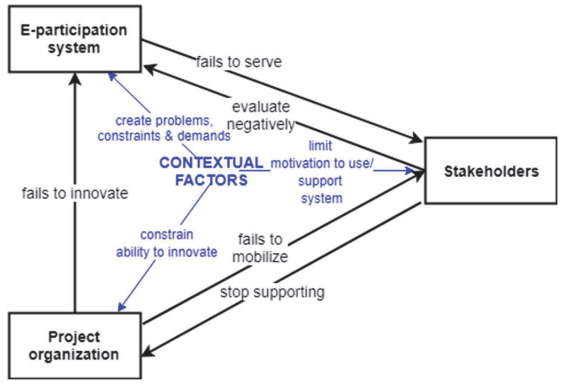

Fig. 1. Failure process of e-participation systems (author, based on Sauer, 1993, 29).

3. A framework for explaining the failure of e-participation systems

3.1. General premises

Building on Sauer's (1993) 'triangle of dependencies', an analytical tool can be constructed for explaining the failure of e-participation systems (Fig. 1). It rests on four key assumptions:

1. The implementation of an e-participation system can be regarded as an *innovation process* characterized by uncertainty and susceptibility to changes in the context;
2. While contextual factors and changes are not the immediate cause of failure, context may constitute an important trigger for failure;
3. The failure of e-participation systems is a *process* where contextual factors interact with the innovation process and stakeholders in a manner leaving the project organization unable to innovate the system according to stakeholders' demands and contextual constraints. As the system no longer serves its stakeholders, stakeholders evaluate the system negatively and stop supporting the system.
4. Failure can be avoided if the project organization has the power to change the influential contextual factors or if it manages to align the system to the context.

In order to adapt this generic model to e-participation systems, the specific factors that affect e-participation should be integrated into the framework. These are discussed below.

3.2. Contextual factors

The factors that shape the implementation and outcomes of e-participation projects are commonly associated with technology, organizational variables and politics (Susha and Grönlund, 2014), although more granular categorization schemes also exist (e.g. Kubicek, 2010; Tambouris et al., 2012). If e-participation systems are e-government information systems that have the objective of supporting democratic

participation, their context comprises three overlapping layers: 1) the context of IS projects; 2) the public sector context; 3) the context of (online) democratic participation.

3.2.1. The context of IS projects

IS literature has identified tens of contextual factors that contribute to failure (see, e.g. Sauer, 1993; Janssen and Klievink, 2012; Dwivedi et al., 2013). The main take-away for e-participation projects is that the context of IS implementation is complicated as it is, encompassing factors such as technical complexity, resource limitations, organizational context, structural arrangements, top management support, user resistance, competitors, political, institutional, legal, cultural, economic and technological environment, etc. Another important insight from IS research is that some human error in project planning and management is common (Hughes, 2016) and unavoidable (Sauer, 1993). The limited rationality of human agents has been found to lead to the underestimation of risk (Janssen and Klievink, 2012) and to unrealistic expectations or even 'pathological enthusiasms' about what information systems can achieve, given their complexity (Goldfinch, 2007; Nelson, 2007).

3.2.2. The public sector context

Literature implies that the public sector context most likely adds a layer of complexity to e-participation projects. Firstly, the involvement of many organizational stakeholders that is characteristic to e-government projects (Dwivedi et al., 2015; Sarantis et al., 2010) brings a number of inter-organizational barriers into play (Janssen and Klievink, 2012). Secondly, public sector organizations are believed to possess distinct characteristics that constrain their ability to integrate new practices (Sarantis et al., 2010). These characteristics include ambiguous and competing objectives (Osborne and Brown, 2011), the pressure to balance the interests of various stakeholders (Angelopoulos et al., 2010; Anthopoulos et al., 2016; Dwivedi et al., 2015), structural and legal complexity, susceptibility to political interests (Anthopoulos et al., 2016; Osborne and Brown, 2011; Rashman et al., 2009), the influence of state and governance traditions (Bekkers et al., 2013), etc. These characteristics have also been found to affect governments' aptitude for engaging citizens (Voorberg et al., 2015) and implementing e-participation (Medaglia, 2012). At the same time, public sector innovation and e-government literature also emphasizes the importance of individuals as innovation champions and change agents (De Vries et al., 2016; Panopoulou et al., 2014).

3.2.3. The context of online democratic participation

Compared to other e-government processes, e-participation is considered to be of a different and more complicated nature (Chadwick, 2011; Reddick and Norris, 2013; Sæbø et al., 2011). It is thus associated with a number of specific enablers and barriers, which are discussed below.

3.2.3.1. Political support. Top management support is a frequently mentioned success factor in IS and e-government projects (Sauer, 1993; Heeks, 2003; Angelopoulos et al., 2010; Reddick and Norris, 2013). However, for e-participation systems, strong backing by managers and politicians is a particularly important success factor (Council of Europe, 2009; Glencross, 2009; Panopoulou et al., 2014). *E*-democracy studies have noted the existence of a 'middleman paradox' where decision-makers responsible for democratic engagement tend to oppose citizen participation (Mahrer and Krimmer, 2005). This may be due to fears of redistribution of power (Arnstein, 1969) and losing status and control (Bovaird and Loeffler, 2012).

3.2.3.2. Cultural factors. At the organizational level, the failure of participatory initiatives has been associated with the risk-averse culture of public sector organizations (Voorberg et al., 2015), fears of change (Chadwick, 2011), and institutional resistance (Panopoulou et al., 2014). At the same time, the recent "Web 2.0 paradigm" has started to foster a stronger culture of participation (Lidén, 2013; Wigand, 2010). Broader cultural factors that affect citizen participation include the level of development of civil society, existing political culture and trust in democratic institutions and processes (Council of Europe, 2009; Freeman and Quirke, 2013; Voorberg et al., 2015).

3.2.3.3. Regulations and policies. Regulations and policies often generate constraints on e-government systems (Sarantis et al., 2010) but they also shape the general information society infrastructure and determine the conditions for democratic participation, including access to technology and information, the right to participate, safeguards for participants, etc. (Berntzen and Karamagioli, 2010). Although several e-participation and e-democracy frameworks (e.g. Council of Europe, 2009; Kubicek, 2010) acknowledge regulation as a contextual factor, the precise effects of regulations and policies on e-participation have not yet been researched thoroughly (Medaglia, 2012).

3.2.3.4. Demand-side factors. The variables explaining political participation are very similar in online (Albrecht, 2006; Lidén, 2013) and offline contexts (Navarro and Font, 2013), including prior social and political mobilization, value orientation, age and gender, socioeconomic and educational backgrounds. Some studies also relate participation to dissatisfaction with public institutions (Navarro and Font, 2013; Vicente and Novo, 2014) and sense of urgency (Sæbø et al., 2011). Apart from a few exceptional cases (e.g. Christensen et al., 2017; Lackaff, 2015), research refers to the low take-up of e-participation tools (e.g. Epstein et al., 2014; Glencross, 2009; Tambouris et al., 2012) and the prevalence of 'lurking' over content creation (Edelmann et al., 2017). There tends to be an overrepresentation of younger, technology-savvy and politically active citizens among those using ICT for political participation (Hindman, 2009; Karlsson, 2012; Lidén, 2013). Citizen participation levels also depend on citizens' awareness of participation opportunities, perceived capacity to participate (Voorberg et al., 2015) and ease of participation (Verschuere et al., 2012). The only determinants that are specific to *online* participation seem to be access to technology and Internet user skills (Albrecht, 2006).

3.2.3.5. Specific requirements for system design. The goals of e-participation systems as democracy instruments create specific demands on their design. In order to avoid failure due to unrealistic expectations, it is vital to explicitly define the system's purpose and limitations from the outset (Panopoulou et al., 2010; Susha and Grönlund, 2014) and consider stakeholders' expectations, needs, skills and patterns of usage during system design (Abreu and Conrath, 1993). In line with technology acceptance theories, e.g. UTAUT (Venkatesh et al., 2003), the acceptance of e-participation systems depends on their perceived usefulness and ease of use (Panopoulou et al., 2010; Zheng, 2017). Therefore, low levels of e-participation may partly be explained by the discrepancy between the expected benefits and the perceived effort of using e-participation systems (Toots et al., 2016). The success of e-participation systems also depends on the fit between the participation instrument, its goals, demand groups and the form of participation (Wirtz et al., 2018). For example, in the case of online consultations, the deliberative element (Lidén, 2013) and moderation of discussions (Coleman, 2004; Talpin, 2013) are viewed as important quality and impact factors. *E*-participation systems are also expected to provide easy access to information (OECD, 2003), interactivity, and adaptability to technological developments (Panopoulou et al., 2010).

3.2.3.6. Specific requirements for process design. The failure of e-participation projects is frequently associated with their poor integration into political processes (Freeman and Quirke, 2013; OECD, 2003; Panopoulou et al., 2010; Scherer et al., 2010). It is argued that e-participation instruments should be fully integrated into

public governance processes in order to make an impact (Council of Europe, 2009; Freeman and Quirke, 2013; OECD, 2003). Successful e-participation processes require the involvement of decision-makers (Scherer et al., 2010) and end users (Abreu and Conrath, 1993; Edelmann et al., 2008) and need to demonstrate the impact of participants' contributions on policy outcomes (Lackaff, 2015; Panopoulou et al., 2010; Porwol et al., 2013; Scherer et al., 2012). Studies emphasize the importance of communication: users should be provided with clear information about the goals and mandate of the participation process (Council of Europe, 2009) and adequate feedback throughout the process (Medaglia, 2012; OECD, 2003). Lastly, the success of e-participation processes requires an active promotion of e-participation tools among the targeted user groups (Glencross, 2009; Panopoulou et al., 2010).

3.3. Application of the framework to failure cases

The factors described above complement the conceptual framework in Section 3.1 by allowing specific assumptions to be made about the failure of e-participation systems:

1. Due to the complexity of context, contextual factors are likely to pose a number problems to e-participation systems, constraining their ability to achieve their intended objectives.
2. Due to specific barriers in the context, e-participation systems are likely to struggle with low demand and acceptance.
3. Many contextual factors lie beyond the e-participation project organizations' scope of influence. Hence, their best strategy for avoiding failure is to regularly analyze the context and constantly adapt the system to contextual changes.
4. Due to the complexity of context and the likelihood of flaws in the innovation management process, e-participation systems face a high risk of failure.

The framework also provides guidance for empirical analyses of e-participation cases. First, as Sauer (1993) suggests, one should start by constructing a rich description of the case, mapping the key events and problems in the system's history. Second, influential contextual factors should be extracted from the case history. Third, in order to understand how the failure process unfolded, the contextual factors should be analyzed with regard to their effects on the system and its stakeholders, keeping in mind the project organization's role as a mediator between the system, context and stakeholders. Therefore, in order to understand *why* and *how* failure happened, it is necessary to analyze the project organization's innovation process to learn what efforts, if any, were made to respond to contextual constraints and demands and sustain stakeholder support.

4. Research strategy

In order to empirically test the framework, an explanatory case study (Yin, 2003) of the Estonian e-participation portal Osale was conducted with the aim to understand why the system failed and how failure occurred. The case study method has a well-established tradition in IS research as it enables the study of systems in their natural context (Recker, 2013; Walsham, 1995) and acquiring a meaningful and realistic understanding of failure (Sauer, 1993; Van Der Blonk, 2003). Although single case studies are unable to reveal generalizable statistical patterns, they can offer insights to inform theory (Walsham, 1995; Yin, 2003) and give guidance to practitioners (Sauer, 1993).

Following Sauer's (1993) suggestion to study case histories in order to uncover the failure process over time, the case was selected based on four main criteria: (1) stakeholders' perception of the system as a failure; (2) a sufficiently long history that would permit following the system's evolution over time; (3) access to information about its context; (4) the case's ability to serve as a critical case, i.e. reveal worthwhile information and help develop new knowledge (Patton, 1990). A suitable case was found in Osale, an Estonian government's e-participation system with a history of more than 10 years and a notorious reputation. As critical cases are often characterized by the reasoning of "if it doesn't happen here, it won't happen anywhere" (Patton, 1990), Estonia provided an interesting context for the study, considering its developed ICT infrastructure, political fascination with e-government (Kitsing, 2011b), high use of e-services (Kalvet et al., 2013) and success of online voting (Toots et al., 2016). While Osale is not the only government-led e-participation system in Estonia, its long history and accessibility of information were the reasons why it was chosen over others, such as *Rahvakogu* (People's Assembly) that existed for just 3 weeks in 2013, or TOM (*Täna Otsustan Mina*) which was used from 2001 to 2006 and was eventually merged with Osale.

Data for the case study was collected through document analysis, interviews, and statistical analysis of user activity on the site. The bulk of document analysis was conducted in January–May 2015, followed by a round of collecting additional data in November–December 2017 mainly with the goal of updating statistical data. Based on existing academic studies, policy papers, reports, press releases, media articles, and statistical data, a timeline for Osale was drawn from its inception in 2004 until 2017, including information on the objectives set for the system and problems associated with its implementation. A particularly useful source was the usability evaluation of Osale commissioned by the Government Office (Osale's owner) in the spring of 2015. The study (cited as Praxis and Pulse, 2015) involved focus groups with key user groups and provided valuable information on the views of Osale's stakeholders.

As the next step, six semi-structured personal interviews were carried out with Osale's managers, initiators and active users in April–May 2015, in order to probe the stakeholder (Sauer, 1993; Walsham, 1995) and 'insider' views (Chadwick, 2011) more deeply. Lastly, a telephone interview with a Government Office consultant was conducted in October 2017 to request an update of the government's plans regarding Osale (see Table 1 for the list of interviews).

The interviews had a twofold aim: to acquire additional factual information for the description of the case, and to discover common themes mentioned in relation to Osale's perceived outcomes and their causes. The guiding questions for the semi-structured interviews were based on the conceptual framework. Depending on their role, interviewees were asked to describe:

Table 1
List of interviews.

	Position, role	Interview date	Interview method
"A"	Government Office adviser, initiator of Osale	15 April 2015	Personal interview
"B"	Coordinator of Osale in 2007–2010	30 April 2015	Personal interview
"C"	Coordinator of Osale in 2011–2015	16 April 2015	Personal interview
"D"	Idea champion	2 April 2015	Personal interview
"E"	User representing an interest group	6 May 2015	Telephone interview
"F"	Individual user	11 and 13 May 2015	E-mail and Skype
"G"	Government Office consultant	23 October 2017	Telephone interview

- the goals set for the system and their expectations of the system;
- the extent to which they considered these goals and expectations fulfilled;
- their interactions with the system and the problems the system encountered over time;
- the ways in which these problems had been addressed;
- the factors in the external context that in their view may have affected the project.

Additionally, Osale's managers were asked to describe the process of the system's daily management and interaction with stakeholders, while users were asked about their user experience and intention to use the system in the future. All interviews were written down and analyzed manually by means of qualitative content analysis, using a theme-based coding scheme to map different expectations, flaws, influential factors and failure reasons and analyze their relationships along the lines of the framework constructed in Section 3.

5. Case study of Osale

5.1. Prelude (2001–2004)

Osale was initiated in 2004–2005 in the midst of a rapidly developing e-government in Estonia. Household Internet usage was constantly rising, public services were becoming available online, and remote Internet voting in nationwide elections was about to be introduced. Osale was not the first of its kind. Its predecessor, Estonia's first and most famous e-participation portal *Täna Otsustan Mina* ("Today I Decide", TOM for short) was launched in 2001 under the initiative of Prime Minister Mart Laar and his IT adviser. TOM was an online platform managed by the Government Office (the body serving the Prime Minister) that allowed citizens to propose their suggestions on policy to decision-makers. However, TOM soon encountered criticism about the low number of active users, low quality of the proposed ideas, limited impact, and lack of interest on the part of government officials (e-Governance Academy, 2010; Glencross, 2009). By TOM's third birthday in 2004, e-democracy enthusiasts had declared it to be a failure (Postimees, 2004). According to the initiators and idea champions of Osale (interviews A, B, D), TOM's failure prompted discussions on a new e-participation tool, which resulted in the development of Osale.

5.2. Initiation and development (2004–2006)

Osale was initiated in 2004 when the Government Office started devising the Good Practice of Engagement – a set of key principles for public participation in policy-making. Ministries and selected civil society organizations (CSOs) were invited to participate in the process. According to Osale's instigator and first coordinator (interviews A, B), the development of the Good Practice led to proposals for a new online participation platform which would resolve TOM's shortfalls by better integration into the formal rule-making process. Following consultations with CSOs and public officials, the Government Office decided to procure a new information system that would enable the government to conduct online public consultations on pieces of draft legislation. The aim was to provide a tool for implementing the Good Practice of Engagement (interviews A, B) and to enhance the transparency, openness, quality and legitimacy of decision-making processes (Hinsberg, 2007). The main participants in Osale's development process were the Government Office, a couple of CSOs (including the national network of NGOs), and the citizen engagement coordinators of ministries that had been newly appointed following the recommendations of the Good Practice of Engagement.

At the time of Osale's inception, the regulatory context for e-participation was only just taking shape. The Public Information Act (2000) defined the requirements for public access to government information; the national Civil Society Development Concept (2002) listed the collaboration principles for government and civil society in policy-making; the recent Response to Memoranda and Requests for Explanations Act (2004) obliged government institutions to respond to citizens' information requests within 30 days. However, whilst several regulations referred to the concept of 'public consultations', the concept was not explicitly defined in any of them (Praxis & Institute of Baltic Studies, 2010).

Osale targeted three kinds of users: government officials, organized interest groups, and individual citizens. According to the lead initiator in the Government Office (interview A), the demand for Osale came from a few active CSOs, while the attitudes of officials were mixed – those who were under greater pressure from non-governmental interest groups expressed more enthusiasm for a central e-participation platform, others remained indifferent or even resistant. The top managers of the Government Office were supportive but the attitude of other government institutions was for the most part lukewarm. The difficulties that many officials had faced when managing the conflicting demands of interest groups had made them skeptical about public engagement (interview A). Unlike TOM, which was born out of an initiative of the Prime Minister, Osale had no idea champions among politicians.

5.3. Implementation (2007–2008)

Osale was launched in July 2007 as a platform for public e-consultations on legislative drafts. In parallel, a civil society-led project "TID + " had started developing an e-participation tool of their own based on an analysis of TOM's experiences. Since the two projects' goals overlapped, the Government Office became a partner in TID + (interview A). In June 2008, the software produced as part of TID + was integrated with Osale, providing the functionality of an "improved TOM" – a system allowing citizens to suggest policies to the government and gather comments and votes in support. Despite all the criticism of TOM, it was maintained in Osale due to pressure from CSOs, the symbolic value of TOM as an innovation, and the wish to indicate that the government has not lost interest in citizens' ideas (interview A).

Along with the TOM functionality, all 1187 ideas which had been proposed previously by the more than 7000 TOM users were transferred to Osale (Simson, 2008). By the time this happened in 2008, Osale's e-consultation function had been used to conduct 18 public consultations, each read an average of 3000 times (Vabariigi valitsus, 2008). As the last step, a search engine was added to Osale that enabled an integrated search of documents across government websites. Following OECD's (2001) typology, Osale thus intended to enable three kinds of government-citizen interaction: information, consultation, and active participation.

5.4. Building awareness (2008–2010)

At the time of development and during the first years of implementation, the coordination of Osale was the task of the Government Office's Communication Unit. An adviser of the unit was responsible for coordinating the government's citizen engagement policies, including implementation of the Good Practice of Engagement and managing Osale. According to the first coordinator (interview B), convincing government institutions to use the system took time. Several ministries had started engaging stakeholders through their own online channels and the concept of a central e-participation system initially met resistance as some feared it would prove unable to fulfill their needs. In order to engage users, the coordinator organized training sessions and encouraged government institutions to use Osale during communication officials' weekly meetings. Whenever a ministry initiated a new piece of legislation or policy, the coordinator reminded the officials responsible to publish the draft on Osale. The coordinator also followed discussions in the portal, responded to citizens' inquiries and forwarded

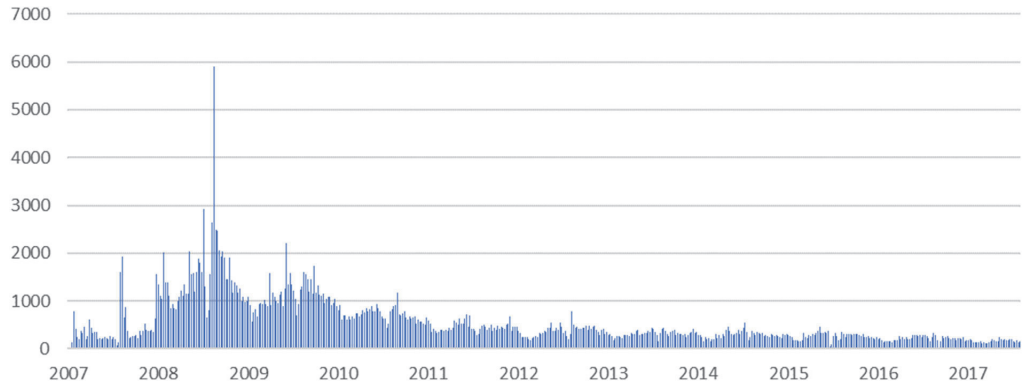

Fig. 2. Weekly unique site visits to Osale, 2007–17 (data: metrix.station.ee).

citizens' policy ideas to the relevant ministries. However, a 2010 survey among ministry officials revealed that only 4% of officials used Osale as the primary channel for informing stakeholders about policy or legislative changes, whilst the majority reported using e-mail and offline meetings for that purpose (Praxis and Institute of Baltic Studies, 2010).

Potential users among CSOs, interest groups and individual citizens were targeted through presentations at events, press articles, newsletters and face-to-face communication. According to the coordinator, several influential interest groups remained reluctant to share their opinion in public and preferred to keep to e-mail communication. The project organization's goals for 2008 included achieving regular use by all government ministries and at least 100 CSOs and interest groups (Hinsberg, 2007). A glance at the discussion threads in the portal suggests the latter goal was never met. Somewhat surprisingly, building political support was never an aim. According to the coordinator, Osale was designed as a "tool for administrators" which had "little to do with politics" (interview B). In the coordinator's view, political figureheads are "important to promote a culture of participation but not the tools through which participation occurs".

At the same time, efforts at raising public awareness slowly seemed to bear fruit – whilst in 2007, only 6% of the population reported having heard of Osale, public awareness had risen to 14% by 2008 (Saar Poll, 2008). The number of weekly visits to the Osale's website rose from an average of 279 in 2007 to almost 1000 in 2008. In order to engage more users, a massive awareness-raising campaign was outsourced to private advertising agencies. This involved an online campaign inviting citizens to answer a survey and submit policy suggestions to Osale with the opportunity to win a meeting with the then Prime Minister Andrus Ansip. The online campaign led to an all-time peak of traffic at the end of January 2009, when the site received 5906 unique visits per week (Metrix.station). Although the campaign did not result in the submission of many new policy ideas, it attracted close to 2500 survey respondents (Sulbi, 2009). At the end of 2009, the European Commission awarded Osale the title of e-Government Best Practice (Riigikantselei, 2009).

However, once intensive efforts at promotion stopped, interest in the portal quickly started to decline – by 2010, average weekly visits had dropped to 933, starting a trend for gradual decline (Metrix.station). The year 2009 also marked the end of all technical work – after some design upgrades implemented as part of the publicity campaign, no developments have been made to Osale since (interview C).

5.5. Critical changes (2011)

The year 2011 started out with major changes. First, the portal's first coordinator left their position. Secondly, a new government policy was adopted that made ex-ante impact assessment mandatory in drafting legislation and required stakeholder involvement in line with the Good Practice of Engagement. As citizen engagement became an integral part of the rule-making process, it was no longer regarded as a communication issue (interview C). Therefore, the responsibility for Osale was shifted from the Government Office's Communication Unit to the Strategy Unit, where the coordination role started being shared between an adviser and a consultant. According to the adviser (interview C), neither of the two spent more than 5% of their time at work on Osale. Their Osale-related work included keeping the contact list of ministries' citizen engagement coordinators up to date and forwarding citizens' policy suggestions to the relevant ministry. Interestingly, the job descriptions of Osale's coordinators never included one single reference to Osale – their activities were purely based on an intuitive assessment of what needed to be done (interviews B, C).

A third crucial event in 2011 was the launch of the Draft Information System (*Eelnõude Infosüsteem*, EIS), a new IS for inter-institutional coordination of pieces of draft legislation. EIS is integrated with Osale: whenever a draft requiring public consultation is published in EIS, a notification is sent to Osale, which is then used as the consultation platform. Although the main users of EIS are public officials, the system enables everyone to register as a user, follow proceedings and comment on drafts. The system thus became a competitor to Osale.

5.6. Steady decline (2011–2017)

According to a 2012 report (e-Governance Academy, 2012), the year 2011 marked Osale's decline into hibernation where active creation of content by the project organization was replaced by "merely technical work". This also shows up in usage statistics – by the end of 2011, weekly visits of Osale had dropped to 564, further decreasing thereafter (see Fig. 2).

The number of drafts published for consultation on Osale and commenting activity also exhibited a downward trend since 2008–2009 (see Fig. 3). An average draft receives one comment, while 54% of all drafts have received no comments at all. In the course of a decade, only four consultations out of 220 have received 10 or more comments from users. At the same time, readership of consultations has been much higher. For example, the National Audit Office's 2008 consultation on citizens' rights in the context of public e-services has been read more than 36,000 times (this, however, may be related to this consultation being permanently featured on the front page).

Although public interest in e-participation has been generally low, Osale has been one of the least used e-participation systems in Estonia. For example, an online legislative crowdsourcing project *Rahvakogu* (launched by a round-table of governmental and non-governmental agents in 2013 in response to a crisis in public trust) attracted 60,000

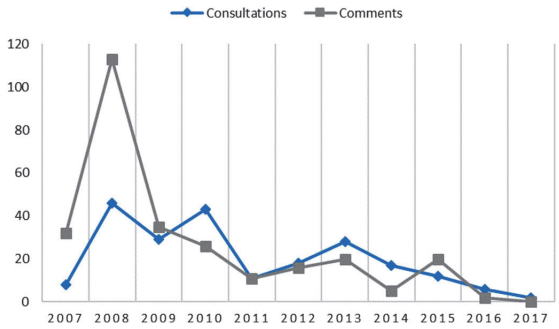

Fig. 3. Annual number of consultations and comments on Osale, 2007–17 (data: Osale.ee).

visitors, 2000 registered users, and 6000 recommendations and comments in just 3 weeks (Praxis, 2014) – despite failing by many other accounts (Drechsler, 2018). In fact, Osale was initially proposed as a platform for this crowdsourcing but the round-table was quick to reject the idea (interview B). As another example, in a 2014 survey, 7% of Estonian Internet users reported having used Petitsioon.ee (a civil society-led e-petitions system launched in 2010), whilst only 1% had used Osale.

Despite being aware of the low take-up and use, the Government Office made no efforts to mobilize users after the initial awareness-raising activities in 2008–2009 (interview C). Neither were any analyses of stakeholders' expectations ever carried out. According to Osale's coordinator, the Government Office saw little value in commissioning studies to learn "what was already known" (interview C).

Osale's poor state of health came under the spotlight whilst drawing up the second Open Government Partnership (OGP) Action Plan in 2014. As the time of drafting coincided with a change in government, the civil society protagonists who were part of the national OGP coordination body assumed the lead in developing the plan (interview D). The new action plan included the goal of evaluating the government's e-participation systems. As a result, an evaluation of Osale was commissioned in 2015 to "learn why Osale.ee is not functioning as expected" (Praxis and Pulse, 2015). The evaluation found that officials regarded Osale as unable to generate useful input, while interest groups considered the system detached from the policy process and unable to facilitate genuine dialogue with the government (Praxis and Pulse, 2015). The evaluation recommended terminating Osale. At the time of writing this paper, the portal remains online, although largely dormant. According to the Government Office (interview G), termination of Osale has only been delayed due to the lack of clarity on how to replace its functions. However, all development in the system has long since stopped.

6. Discussion

6.1. Dimensions of Osale's failure

The case history reveals that Osale failed in several respects. Based on usage statistics, interviews and the 2015 assessment, Osale failed to achieve the expected use and qualitative results, being evaluated negatively by all stakeholder groups. Since organized interest groups have preferred alternative channels for accessing policy-makers (interviews B, D), the main supporters of Osale have been some 5–10 individual citizens (Praxis and Pulse, 2015). Low user take-up has been a subject of consistent criticism throughout the history of Osale (e-Governance Academy, 2010; Kalvet et al., 2013; Runnel et al., 2009) and is an important failure dimension because it has also undermined the system's ability to achieve its stated objectives of increasing the quality and legitimacy of decision-making processes (Hinsberg, 2007). Osale has therefore struggled with issues of adoption and meeting stakeholder expectations as IS often do (Delone and McLean, 2003; Lyytinen and Hirschheim, 1987; Sauer, 1993; Walsham, 1995). Moreover, it has also failed to deliver on its objectives as a democracy instrument (Prosser, 2012; Reddick, 2011; Tambouris et al., 2012; Wirtz et al., 2018).

At the same time, stakeholders are careful not to deem Osale a total failure. Despite criticism, users appreciated Osale as a transparency tool, allowing them to stay informed about new policies and share their opinions in public (interviews E, F). Osale is also regarded as a valuable learning process for understanding the challenges of e-participation (interview D).

6.2. What contextual factors contributed to failure?

The story of Osale uncovers a number of contextual factors that played a role in its failure. First, Osale has suffered from problems that are commonplace in the implementation of IS projects, from flaws in project management to user resistance. Complexities have also arisen from the public sector context, including the challenge of serving multiple stakeholders and the difficulty of changing policy-making practices. However, the biggest challenges have originated from the environment of democratic participation: Osale has struggled with low demand, cultural barriers, regulatory gaps, lack of political support, and meeting the specific design requirements for e-participation processes. The key factors are discussed below.

6.2.1. The context of IS projects

6.2.1.1. Human error in project management. In retrospect, a number of human mistakes were made in Osale's planning and management. As is often the case in IS projects (Goldfinch, 2007; Nelson, 2007; Janssen and Klievink, 2012; Hughes, 2016), the initiators underestimated the complexity of e-participation and the risks of implementing a system with ambiguous goals in a context of little experience, unclear demand and high uncertainty about how such form of e-participation would work. There were clear flaws in the innovation process (Sauer, 1993) as the project organization intuitively recognized problems but made no effort to analyze the situation, learn, and improve.

6.2.1.2. Structural arrangements of the project organization. The case points to the importance of structural arrangements as a factor of failure (Sauer, 1993). Some of the flaws in innovation management are likely due to the lack of planning and the completely ad hoc nature of Osale's management. As the coordinators' job descriptions never specified their responsibilities with regard to Osale, its management turned out passive and reactionary. Osale was also affected by the structural shift from the Communication Unit to the Strategy Unit in 2011 – as expressed by an interviewee, "the Strategy Unit never really adopted Osale as their baby." One may wonder whether the stop of active promotion had to do with the different priorities of departments dealing with communication vs. strategy-related tasks.

6.2.1.3. User resistance. In many ways, Osale represents a typical case of new systems struggling with user resistance (Dwivedi et al., 2015; Fincham, 2002; Wilson and Howcroft, 2002). The project organization's work in the first years convincing government officials and non-governmental users to use Osale encountered considerable resistance. Despite some initial progress in recruiting users, user numbers dropped again as soon as active engagement and promotion efforts stopped.

6.2.1.4. Competitors. The adoption of the Draft Information System (EIS) in 2011 most likely accelerated Osale's fall from active use, despite its integration with Osale. The case thus points to competition as a factor in failure (see Dwivedi et al., 2013; Sauer, 1993). EIS can be regarded as a competitor to Osale in terms of providing access to public information and the opportunity to comment on draft legislation.

Unlike Osale, the use of EIS is mandatory for officials. According to one idea champion of Osale (interview D), EIS's advantage is that it offers improved integration with formal procedures – unlike the fuzzy concept of public consultations, the inter-institutional approval procedure of drafts is regulated in a detailed manner, including the requirement of providing feedback to all comments. Due to this, many interest groups have chosen to submit their input via EIS rather than Osale, although inter-institutional approval occurs later in the policy cycle. One user (interview F) also mentioned social media as a competitor to Osale as it allows for new flexible forms of discussion and direct access to decision-makers.

6.2.1.5. Technological changes. Previous studies have cited new technologies as a factor that may contribute to IS failure (Sauer, 1993), although the importance of technology tends to be minor compared to people and processes (Dwivedi et al., 2013). For Osale, the increasing use of smartphones and social media technologies created new requirements for Osale's design (Praxis and Pulse, 2015; interview C). Users expected Osale to adapt to these developments by shifting to a mobile responsive, user-friendly, dynamic and customizable interface (Praxis and Pulse, 2015). However, no technical upgrades were ever made in Osale to adapt to these changes.

6.2.2. The public sector context

6.2.2.1. Ambiguity of objectives and stakeholder multiplicity. It has remained somewhat unclear what goals Osale was supposed to achieve in the first place and what different stakeholders expected to gain from the system. Based on previous research, contested goals and a lack of clear vision is not uncommon in public sector ICT projects (Anthopoulos et al., 2016; Dwivedi et al., 2015; Susha and Grönlund, 2014). Satisfying the needs of various user groups has clearly been challenging for Osale as some user expectations have only been revealed in hindsight. For example, as the 2015 evaluation notes, officials expected to receive citizens' contributions in a form that is easy to integrate into existing policy documents, while citizens would have preferred to be engaged in generating ideas in the early stages of developing policy (Praxis & Pulse, 2015). Another subject of conflicting expectations has been the extent to which Osale should have enabled deliberation. While most interviewees and the evaluation pointed to the absence of interactivity as a clear flaw, the initiator and former coordinator (interviews A, B) claim that Osale was never designed as a deliberation platform but as a tool for simply aggregating opinions and ideas. The assessment and interviews (B, C, D) also refer to changes in expectations regarding participation tools: instead of using one central system, citizens now prefer interacting with the government via the platforms they are already using. Expectations and needs regarding Osale have also greatly varied within the public sector – whereas some ministries saw Osale as a potentially useful tool, others that had a habit of engaging stakeholders through meetings of expert committees saw no need to discuss their policy plans on an online platform (interview B).

6.2.2.2. Complexity of organizational change. The most frequent criticism of Osale concerns its poor integration with the policy-making process, which has been considered detrimental to its impact (e-Governance Academy, 2012; Praxis and Pulse, 2015; interviews C, D, F). This detachment can be at least partly attributed to the difficulty of organizational change in the public sector (Sarantis et al., 2010) and integration of e-participation into public policy-making processes (Panopoulou et al., 2014; Susha and Grönlund, 2014). This has been a particular problem for Osale's function of crowdsourcing policy ideas as the existing policy-making routines include no clear process for accommodating unsolicited input from outside of government circles (Praxis and Pulse, 2015).

6.2.2.3. Importance of individual innovation champions. The study highlights the importance of individual innovation champions as a powerful force of change in the public sector (De Vries et al., 2016; Panopoulou et al., 2014). Several interviewees (B, C, D) and previous studies (e-Governance Academy, 2012) noted a clear loss of commitment to Osale occurring after the first coordinator left. This resulted in the halt of all active innovation and support management work in Osale.

6.2.3. The context of online democratic participation

Due to Osale's goal to provide a platform for citizen participation, its outcomes have been shaped by particular factors that affect a society's ability to uphold a democratic dialogue:

6.2.3.1. Lack of political support. Literature has stressed the importance of top-down political leadership of e-participation and e-democracy initiatives (Council of Europe, 2009; Mahrer and Krimmer, 2005; Panopoulou et al., 2014). All interviewees insisted that Osale has not been a political priority – it has never been referred to in key policy documents, statements or political discussions. Whereas TOM had been the Prime Minister's initiative, political interest in Osale has been completely lacking. It is likely the presence of high-level political champions explains why TOM initially managed to attract much more public interest than Osale, despite eventually failing for other reasons.

6.2.3.2. Unfavorable cultural context. Osale was planted in a challenging cultural context. As democratic transition only happened in Estonia in the 1990s, citizens' interest in political participation has been lower than that of Europeans on average (Flash Eurobarometer 373, 2013). This also applies to the government – as stated by an OECD report, “consultation between government and civil society organisations in Estonia is still being developed and embedded into the culture of every-day work” (OECD, 2011, 219). Due to little experience with democratic citizen participation, public sector officials have exhibited varying levels of openness to online citizen engagement, often depending on the organizational culture and attitudes of top managers (Praxis and Pulse, 2015; interview B). This is not surprising as cultural impediments to civic participation also exist in more mature democracies (Albrecht, 2006; Panopoulou et al., 2014; Voorberg et al., 2015). Officals' use of Osale has also been inhibited by a peculiar cultural barrier – due to the perception of Osale as an official communication tool, officials have been cautious about publishing anything other than their organizations' official positions on the platform (Praxis & Pulse, 2015). This has understandably limited a dynamic debate on the site.

6.2.3.3. Regulatory context. Regulatory context is a somewhat under-researched factor in e-participation literature (Medaglia, 2012). The case of Osale shows the importance of regulations as a driver and a barrier. The adoption of the Good Practice of Engagement triggered the idea to develop Osale in the first place. However, due to the absence of clear regulations on public consultation, Osale's role remained ambiguous and its output poorly integrated into the policy-making process (Praxis & Pulse, 2015; interviews B, D). Some barriers also emerged from public procurement legislation. Although Osale's initiators supported the idea of agile development, rigid procurement rules required the whole platform to be developed at once (interview A). This restricted end-user participation in the system design, which is considered an important success factor in public sector innovation (Mergel, 2016). As another legal factor, the adoption of a new legislative drafting policy in 2011 drove the structural changes in Osale's management and forced through the shift of coordination from one unit to another, the effects of which were already discussed. It therefore appears that successful e-participation not only requires clear regulations on public engagement in policy-making but also public procurement legislation that supports agile and adaptive government.

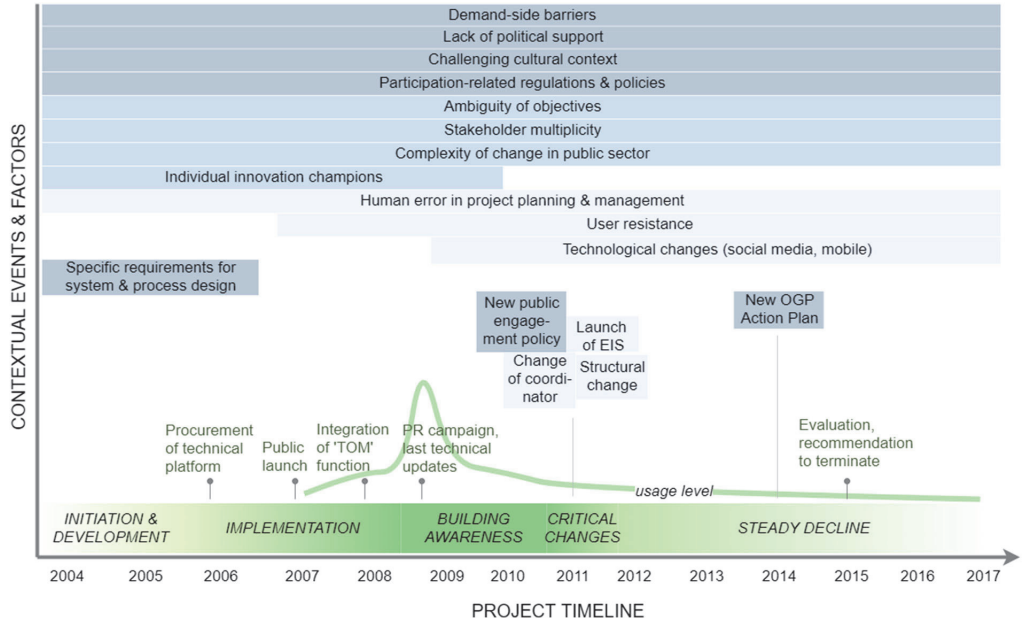

Fig. 4. Timeline of Osale's failure process.

6.2.3.4. Demand-side factors. The case of Osale underlines the challenge of low demand for e-participation (see Epstein et al., 2014; Glencross, 2009; Tambouris et al., 2012). Users' lack of interest in Osale suggests that its initiators may have overestimated the capability of citizens, interest groups and officials to engage in a meaningful online dialogue on draft legislation. According to Osale's coordinators (interviews B, C), officials were repeatedly suggested to make participation easier for citizens by simplifying legal texts and highlighting the aspects in which citizens' feedback was expected. Due to the low priority of Osale for officials (interview B), this was rarely done. However, most interviewees suggested that the promotion of Osale has also been inadequate. Whilst the first years saw active efforts to build public awareness, promotion stopped completely at the end of 2010. Some studies (e-Governance Academy, 2012) explain Osale's decline with a 'vicious cycle': citizens' low awareness of Osale led to low use, which decreased government officials' incentives to use Osale, which in turn decreased use by citizens and interest groups. As a result, Osale was consistently under-used by all stakeholder groups.

6.2.3.5. Requirements for system design. Literature points to a number of design requirements for e-participation systems to be able to facilitate democratic participation (see the overview in Section 3.2.3). The 2015 evaluation suggests that these requirements were largely not fulfilled or acknowledged in the system design process – stakeholders have criticized Osale for its uncomfortable and unattractive user interface, poor accessibility of information, outdated technological platform and the lack of filtering and moderation of comments, which is deemed incompatible with the expectation of facilitating an interactive dialogue (Praxis and Pulse, 2015; interview C). The technical functionalities (interview F) and user support (e-Governance Academy, 2012) have also been regarded as limited. Many of these flaws were already raised by the users of Osale's predecessor TOM (TOM Survey, 2008) but remained unaddressed in Osale.

6.2.3.6. Requirements for process design. As the study implies, Osale's key problem has been its poor integration with the policy-making process (e-Governance Academy, 2012; Praxis and Pulse, 2015; interviews C, D, F), which is cited as a major failure reason for e-participation initiatives (Freeman and Quirke, 2013; OECD, 2003; Panopoulou et al., 2010; Scherer et al., 2010). According to the first coordinator, "it never became quite clear how to use Osale; no clear process or guidelines emerged, let alone a good practice on when and how it should be used" (Interview B). Although Osale was designed for engaging citizens in the early stages of drafting legislation, not all drafts have been submitted for public consultation (Praxis and Pulse, 2015) and consultations have often been carried out late, leaving citizens little time to respond (e-Governance Academy, 2012; interview C). Users have been discontent with the lack of feedback to their suggestions (interviews E, F) and most policy ideas submitted through the 'TOM function' have been left without a response due to its complete detachment from the policy-making process (Praxis and Pulse, 2015). It is thus evident that the requirements for an effective participation process have not been met in Osale.

6.3. Why and how did failure occur?

As it turns out, the contextual factors that contributed to Osale's failure are not particularly unique – they have been previously described as factors that may affect the success of e-participation or e-government projects. However, in order to draw lessons from the case, a more important question is *how* this multitude of circumstances and constraints came to lead to Osale's failure. According to the framework put forth in Section 3, the effect of contextual factors on information systems is not direct – it is mediated by the project organization's innovation process and stakeholders' reaction to the results of the innovation process. The model suggests that failure occurs if the innovation process fails to address the demands and constraints posed by the context, either because of the complexity of the context or flaws in the innovation process. In the case of Osale, both have been true. The timeline in Fig. 4 shows that important barriers have been present in the system's context ever since its inception throughout the implementation process. However, it also shows that the system was only

actively managed for the first couple of years and almost left to its own devices thereafter.

Therefore, Osale's failure process can be regarded as a sum of the following interactions: 1) context posed challenges and barriers to Osale and limited its potential user base from the outset; 2) the project organization failed to understand the context, align the system with the context and build sufficient stakeholder support; 3) due to flaws in the system and lack of attention to stakeholders, Osale became assessed negatively and quickly lost support. This started a cycle of decline which eventually became impossible to reverse.

6.4. Could failure have been avoided?

An important benefit of the research approach used in this study is that it not only allows us to map the factors and interactions that led to failure but also understand whether failure could have been avoided. To this end, two questions should be asked: 1) What flaws occurred in the innovation management process?; 2) Did the project organization have the power to change the adverse contextual factors? It is evident that in the case of Osale, the key contextual barriers (low demand, cultural barriers, regulatory gaps, etc.) were beyond the project organization's control. It is thus unlikely failure could have been fully prevented by better project management – in fact, Osale's failure process seems to have started even before the system went live.

However, Osale's innovation management process could have been improved to detect the root causes of adoption problems much earlier. The innovation and support management process could have been improved by conducting regular analyses of Osale's environment, setting clear development goals and responsibilities within the team, and reaching out to stakeholders to understand and manage their expectations. The project organization could also have prioritized recruiting supporters among politicians and top managers. That nothing of the kind was done implies that whilst context played the leading role in Osale's decline, inadequate innovation management likely made matters worse.

As suggested in Section 2.1, ambitious objectives coupled with a complicated context tend to generate high failure risks for e-participation projects. Osale's ambitious goal of providing a central and permanent consultation platform for the government made its implementation more challenging compared to e-participation initiatives with a more limited duration or scope, such as Estonia's *Rahvakogu* or Petitsioon.ee. Due to the inevitable uncertainties in information systems' context (Janssen et al., 2015; Sauer, 1993), long-term projects entail a number of risks related to changes in stakeholders' expectations and the broader environment. Hence, project organizations' best strategy for reducing the risk of failure is to constantly scan the context and adapt the system to changes in the context, even if it means a complete repurposing of the system.

6.5. What lessons can be drawn from the case?

The case generates several theoretical propositions about the failure of e-participation systems. First, it demonstrates the sheer complexity of the context of e-participation systems that is due to the socio-technical and political nature of e-participation systems. In addition to the challenges that are common in IS projects, e-participation systems also grapple with issues related to organizational complexities in the public sector and the nature of democratic participation. Due to their complicated task of providing a platform for dialogue between government and citizens, e-participation systems are likely to have difficulties sustaining use, meeting stakeholders' expectations and achieving their intended objectives.

This points us to crucial differences between e-participation systems and the kinds of e-government systems that perform tasks such as supporting back-office processes or facilitating service provision. Firstly, stakeholders' expectations to e-participation systems tend to be more ambitious as well as more ambiguous. Secondly, in most contexts (perhaps apart from extremely well-developed participatory democracies), e-participation systems are not set up to facilitate or automate an already existing process but to introduce a completely new process of citizen participation, thus facing problems with user resistance and unclear demand. This also provides a possible explanation for why Osale has not managed to repeat the success of e-government services and e-voting in Estonia. Although all rely on technology, the goal of upholding a democratic dialogue between government and citizens presumes much more fundamental changes to government practices than digitizing a public service or a voting procedure. Hence it is likely to generate more resistance and friction. Moreover, as the success of e-participation systems depends on their ability to engage diverse types of users with different needs and abilities, they are likely to encounter user acceptance problems. Due to these reasons, e-participation systems seem to face an inherently high risk of failure.

Nevertheless, this does not mean that all e-participation projects are doomed to fail. Literature has reported several successful cases, e.g. the mitmachen.at youth engagement project in Austria (Edelmann et al., 2008), the Leitbild Growing City consultation platform in Hamburg (Lührs et al., 2003), or the Mitreden-U project in Germany (Schulz and Newig, 2015). However, for the most part, these have been one-off projects or pilots with a very limited timescale, clear goals, well-defined participation process and extensive promotion efforts to engage users. One notable exception is the Better Reykjavik policy crowdsourcing system in the capital of Iceland (Lackaff, 2015), which is largely perceived as a success story and has managed to create a sustainable local participation platform. The success of Better Reykjavik has been explained by Iceland's specific cultural, social, and historical context, an exceptional political situation at the time of its initiation, design choices that support interactive discussions, and consistent promotion of the system among users (Lackaff, 2015). It may therefore be hypothesized that e-participation may work better at a limited and local scale (as has, for example, been suggested by Bannister and Connolly, 2018), and in conditions where favorable context meets skillful project management.

7. Conclusions

As a number of governments have responded to citizens' demands for more democratic participation by building e-participation systems and sites, this paper set out to understand why many of them have failed in terms of adoption and outcomes. In the absence of well-developed explanatory frameworks in e-participation literature, the paper combined theoretical insights from the information systems and e-participation domains and proposed a research framework that enables to better understand failure causes by zooming in on the process of failure.

The application of this framework to the case study of the Estonian government's e-participation system Osale revealed that systems that aim to engage governmental and non-governmental users in a democratic dialogue face three kinds of challenges. Firstly, such systems are susceptible to the human error and environmental constraints that are common in IS projects. Secondly, their implementation is complicated by the characteristics of public sector organizations. Thirdly and most importantly, e-participation systems face distinct barriers related to the complex environment of democratic participation. Such barriers range from low demand and lack of political interest to the difficulty of designing a system that would effectively enable a democratic dialogue while corresponding to the diverse expectations of different stakeholders. These challenges emerge both from the inherent uncertainties in the context of socio-technical systems and the nature of political participation.

The case study demonstrated the value of learning from the analytical frameworks in IS literature to overcome the current gaps in e-participation research as regards explaining failure. The framework builds on the socio-technical tradition of IS failure research but also

Table 2
Recommendations to e-participation system managers.

1. Manage e-participation systems as a process of **continuous innovation**, learning and adaptation.
2. Regularly **analyze the context** to align the system with changes in the context.
3. Build **flexibility and adaptability** into the system by design.
4. **Know your stakeholders**. Who are they? What needs do they have? Can the system fulfill these needs?
5. **Manage your stakeholders** and their expectations. Involve them in the system design, study their expectations on a regular basis, clearly communicate the mandate and limitations of the system.
6. Secure **political support** to the system.
7. **Ensure a fit between** the goals and instrument for participation as well as the design of the e-participation system and participation process. If the system aims to generate input to policies, design a clear process for the inclusion of this input. If the system aims to support dialogue between users, provide an interactive interface and a moderation process.

accounts for the specific nature and context of e-participation. The main advantage of the approach is that it opens the 'black box' of failure up for scrutiny by focusing on the interaction between the system, its context and the project management process. By regarding project organization as a mediator between a system and its context, a more realistic understanding can be gained of what options project organizations have at hand to prevent failure in the given circumstances. Although the findings of this study imply that the complicated context of e-participation makes e-participation systems prone to fail, they also point to the benefits of a well-designed innovation process. Table 2 provides some recommendations to practitioners in this regard.

The limitations of a single case study and the focus of this study on a specific type of e-participation projects do not provide sufficient grounds for abandoning the idea of building online platforms for citizen engagement altogether. However, the study does point to the faults of techno-deterministic thinking and hoping to invigorate democratic participation simply by adopting a new tool or technology. The proposed analytical framework presented a way of grasping the complexity of the processes and interactions involved in e-participation; future research is encouraged to further improve the framework based on other cases and contexts.

Declarations of interest

None.

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Success in eVoting – Success in eDemocracy? The Estonian Paradox

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Abstract. Estonia has acquired the reputation of a successful e-voting country, and perhaps justifiably so. It was the first country in the world to enable remote online voting in nationwide elections in 2005 and the share of e-voters has been on a rise ever since, now reaching one-third of all voters. Against this backdrop of a seemingly flourishing e-democracy, we set out to ask if the country's success in e-voting also implies its success in e-democracy in a broader sense. In a qualitative case study, we compare Estonia's experience in e-voting with the implementation and outcomes of three e-participation projects to demonstrate that considerable discrepancies exist between the take-up and perceived success of e-voting vis-à-vis other e-democracy instruments. In light of these findings the paper further discusses the factors that are likely to account for these differences and highlights the need to look beyond the success of online voting for a holistic evaluation of the state of e-democracy in a given country.

Keywords: e-Democracy · e-Participation · e-Voting · Estonia · Case study

1 Introduction

Throughout time, democracy has continuously evolved and even undergone drastic changes – from face-to-face, via territorial to transnational societies. Most recently, the Internet fosters this transformation as it challenges the concept of state sovereignty and need for representation. Arguably, e-democracy as a transnational, location independent way for citizens to interact with their state and be able to communicate and deliberate in the way of a strong democracy, can be considered the concept for a third transformation following Dahl [1]. Consequently, there is a need for e-democracy instruments that help facilitate and shape such an e-democracy.

Estonia has been a pioneer in developing electronic public services and today all public services include an e-service component. The eID card (the primary identification document for citizens and permanent residents) has enabled digital signing of documents since 2002 and remote e-voting in nationwide elections since 2005. Internet penetration has constantly increased – while in 2005, 58 % of the population used the Internet, today 88 % are internet users [2]. Estonia undertook first steps to develop e-democracy in the early 2000s, creating the first e-participation platform in 2001 and holding electronic elections since 2005. However, while these early efforts placed the

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country among the top ten in the UN e-participation index from 2008 to 2012, Estonia seems to have fallen behind since then, now ranking 22nd out of 193 [3].

While Estonia has acquired the reputation of a successful e-voting country, we set out to ask if Estonia's success in e-voting also implies its success in e-democracy in a broader sense. To answer this, we developed an evaluation framework for the case study of e-democracy instruments in Estonia, by combining some of the success criteria often employed in information systems, e-participation and e-democracy literature, focusing on user acceptance on the one hand and the aspect of democratic legitimacy on the other. Thus, we are looking at the following criteria: (1) level of use; (2) user diversity, (3) stakeholder satisfaction with the system and (4) impact on the political process. While the first and the third category are typical IS success measures, the second and fourth aim to incorporate the component of democratic legitimacy, which is considered the overarching aim of e-democracy projects [4]. The perceived legitimacy and success of a democratic exercise has been associated with not only engaging a sufficient number of participants but also reaching a diverse group of participants [4–7]. Similarly, the actual impact of e-democracy tools on political processes is considered a key measure of their success [5, 6].

The paper is structured as follows. Section 2 gives an overview of our research methodology. Section 3 establishes the theoretical framework for the analysis based on two relevant and complementary literature streams – public sector innovation generally and e-participation literature more specifically. This is followed by a summary of the Estonian e-voting system in Sect. 4 and three major nationwide e-participation projects in Sect. 5. In Sect. 6 we discuss the outcomes of the four e-democracy instruments in relation to the factors that have affected their success, followed by a few concluding remarks on the possible reasons why e-voting has worked more effectively in Estonia than e-participation.

2 Methodology

The aim of this study is to explore the steps that Estonia has undertaken in order to build e-democracy by analyzing the e-democracy instruments, such as TOM, Osale.ee, People's Assembly (*Rahvakogu*), most recently Rahvaalgatus.ee/Citizen OS[1], as well as e-voting, that have been implemented since the transformation of the public sector based on the use of the Internet caught on in the early 2000s. In particular, we are interested in identifying why e-voting works in Estonia and why e-participation does not. The in-depth study of a contemporary phenomenon using multiple sources of evidence in its real-life context is a typical application of case-study methodology. Also, it is an area where there is traditionally – up to today – not enough empirical research [8] undertaken in the IS field.

Yin distinguishes between exploratory, descriptive and explanatory case study types [9]. As we intend to gain new insight in how an e-democracy is (not) being built,

[1] Rahvaalgatus.ee is only a very recent development in 2016. It was not further analyzed as part of this study and is only mentioned here for completeness.

the exploratory approach is selected. Due to the unique situation Estonia is in – it is to date the only country in the world that offers e-voting in all its elections without any restrictions to all eligible voters [10], it was abstained from choosing a comparative multiple case study setup and focus solely on the Estonian case. For conducting the actual case study research we follow Yin's three phases (i) define and design; (ii) prepare, collect; and (iii) analyze and conclude [9].

The data for compiling the case study were collected mainly through desk research in 2015, including existing studies, policy papers, reports, press releases, articles in the media, use statistics, legislative acts and government strategies.[2]

3 Conceptual Framework

Driven by the question why some e-democracy instruments, such as e-voting, seem to work better than others, we focused on studying the factors that make for a successful e-democracy tool. As e-democracy instruments can be viewed as a particular kind of public sector innovation, we found some useful guidance in public sector innovation research as well as e-participation and e-democracy literature.

3.1 Key Success Factors in Public Sector Innovation

E-democracy instruments can generally be treated as public sector innovation concerned with "the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes efficiency, effectiveness or quality" [12]. The emergence of literature on innovation genuinely attributable to the public sector can be observed since around 2000, with a focus on innovations in public services and governance [e.g., 13, 14–16].

One of the most recent systematic accounts of public sector innovation is a literature review by De Vries et al. [17] that maps influential factors in public sector innovation at different levels and in different stages, from idea-generation to adoption and diffusion. They distinguish key innovation drivers and barriers along four main categories: (1) environmental level, including regulatory pressures, environmental pressures (media attention, political and public demand), participation in networks and

[2] For Osale.ee, an important information source was an evaluation report of the usage and usability of Osale.ee published by the Government Office (manager of the system) in spring 2015 (quoted in this paper as [11]), which relied on focus group interviews with Osale's managers and key user groups (ministry officials, civil society organizations, interest groups, and individual citizens). In addition, six semi-structured personal interviews were undertaken with key idea champions, IS managers and active users in April and May 2015, several of whom had also been involved in the creation of Osale's predecessor TOM.

For e-voting the experience as part of the OSCE/ODIHR election related activities on Estonia were of particular importance where one of the authors was able to participate. The opinions put forward in this article are all of the author's alone and should not be attributed to the OSCE/ODIHR or any other institution.

For *Rahvakogu* we were grateful to have had access to a forthcoming study thereon.

inter-organizational relationships; (2) organizational level: resources, leadership styles, risk aversion, incentives/rewards, organizational structures, etc.; (3) characteristics of the innovation itself: ease of use, relative advantage, compatibility, cost, trustworthiness, etc.; (4) characteristics of innovators, including employee autonomy, tenure, mobility, knowledge and skills, creativity, commitment, etc. Some factors, such as leadership, were found to be important in all stages of innovation. The European Commission's report "Powering European Public Sector Innovation" [18], perhaps the most influential policy document on the topic, highlights similar barriers. Some of the key impediments to success are related to scattered competences, lack of coordination, unfavorable administrative and organizational culture, lack of resources, lack of leadership, risk-aversion and failure-avoidance, lack of collaboration and limited knowledge on how to apply and measure the outcomes of innovative processes.

Case studies of e-government innovation support these findings. Political will and innovation acceptance at all levels of the organization have been found to be key drivers of successful e-government innovations, while different stakeholder agendas, political turbulence and resource issues act as barriers [19]. Similarly, a case study of the Estonian e-government evolution identified leadership and public sector competencies, availability of resources, legislative and regulatory support, and the existence of (strategic) IT infrastructure as important drivers. The study also emphasized the importance of frequently underestimated factors: the competencies of the private sector, public-private collaboration and the actual process of technology transfer, including support mechanisms to public procurement of innovation [20].

3.2 Key Success Factors for e-Democracy Instruments

The success and failure of e-democracy instruments has been associated with a variety of factors similar to those outline above for public sector innovation. A key success/failure factor seems to be their level of integration into organizational procedures and political processes [e.g., 5, 6, 21]. E-democracy methods should have a clear mandate [6] and involve decision-makers from the outset [22]. Integration can be seen as a key prerequisite for impact, which to date seems to be limited at best [5, 23]. Another set of factors can be associated with organizational culture, attitudes and political support. In addition to organizational culture, broader cultural preconditions for e-democracy include a developed civil society, social trust and an open political culture [6, 21].

The failure of many e-government initiatives has been attributed to overlooking the demand side and citizen's perspective [24]. Empirical evidence of e-participation tools suggests that their take-up has thus far been globally low [25]. Neither have e-participation initiatives brought more people in decision-making, engaging just a narrow "elite" of politically active citizens [7, 26, 27]. Variables explaining participation include prior interest in politics, internet skills, younger age and high level of education [27], which is very similar to participation patterns in offline contexts [28]. The challenge of attracting users implies the need to reckon with their needs and capabilities by engaging users in designing the e-participation tools [6]. Effective participation in the democratic debate also presumes particular requirements to system

design, such as information accessibility and competent moderation [5, 29]. Finally, the acceptance of any ICT-based democracy tool tends to be determined by their perceived usefulness and ease of use, the two central concepts in technology acceptance theories [30]. It is assumed that user acceptance is higher for systems that require less effort, while demonstrating clear benefits for the user.

Either way, the development of an electronic democracy with transnational character [31] needs the further development of e-enabled instruments of democracy, i.e., e-initiatives, e-referenda and of course also e-voting instruments [32]. E-voting takes a special role within this set of e-democracy instruments. Not only is it one of the most visible e-government projects which sometimes receives all the attention of the public, it also is often one of the most discussed and debated [33].

The success of e-voting is often linked with an incremental, step by step, implementation [34], careful consideration of stakeholders' interests [35], as well as a holistic, interdisciplinary, approach [36]. It can be noted that e-voting is more focused on technological issues than other e-democracy instruments, partly due to the inherent paradox between unequivocal identification of voters on the one side and must not being able to establish a link between the vote and the voter, essentially keeping the vote secret and hiding the identity of the voter (preserving anonymity) [37]. Due to the fact that to date most e-voting undertakings do not follow classical experimental setups [38] and are embedded in their national context [39] it is hard to draw comparative conclusions and provide learning to others. We therefore decided to change the approach and conduct an in-depth analysis of a country's efforts around all kind of e-democracy instruments.

4 The Case of e-Voting in Estonia

The Estonian efforts around e-voting started in 2001 with a plan to introduce e-voting, allowing to cast votes remotely via the Internet (often also called "Internet voting") already for the Estonian 2003 parliamentary elections. Following the e-government logic this seemed like the logical next step after e-tax reporting, e-banking and a paperless cabinet meeting of the government's ministers [40]. It took two more years until e-voting become a reality, due to discussion around its constitutionality. With the first ever, countrywide, unrestricted, remote e-voting channel offered in legally binding elections, the 2005 municipal elections, Estonia manifested its narrative of being an e-country. To date it remains the only country with such a universal approach to e-voting.

Several articles have been written about the Internet voting experience in Estonia [41–44], but probably the most comprehensive overview can be found in [45]. Here Vinkel classified the development of Estonian e-voting in three stages: (i) setup period (2002–2005), (ii) growth period (2005–2011), (iii) maturity period (from 2011). In the first period the main technological decisions were taken (usage of the card; double-envelope algorithm). In the second phase, a continuous exponential increase in usage was experienced (see Fig. 1), while the actual application was not changed in functionality, design nor usability. The ongoing third developmental phase was started

by a security incident during the 2011 Riigikogu elections[3]. It was followed by an electoral reform with the introduction of individual verifiability as its main result [47].

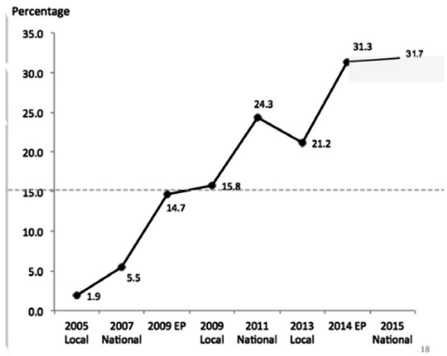

Fig. 1. Share of E-voters out of Voters in Per Cent [48]

5 Estonian e-Participation Projects

5.1 TOM

Estonia's first national-level e-participation project TOM or *Täna Otsustan Mina* (meaning "Today I Decide") was launched at the initiative of Prime Minister Mart Laar and his IT advisor as early as in 2001, possibly making it one of the first of its kind in the world. The online platform, administered by the Government Office, allowed citizens to make proposals for new legislation and policies and discuss and vote upon them. More popular ideas would be forwarded to relevant government officials, who then would have one month to post a formal response.

Despite a relatively lively public interest in TOM, the project soon encountered challenges, such as a limited number of active users, low quality of ideas, limited impact of citizens' proposals and the prevalence of formalistic responses by officials over an open attitude to dialogue [49]. By TOM's third birthday in 2004, e-democracy enthusiasts had declared it a failure [50]. According to interviews with implementers and idea champions of the project, TOM seemed to be ahead of its time. Government institutions lacked an understanding of how to integrate TOM-generated ideas into their work process and citizens lacked the knowledge and skills to formulate their ideas in sufficient quality and formats that officials could work with. According to TOM's administrator, there was a gap in the regulatory, strategic and political context – as government-wide discussions on citizen engagement policies only started around 2004–2005, the ground for e-participation was not yet fertile [51].

[3] A student managed to program a Trojan horse that would cast a different vote than the one intended by the voter. He consequently filed a complaint to the election management body but this was eventually turned down [46].

Citizens were equally dissatisfied. In a survey involving 25 active users, a number of ideas for improvement were voiced, such as the need for more active promotion of the project, improved information accessibility (e.g. systematizing citizens' ideas according to topics), design updates, involvement of experts and moderators to increase the quality of debate, and integration with other government information systems [52]. However, instead of re-designing TOM, the government decided to build a new e-participation tool (later named Osale.ee) and migrate TOM to the new platform. By that time, TOM had more than 7,000 registered users, who had generated 1187 ideas in total [53] out of which no more than 1 % were actually implemented by the government [49].

5.2 Osale.ee

The idea for developing Osale.ee (www.osale.ee) emerged around 2004–2005 during the process of designing a government-wide policy for citizen engagement. The process brought together government officials and civil society activists and led to ideas for a new e-participation tool, which would address the shortcomings of TOM by better integration into formal rule-making processes [51, 54]. Consequently, the Government Office took the decision to develop a new e-participation portal which would enable officials to engage civil society in legislative drafting. The goal of the portal was to enhance the transparency, openness, quality and legitimacy of decision-making [55].

Osale.ee was launched in 2007 as a platform for public consultations on legislative drafts. A year later, the system was upgraded with the functionality of an "improved TOM", which allowed citizens to propose ideas to the government, and gather comments and votes in support. Despite all the criticism of TOM, its functionality was preserved in Osale.ee because of TOM's high symbolic value, pressure from civil society and the wish to signal that the government had not lost interest in citizens' ideas [51]. Osale.ee also included a third function – a search engine of government documents. It thus aimed to enable all three types of government-citizen interaction: information, consultation and active participation [56].

Osale.ee intended to engage three kinds of users: officials of government institutions (mostly of the executive branch), individual citizens and their institutionalized representatives. In practice, however, the tool soon became criticized for failing to attract users and lack of impact [57, 61]. The portal is still operational today but largely considered failed in terms of adoption and outcomes [11].

5.3 People's Assembly

In 2013 Estonia experimented with a post-Parliamentary democracy tool, the People's Assembly (*Rahvakogu*). The initiative came from the President of Estonia and several civil society organizations as a response to a public trust crisis. It consisted of an online platform for crowdsourcing proposals to amend Estonia's electoral laws, political party law, and other issues related to the future of democracy in Estonia. After three weeks of online crowdsourcing, the ideas were debated during a one-day 'deliberation day'

involving a stratified random sample of members of the public to proportionally represent different regions, age groups and gender [58]. The process resulted in 15 proposals that were presented to the parliament.

A year later, three proposals out of the 15 became laws and several more have by now been partly implemented or re-defined as commitments in the government coalition program. However, as the organizers admitted, the exercise failed to achieve its main goal – to increase trust in institutions of representative democracy [59].

6 Discussion

The four e-democracy instruments that have been implemented in Estonia – e-voting, TOM, Osale.ee and People's Assembly – have met mixed success. E-voting, despite some initial barriers, has by now been adopted by a considerable share of voters (close to 32 % in the latest elections) and is generally regarded as an effective tool [48]. At the same time, the e-participation projects have only been able to engage a narrow group of active users and are largely perceived as lacking impact. Although TOM had close to 7,000 registered users, only 9 % of them actually posted an idea [49]. Osale.ee, the only ongoing e-participation project, has been reported to have no more than 5–10 committed active users [11]. While the People's Assembly online platform succeeded in attracting a high number of proposals and comments (close to 4,800) it was still heavily dominated by a homogenous user group – middle-aged well-educated ethnic Estonian men [59]. It is therefore fair to conclude that none of the e-participation projects has been particularly successful in enhancing e-democracy in the sense of fostering an active engagement of all parts of society in shaping public decisions.

Based on theoretical and empirical literature, e-democracy innovations are challenged by various barriers. These include a lack of administrative and political championing, poor integration into organizational procedures and broader political processes, lack of easily demonstrable impact, unfavorable cultural context, hostile attitudes to citizen engagement, and the difficulty of matching different expectations and capabilities in designing systems intended to engage diverse user groups. Therefore, the success of e-voting compared to e-participation projects could at least partly be associated with its inherently high integration into policy processes and administrative routines, high political interest and support to the instrument, its immediate and easily demonstrable impact on the constitution of elected bodies, clear mandate and a clear procedure for translating input to outcomes.

E-voting has demonstrated clear benefits related to convenience to users – if voting on paper would take more than half an hour, voters are more likely to prefer the electronic channel over the traditional one [48, 60]. Looking more closely at the development path of e-voting, one can identify that the service has been characterized by a relative stability as the application remained relatively unchanged within the first six years of operation – and this change only happened due to external pressure (an attack) [45]. Initially the take-up of e-voting was relatively low (only 2 % of the voters chose the electronic channel in the 2005 municipal elections first offering e-voting) and focused on early adopters of the ID card, similar to e-banking. There was thus in fact a high barrier of learning to be overcome. Once this barrier was mastered, the immediate

return was incurred: convenience. With e-voting people potentially save time, while with other e-democracy instruments the actual impact has often not been clearly visible.

Unlike e-voting, Estonian e-participation projects have never achieved true integration with existing political processes and their mandate has remained unclear. In the case of TOM and Osale.ee, government institutions do not seem to have found a way to accommodate unsolicited ideas from citizens into their daily routines. Although Osale.ee aimed to fix the shortcomings of TOM by better integration into the policy-making process, it largely seems to have failed in this respect. Part of the problem has been the ambiguity of the concept of public consultations, which is undefined in legislation [11, 62]. Hence, the extent to which the government should take citizens' input into account has remained unclear. Similarly, as the Parliament's policy-making routine included no procedures for working with crowdsourced proposals, the Parliament was generally reluctant to discuss the ideas put forward by the People's Assembly [59].

The latter also has to do with political interest, which seems to have been relatively low for all e-democracy instruments but e-voting. As the Prime Minister's project, TOM clearly had political backing at the highest level, albeit limited to the Prime Minister's office, while its successor Osale.ee never saw any political champions [54, 62]. Political interest was more mixed for People's Assembly – although the process was formally initiated by the President, it did not meet similar interest on the part of the Parliament, the group of politicians whose support would have been key to the project's impact.

Due to loose integration and low political interest, all three e-participation projects have lacked the expected impact. The actual implementation of citizens' ideas proposed through TOM and Osale.ee has remained marginal [49]. Public consultations on Osale.ee have not yielded better outcomes – both government officials and interest groups criticize the platform for low usefulness [11]. The People's Assembly, despite several positive effects, did not bring the government closer to citizens and failed to stimulate a fundamental reform of political institutions it originally intended to [59]. Therefore, considering the effort that is required from citizens, administrators and politicians to engage in a complex political dialogue and the absence of immediate benefits such as time savings, it might well be argued that it is inherently more difficult for e-participation projects to repeat the success story of e-voting.

7 Conclusions

Estonia's success in e-voting does not mean the country has been successful in promoting and enabling e-democracy in general. Somewhat paradoxically, the country that has been a champion of e-government and a pioneer in e-voting has not quite been a success story in e-participation and has consequently failed to develop a full-fledged e-democracy as some had initially hoped.

However, it is not only that the politicians lack out on supporting this transformation (which could be due to the fear of losing power; compare [63]) but also citizens themselves. Contrary to the hopes of many early Internet enthusiasts, citizens do not appear to be particularly interested in taking advantage of all the opportunities for direct access to decision-making that contemporary technologies can offer, especially if the

benefits are not immediately evident. As it seems, the third transformation of democracy towards a fully developed e-democracy still has to happen and not even Estonia can help out with this one – for now.

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Publication III

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LEADER IN E-GOVERNMENT, LAGGARD IN OPEN DATA: EXPLORING THE CASE OF ESTONIA

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Abstract

Estonia is often considered as a global leader in digital government. However, when it comes to Open Government Data (OGD), Estonia seems to be far behind many other countries according to international surveys and indices. This paper takes a closer look at the puzzle of Estonia's low OGD maturity against the backdrop of a highly developed e-government by conducting an exploratory case study of Estonia using document analysis, survey data and semi-structured interviews. The results suggest that some of the e-government solutions that have been the key pillars of Estonian e-government success in the past may have become a barrier to understanding and implementing the concept of OGD. However, we are also beginning to see signs of a slowly increasing national OGD capacity thanks to the emergence of an active civic movement driving the development of OGD in Estonia.

Keywords

Open government data, e-government, Estonia, case study

Résumé

— Chef de file en matière de gouvernement numérique, mais à la traîne dans l'ouverture des données publiques : une étude du cas estonien — L'Estonie est souvent considérée comme un chef de file mondial en matière de gouvernement numérique. Cependant, du point de vue de la politique qu'elle mène en matière de « données gouvernementales ouvertes » (open government data)*, l'Estonie apparaît dans les enquêtes internationales loin derrière de nombreux autres pays. Cet article examine de plus près cette apparente contradiction d'un État qui demeure à la traîne dans le domaine de l'ouverture des données publiques alors même qu'il est considéré comme en pointe en matière de gouvernement électronique. Le cas de l'Estonie y est étudié en s'appuyant*

*sur une recherche documentaire, des données d'enquêtes ainsi que des entretiens semi-directifs. L'article arrive à la conclusion que certaines des solutions d'*e-government *qui, par le passé, ont constitué les piliers du succès du gouvernement numérique estonien sont aujourd'hui devenues des obstacles à l'élaboration et à la mise en œuvre d'une politique en matière de données ouvertes. Cependant, celle-ci commence à se dessiner grâce à l'émergence d'acteurs de la société civile qui en constituent le vecteur de développement.*

Mots-clefs

Données gouvernementales ouvertes, e-gouvernement, Estonie, étude de cas.

How information is gathered, secured, controlled, and shared has been an area of high interest to the field of public administration for many years (Henry 1974). However, since the initial conceptualization and advent of government digitalization in the late 20th century, this is a topic that has been exploding in terms of interest and real-world applicability (Attard *et al.* 2015; Janssen, Charalabidis, and Zuiderwijk 2012). In today's media and ongoing political and academic discourse there is a continuous stream of terms related to the subject such as freedom of information, open government data (OGD), public data, public information, and more recently the idea of data ownership and cross border exchange of data (Krimmer *et al.* 2017). Though data and information are being debated accross countries and governments, there is a wide breadth of different understandings of the concepts and, as to be expected, these understandings are largely influenced by the context that the debates are taking place in. In order to understand the concept of public data, this paper aims to look at how the topic has been dealt with within one specific country, that of Estonia.

Estonia is widely known as being a leader when it comes to digital government (Kalvet 2012), information and data management, and transparency (Kitsing 2011; Kalvet 2012). Estonia is constantly ranked in the top 10 (for example, see WASEDA IAC ranking [1]) when it comes to e-government, and in the most recent Digital Society and Economy Index (DESI) report from the EU it was placed in second place when it comes to online public service delivery (European Commission 2018). Though Estonia is associated with being a digital government leader, it prides itself on being transparent and making public data easily accessible, and interoperability and data exchange is core to the success of Estonia's digital government, it consistently ranks as one of the worst countries in Europe when it comes to OGD (European Commission 2018). How is it that a country that, on paper, should logically be a leader in OGD consistently offers a lackluster performance? It is this interesting dichotomy that led us to conducting a case study of the OGD landscape in Estonia.

This paper [2] aims to deal with the idea of public data at large, but it will do this through a discussion of open government data. These two terms have been used synonymously in the past, however, there are subtle differences between the two and thus they are defined below:

— Public data: "Public information (hereinafter information) is information which is recorded and documented in any manner and on any medium and which is obtained or

1. See https://www.waseda.jp/top/en-news/53182 accessed 28 October 2018.

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created upon performance of public duties provided by law or legislation issued on the basis thereof" (Riigikogu 2000);

— Open government data: Data that is collected and maintained by the government, machine-readable, human understandable, and licensed for all to use, share, and access (O'Reilly Media 2018).

In essence, *all* OGD is public data, but *not all* public data is OGD. The largest differences are that public data does not necessarily need to be made easily available to the public; it does not have to come in a machine-readable form, and does not need to be licensed for reuse. OGD with its focus on easy access and usability represents an improvement on how public data is disseminated and provides many new ways of creating public value (Janssen *et al.* 2017; Gonzalez-Zapata and Heeks 2015).

The rest of this paper is devoted to exploring the research question: Why is Estonia struggling with providing and maintaining OGD when it appears to be a leader in many other aspects of digital government? Secondly, the paper aims to explore the ongoing process within Estonia to foster the development of OGD availability and use within the country. In order to answer these questions, a single exploratory case study (Yin 2013) has been conducted. In the next section, an overview of the current ongoing scholarly and political discussion on OGD will be provided. After this, there will be a brief overview of our approach to the case study and a description of the Estonian case. Finally, the results of the case will be discussed and reflected upon.

OVERVIEW OF OPEN GOVERNMENT DATA

As mentioned above, OGD is data that is collected and maintained by the government, machine-readable, human understandable, and licensed for all to use, share, and access. Though the idea of open government, public data, and freedom of information are concepts similar to OGD, the phenomenon that is OGD has only truly emerged in the past ten years with the beginning of the Obama presidency in the USA in 2008. Thus, this section aims to provide a brief overview of how OGD came into the spotlight, why it is viewed as important for society and government, and the drivers and barriers associated with the release and usage of OGD.

The concepts of OGD and open government are strongly intertwined; in the US both jumped into the spotlight with President Obama's 2009 memorandum on Transparency and Open Government which stated that government should be transparent, participatory, and collaborative (Obama and White House 2009). This top-down effort to shine a light and open up traditionally internalized governance processes to the public was done in an effort to promote transparency and accountability. Since 1966, the traditional way for exposing and opening up data was through the process of Freedom of Information Act Requests (FOIA); FOIA requests provided a way for interested stakeholders to request information from government authorities that had not yet been made publicly available in the name of transparency (Shepherd, Stevenson, and Flinn 2011). Though this still provided citizens access to data and information, it was widely believed that government could do more in regards to providing citizens access to data. Transparency, accountability, and openness are a core part of any well-functioning democracy, and one way to continue to foster the development of these attributes was to preempt citizens having to ask for access to data and provide all data that could be made public to the citizens in a manner that was easy

to use and access. Of course, not *all* data should be made open, generally exceptions are stringently laid out for data that contains personal information, information related to national security, etc. As noted by Linders (2012), the provision of data in this way seems to be quite logical as the government is the largest collector of data and this collection is paid for by the taxpayers, thus it should be available to a government's citizens.

Though the previously mentioned benefits of increasing transparency and accountability are likely the most discussed benefits of providing access to OGD, they are not the only ones and many other benefits have emerged in the current literature. Other works on the benefits of OGD have noted that OGD may provide the following: improved social participation, innovation, new service creation, improved policy making process, enhanced citizen services, new business models, improved data quality, improved decision making, optimized administrative processes (Janssen, Charalabidis, and Zuiderwijk 2012; Gonzalez-Zapata and Heeks 2015; Burwell *et al.* 2013; Toots *et al.* 2017; Dawes *et al.* 2016; Foulonneau, Martin, and Turki 2014).

Many of these benefits appear to be related, such as driving innovation, the creation of new services, enhancing citizen services, and creation of new business models. In essence, some authors have found that the availability of OGD has allowed for the creation of new and innovative services that are heavily reliant upon OGD. Additionally, others have noted that the availability of OGD actually encourages social participation and enables new ways of creating public services (see, for example: OECD 2016). That is to say, the availability of OGD allows for any stakeholder or actor to take OGD and create a new service that provides public value; OGD seems to act as a catalyst for enabling co-creation (McBride *et al.* 2018). Though often times benefits of OGD appear to be citizen-oriented, there are also many benefits for government agencies. For example, when agencies are required to go over their data and ensure that it is in appropriate form for release, they are forced to evaluate the current status and quality of their data, and also to take note of which data they currently have in their possession. Thus, OGD may often lead to improved data quality within the organizations. In addition to this intra-organizational benefit, OGD may encourage data sharing and communication between organizations, thus providing inter-organizational benefits as well. Finally, OGD may be used to support decision making by proving decision makers access to data that can then be used in the creation of models to augment their decision-making capabilities (see the discussion in McBride *et al.* 2018).

Though there are many benefits associated or expected by increased availability of OGD, Janssen, Charalabidis, and Zuiderwijk 2012 point out that there are also many myths associated with OGD and barriers preventing its usage and uptake. These barriers can generally be divided into two groups, those at the governmental level and those at the citizen level (governmental barriers largely relate to the provision of OGD whereas the citizen level relates to the usage of OGD). On the governmental level, the most commonly cited barriers include lack of technical infrastructure and expertise, poor data quality, security and confidentiality issues, and lack of top-down leadership or prioritization (Conradie and Choenni 2014; Janssen, Charalabidis, and Zuiderwijk 2012; Barry and Bannister 2014; Beno *et al.* 2017; Young and Yan 2017). In order to bypass these issues, authors have suggested ensuring adequate funding is available (Toots *et al.* 2017), top-down leadership/legislation is in place (K. Janssen 2011), and the value of OGD is demonstrated through the creation of real-world applications that create a positive impact or public value (McBride *et al.* 2018). On the citizen level the most commonly cited barriers relate to lack of understanding of the technology behind OGD or of the tools that may be used to analyze the data, lack of time to use or analyze the data, or the data that is available is not clean or of high quality and thus becomes hard to use (Young and Yan 2017; Albano and Reinhard 2014; Martin

et al. 2013; Zuiderwijk *et al.* 2012). It is true that there is generally a higher level of technological competency required when it comes to using and interacting with OGD, but it is possible to begin to bridge this divide by designing OGD portals in a way that encourage or enable users without advanced data analytics skills to easily visualize OGD on the portal and interact with the data in a user friendly manner. In order to deal with the issue of data cleanliness it is important for government agencies to ensure that data they provide is accompanied by the correct metadata and that the data is compliant with said metadata.

RESEARCH METHODOLOGY

Due to Estonia's unique image as a leader in the field of government digitalization and public information access, a case study focusing on the development of the OGD ecosystem here may be considered critical. When provided with an opportunity to study an ongoing phenomenon unique to a certain context, a single holistic case study may be viewed as an appropriate methodology (Yin 2013); furthermore, the research question is highly exploratory in nature and is thus more conducive for exploratory research methodologies, such as a case study.

The unit of analysis for this case is the Estonian OGD ecosystem with the case study aiming to understand the journey that Estonia has undertaken when it comes to making government data available to the public. In order to improve the validity of the case study and allow for triangulation of results, multiple sources of evidence have been utilized. The first source is document analysis. Documents that have been analyzed include existing surveys and indexes on OGD in Estonia such as those conducted and maintained by the European Data Portal (EDP), OECD and the Open Data Barometer. Additionally, Estonian laws and policy documents have been examined such as the 2014 Green Paper on Machine-Readable Public Information, the 2001 Public Information Act , and the 2020 Digital Agenda. Secondly, a survey focusing on the drivers and barriers of OGD usage was conducted among key public sector, private sector, and non-profit stakeholders in Estonia and five other European countries (Belgium, Greece, Ireland, Lithuania, UK) in 2016; the 9 Estonian responses from this survey are included in this case study. Thirdly, the study uses input from seven semi-structured interviews and informal conversations conducted in 2017 and 2018 with key Estonian e-government experts, many of them with long-time insider experience in the public sector. Semi-structured interviews allow for more in-depth information to be gathered that was not immediately clear from the initial document analysis, and also allow for new ideas to be brought up by the interviewees through the conversation that takes place (Runeson *et al.* 2012). Finally, as two of the authors are currently contributing to the government-funded project "Advancing the Use of Open Data" launched at the beginning of 2018, participant observation and ethnographic evidence are utilized to provide additional insights that have not yet been documented in studies.

It must be noted that case studies are often criticized for their level of generalizability; however, as this case is exploratory in nature and it aims to provide information about OGD within one specific context, this issue may be avoided. Secondly, by using multiple sources of evidence, issues with internal validity may be minimized (Yin 2013). Lastly, the authors have tried to minimize possible risks of subjectivity due to personal involvement by comparing their own observations with other sources of evidence and relying on external evidence where possible.

OGD LANDSCAPE IN ESTONIA

Estonia is a small state of 1.3 million people located on the Baltic Sea. Since regaining its independence from the Soviet Union in 1991, the country has rapidly progressed to build up a modern democracy and public administration system (OECD 2011) and become one of the world leaders in digital government (Kitsing 2011), constantly ranking among the top 13 to 20 in the global United Nations (UN) E-government Development Index (United Nations 2018). Estonia is considered to be among the most mature e-governments in the European Union – for example, the 2017 EU eGovernment benchmark (European Commission, 2017) report positioned Estonia among the top 5 performers in Europe across the dimensions of user centricity, transparency, cross-border mobility and usage of key technical enablers (European Commission 2017), while the 2018 Digital Economy and Society Index (DESI) ranked Estonia 2nd in the dimension of provision and use of digital public services (European Commission 2018).

The foundations of Estonian e-government are widely held to rest upon two pillars: the national data exchange layer called the 'X-Road', and the electronic identity (eID), both adopted around 2001-2002 (Kalvet 2012). The X-Road is a data exchange platform interconnecting government information systems and databases. The platform allows government authorities and citizens to securely send and receive information over the internet within the limits of their authority, thus enabling communication within the public sector as well as public service provision to citizens. The Estonian eID is a chipped identity document that enables citizens to authenticate themselves electronically, access e-government (and private) services and digitally sign documents. Thanks to the existence of the eID and the X-Road, the Estonian government has managed to run a virtually paperless government, enable remote internet voting in nationwide election since 2005, put 99% of public services up online with the exception of marriages, divorces and real estate transactions and provide a one stop shop for citizens to access services (Enterprise Estonia 2018) and share and reuse government data in line with the 'once-only' principle to reduce the administrative burden of citizens and businesses (Krimmer *et al.* 2017). According to 2017 data, 78% of Estonians regularly interact with public authorities via the internet, which is far more than the EU average of 49% (Eurostat 2018). Studies also show that user acceptance and satisfaction with public e-services is generally very high (Kalvet, Tiits, and Hinsberg 2013).

Given this background, it may be surprising to not see Estonia among the champions in international open government data rankings. On the contrary, Estonia's results in European and global open data indexes have been modest at best – in the 4th edition of the Open Data Barometer, Estonia ranked 44th among the 114 surveyed countries (World Wide Web Foundation 2017), in the 2017 OECD OURdata index, Estonia ranked 22nd among 32 countries (OECD 2017) and the European Data Portal's 2017 landscaping survey (European Commission 2017) placed Estonia 24th out of the 32 participating European countries, qualifying Estonia as an open data 'follower'.

In order to understand the discrepancy between Estonia's position as a leader in e-government and a follower in OGD, a brief overview of the evolution of OGD in Estonia is in order. The first piece of legislation that mandated public access to government information was adopted in 2000, just nine years into the rebuilding of an independent government. The Public Information Act regulated citizens' right of access to government documents and the government's obligations with regard to responding to citizens' requests of information. However, it was only upon joining the global Open Government

Partnership (OGP) in 2012 that the concept of OGD first emerged in Estonia. Due to the global OGP movement's focus on open data amongst other open government values, Estonia's first OGP Action Plan 2012-2014 contained several goals related to OGD, including the adoption of an open data policy for Estonia in the form of a Green Paper, creation of a government open data repository and launch of pilot projects in the field of OGD. The Green Paper on Publishing Machine-Readable Public Information was adopted in 2014 along with guidelines for data publication for public sector organizations. Soon after that, the national Open Data Portal was launched in 2015. Around the same time, the 2013 revisions to the EU Directive on the re-use of public sector information (the so-called 'PSI Directive') [3] evoked the addition of new OGD-related requirements into the Estonian Public Information Act, including the introduction of the 'open by default' principle and new requirements regarding the machine-readability of public information. These changes were legally enforced in 2016. In the same year, the Estonian Information System Authority (the government agency responsible for managing the state's information system and information security) launched a funding scheme to support the publication and reuse of open government data, financed by the EU Structural Funds. The last two OGP Action Plans make just a few mentions of OGD (setting to publish tax-related data and the Parliament's data as OGD) but the current general e-government strategy Digital Agenda 2020 includes two OGD strategic objectives: 1) "promoting the use and opening up of information gateways (i.e. state portal eesti.ee, open data portal, etc.) for third parties, including internationally, for easy and secure access to data and information"; 2) support to the digitization and dissemination of Estonian cultural heritage as *open data*.

Despite the existence of regulatory requirements, the Green Paper, strategies, guidelines, national *open data* portal and financial support, OGD is still in short supply in Estonia. Although, in many cases, government data can be accessed by the public via web services and applications or official data requests via the X-Road infrastructure, not many public sector organizations consistently publish their data as easily accessible, downloadable, machine-readable and reusable OGD. For example, in summer 2018, the national *open data* portal "opendata.riik.ce" exhibited 89 datasets – this includes links to external repositories that contain many more datasets; however, altogether the number of OGD sets in Estonia may still be counted in hundreds not thousands. Due to limited OGD provision, data reuse also remains low – for instance, the national open data portal currently showcases only 7 applications that make use of the datasets available on the portal.

What, then, have been the reasons for Estonia's poor progress with regard to OGD? A survey of experts and practitioners that we conducted in 2016 revealed that Estonian stakeholders perceive a number of barriers in the open data environment that prevent the publication and re-use of open data. The most important barriers concern the lack of knowledge and awareness of OGD and its benefits, weak political will and lack of perceived value of OGD compared to the costs of releasing OGD. Respondents to our survey pointed to barriers such as "high data integration costs", "lack of resources", "alternative cost", "unclear business case", and suggested that the development of data-driven services may simply not "pay off". According to their answers, resource issues are also important for organizations that have a policy of selling data for a fee, to whom releasing OGD would

3. Directive 2013/37/EU of the European Parliament and of the Council of 26 June 2013 amending Directive 2003/98/EC on the re-use of public sector information.

mean losing a source of revenue. In addition to that, Estonian experts and officials are concerned about data quality and perceive a low demand for OGD, describing Estonia as a "small market" with a "small demand for open data" and suggesting that demand for OGD may be low because of the existence of the national data exchange layer X-Road. Lack of funding, lack of technical know-how, and misaligned organizational priorities were also mentioned as barriers by the interviewees. Additionally, what came out of our interviews with key Estonian ICT experts from both the public and private sector is that Estonian public sector organizations tend to be very critical about releasing data dumps and have thus been reluctant to simply put OGD sets up online – therefore, if OGD is to be provided at all, APIs (application programming interfaces) need to be made available for that purpose.

Comparing the Estonian survey results to the other five surveyed countries we found the barriers to be rather similar, although the relative importance of each barrier may vary in different national contexts. However, one barrier – that of the national data exchange layer – appears to be unique to Estonia. As the Public Information Act and the Government Regulation on Information systems' has recently changed to oblige public sector organizations to use the X-Road for service provision, the X-Road has become the infrastructure that is used for all data exchange within the public sector and between public organizations and citizens on a daily basis. Data exchange via the X-Road is based on data services that have been previously defined by data owners and access to data is based on data usage agreements with the data owner, whereas data formats for queries are also predefined by the particular service. This usually means that a party who wishes to access government data must be an X-Road user, must be identified with an eID, and needs to have authorization to access and use the data. Because of the habit of using the X-Road to meet their data needs and the perceived security of the environment, public sector organizations tend to be reluctant to invest additional resources in publishing OGD on the national portal or other open repositories. Quite often, OGD initiatives arise due to lack of interoperability between government systems or data lying in silos, but, due to Estonia's X-Road interoperability solution, these data silos do not exist and thus one traditional driver of OGD initiatives is not in play within the Estonian context. Therefore, it may be said that one of the key pillars of Estonian e-government, the X-Road, turns out to be a barrier rather than an enabler in the particular context of open data.

This said, our survey also cast some light on positive opportunities that could be drivers of further OGD provision and use in Estonia. The main drivers are seen in making more open government data available and paying attention to data quality, taking stronger measures to enforce existing government policies and the open-by-default principle in the Public Information Act, voicing a stronger demand from the community, continuation of funding for government organizations to open their data, building knowledge about OGD and its social and economic value, developing the data skills of data providers and users, and sharing best practices.

Looking at the most recent developments in Estonia in 2017 and 2018, the tables may indeed have started to turn, likely because of the emergence of an organized civic movement around OGD. At the end of 2017, the Ministry of Economic Affairs and Communications (the government institution responsible for open data policy) launched a public procurement to find an implementing partner for Estonian OGD policy for the period of 2018-2020. The contract was won by Open Knowledge Estonia (OK-EE), a community-led non-governmental organization established in 2016 to advance open knowledge and open data in Estonia. OK-EE's contractual obligations now involve a wide range of activities related to OGD, including the administration and development of the national open data portal,

awareness-raising activities, organization of events for public sector data holders and re-users, data collection for international open data surveys on behalf of the Estonian government, participation in international working groups, revival of the work of the national public sector working group on open data and development of policy recommendations to the government. Estonia is thus in an interesting situation where the bulk of OGD-related activities have been outsourced to a non-governmental community organization for the next 3 years with high expectations to the results. However, this runs against a commonly held belief that OGD initiatives are only successful if they come via top-down approaches and thus the results will have interesting scholarly implications (Goldstein 2013).

Given the current state of affairs and the small size of the open data community in Estonia, the goals of the project are rather ambitious: to improve Estonia's position in all international OGD rankings, increase visits to the open data portal from 800 monthly users to 2000 users by 2020, publish at least 20 new datasets on the portal each year (at the start of the contract there were 70), publish at least 5 new OGD-driven services and applications on the portal each year (at the start of the contract there were 4 in total), create a Facebook account for awareness-raising with at least 1000 followers, etc. Some movement towards these goals has already happened – in half a year, the average number of users per month has increased to 1700, the number of datasets in the portal has more than doubled to 145, three new OGD-driven applications have been added to the portal and the portal will soon change to a new and better platform. Open Knowledge Estonia has also managed to reconvene the public sector open data working group and initiate a dialogue between public sector data providers and citizens interested in OGD in a dedicated Github repository. Whether these developments turn out to be sustainable and result in improved OGD rankings remains to be seen.

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Estonia presents an interesting case of a country that has made rapid advances in developing most dimensions of e-government but keeps lagging behind other countries in terms of open government data maturity. Our brief exploration of the OGD landscape in Estonia suggests that a number of barriers and impediments still exist in the Estonian OGD ecosystem that need to be overcome, most notably lack of understanding of OGD, low political priority and top-down leadership, resource constraints, concerns about data quality, the perception of the Estonian re-users' community as too small a market for OGD and the preference for using the national data exchange layer to releasing government data. Many of these barriers resonate with what has been found in the government data literature. However, what is interesting is the effect of technical infrastructures on OGD development in Estonia – whereas commonly the problem is in the lack of a proper technical infrastructure for data sharing, then in the case of Estonia it is precisely the existence of a data sharing infrastructure that works as an impediment against OGD because of its different logic of operation.

Looking at the barriers to OGD in Estonia, the role of political priority stands out. Political interest has been cited as one of the key factors of Estonian e-government success (OECD 2015) as well as a factor explaining Estonia's somewhat poorer performance in certain e-government domains such as e-participation (Toots, Kalvet, and Krimmer 2016). Previous works have noted that in Estonia, political support has been higher to those areas of e-government where the expected gains have coincided with politicians' goals

to build a lean government and efficient bureaucracy; this has most clearly been the case with e-services (Kitsing 2011). This observation may also explain why OGD has not yet gained real momentum in Estonia – it is foremost conceived as a tool for transparency and openness towards the citizenry instead of something that could be easily applied to increase government efficiency or generate savings. What is interesting, and has been pointed out by a majority of the interviewees and in our survey is that OGD is viewed as important and a necessary step for improving Estonia's institutions (some ministries even have OGD as a pillar in their mission statements such as the Ministry for Education and Research), yet due to either technical or resource restrictions it has not yet been possible to act on this apparent importance of OGD.

However, what is also becoming evident in the case of Estonia is that in a situation where political interest has been lacking, private actors and civil society can constitute the necessary driver to spur OGD development and provide the leadership and capacity that may be missing in the public sector. On the one hand side, the government's decision to delegate the implementation of OGD policies to a community organization that was founded barely two years ago can indeed be seen as a positive opportunity, a sign of trust and a case of government-citizen co-creation. However, it also raises the question of the government's responsibility for advancing the field and the sustainability of the outcomes. Based on what has been learned about the role of political will in e-government development, a true OGD revolution will likely not happen unless public sector leaders start seeing OGD as a benefit rather than a burden.

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Publication IV

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Open Data as Enabler of Public Service Co-creation: Exploring the Drivers and Barriers

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***Abstract*—Open data is being increasingly looked at as a major driver of public service innovation. Open access to datasets and advanced analytical tools are believed to generate valuable new knowledge that can be turned into data-driven services. At the same time, open data is also believed to spur open governance and enable the engagement of various stakeholders in the co-creation of services. Despite this appealing vision of open data-driven co-creation of public services, we are far from understanding how it can be realized in practice. We turned to 63 experts and practitioners in a survey covering six European countries and found a multitude of barriers that need to be overcome first. Luckily we also found some drivers. This paper provides some first insights into these drivers and barriers and proposes policy recommendations to foster a data-driven transformation of public service creation.**

Keywords - open data, public service, co-creation, co-production, drivers and barriers

I. INTRODUCTION

Open data is no longer new to the topic of e-government research and practice. That being said, one area in which open data's full potential and limitations are being overlooked lies within the idea of service co-creation. There is a vision of open data revolutionizing service creation in the public (and private) sector [1], some studies even speak about a new generation of "open e-government services" [2], but not much is known about what preconditions need to be there for that revolution to actually happen. This paper aims to provide an initial contribution to fill the gap in understanding the relationship between service co-creation and open data, with a focus on public services.

According to a widely used definition, open government data refers to the idea that public sector data should be available in a convenient (ideally machine-readable) form, freely accessible, reusable, and redistributable by everyone [3]. Although the private sector can also make its data open, the existence of large quantities of data in government databases makes the public sector a key provider of open data. The availability of open data is important as it is believed to facilitate the linking and reuse of data for the creation of new data-driven services [4]. However, in practice, various sociotechnical barriers are associated with the supply and use of open data. Such impediments have to do with availability, ease of access, usability, quality, compatibility, interaction between data providers and users, and many other factors [5].

The concept of open data is also strongly intertwined with the idea of open government, i.e. opening up government processes, documents and data for public scrutiny and involvement [6], which in turn is closely linked to the concepts of transparency and accountability [7]. The word 'involvement' deserves a special emphasis here since the core idea of open government is not only that the government should be transparent but that it should also act as an open system that interacts with its environment and actively seeks feedback to improve its work [8]. The development of the open government paradigm has thus led to the idea that open data should not only be used to inform and serve society but also stimulate the active participation of societal actors in public policy making and creation of services for the public value.

This thinking bears many resemblances to the idea of service co-creation and co-production[1]. The concepts have been around for a couple of decades [9], but are seeing a revival in the context of open government and the development of ICT-enabled platforms for government-citizen interaction. Whereas traditionally public services have been initiated, designed, and delivered by public administrators, with citizens at the receiving end [10], the idea of co-creation or co-production suggests that citizens and other stakeholders should participate in the planning and provision of public services. According to this logic, public services are no longer simply something delivered by public agencies but instead a process of co-creation with users and communities [11]. However, much like open data, the success of co-creation depends on various drivers and barriers that arise from its complex context. Some are related to the individuals who take part in co-creation initiatives, some to organizational processes in public sector organizations, others to resources, culture and attitudes (see, for example, [11] and [12]).

[1] The terms "co-production" and "co-creation" are often used synonymously to refer to the participation of users and stakeholders in the design and delivery of public services. While there are slight differences in their meaning (see also Section III.B), we treat them interchangeably in this paper.

Although a number of previous studies have explored the drivers and barriers of open data (e.g. [5], [8], [13], [14]) and co-creation (e.g. [11], [12], [15]) separately, there is a gap in our understanding of the specific factors that matter in settings where the two concepts overlap. We argue that if governments want to seize the potential of open data in public service co-creation, a better empirical understanding of this phenomenon is needed. This paper seeks to contribute to improved knowledge of the drivers and barriers, while also discussing possible policy solutions to some of the biggest hurdles. Having had the opportunity to collect empirical data from experts and practitioners in six European countries, we are hereby sharing our first insights into the issue.

The paper is divided into three main parts. In Section II we explain the methodology of the study. Section III looks at existing studies of drivers and barriers and gives an overview of the survey results. In Section IV we discuss the implications of our findings and make some policy recommendations.

II. METHODOLOGY

This paper presents the initial results of an ongoing study of open data-driven co-creation, undertaken in the framework of OpenGovIntelligence, a European research and innovation project[2]. This initiative aims to explore the ways in which open data can be used for the co-creation of public services by building theoretical and empirical knowledge of the topic and testing some promising approaches in real-life pilots. The pilots are being conducted in six European countries – Belgium, Estonia, Greece, Ireland, Lithuania and the UK. In addition to their differences in terms of the overall political system and public administration tradition, these countries also differ in their existing government data exchange systems and level of open data maturity, involving early adopters (the UK most notably) as well as laggards (e.g. Estonia or Lithuania). This provided us an opportunity to study open data-driven co-creation in six different contexts and engage experts and practitioners in these countries in an exploration of the related drivers and barriers.

The first step of the research that was undertaken was a literature review in March-May 2016. We consulted literature on the topics of open data, data-driven services, public service co-production and co-creation, public sector innovation, and the related drivers and barriers. The aim of the literature review was to understand the way in which these concepts have been defined and addressed in literature, and develop the framework for the subsequent survey. The review included academic articles from databases such as Scopus/Elsevier, Springer and Google Scholar, and to a lesser extent relevant working papers and policy reports (mostly published by the European Commission and OECD). Most of the publications found dated from 1995-2016. Among these publications, a further selection was made based on relevance to our research, leaving altogether 91 academic and policy reports which were looked at more thoroughly.

The literature review was followed by a web-based survey in May-June 2016 with the aim to study the particular drivers and barriers that are relevant for open data-driven co-creation – as our literature review showed, the drivers and barriers in this specific context had not been thoroughly discussed in previous studies. An additional aim was to understand the importance of country context for the drivers and barriers. The survey involved civil servants, entrepreneurs, private sector employees, civil society and research actors from the six pilot countries. This mix of public and private actors allowed us to probe both the public sector and user side of data-driven co-creation. The invitees were hand-picked with the assistance of the project partners in the respective countries who had knowledge of experts and practitioners with some degree of expertise and experience related to open data and/or co-creation.

The survey yielded 63 responses, including 34 public administration representatives and 29 non-governmental actors from all six countries, with the highest number of respondents (16) from Greece and lowest (8) in Lithuania. 22 respondents represented the central or federal government level, 7 represented regional government and 4 local government. 15 respondents were from private companies, 7 represented non-governmental and civil society organizations, while 8 represented universities and other research institutions.

The survey included 11 questions, mostly open-ended. Respondents were first asked to describe their previous experience with using open data and taking part in public service co-creation. They were then asked to outline the key drivers and barriers to the use of open data for service co-creation based on their experience, point to missing capacities and needs with regard to opening up data or engaging in open data-driven service co-creation. The next questions asked respondents to give examples of successful and unsuccessful policy initiatives that have been implemented to encourage the reuse or supply of open data, and propose ideas for missing policies in the field. For the purpose of the survey, open data was defined along the lines of the definition proposed by the Open Knowledge Foundation as data that is presented in a machine-readable format that can be freely used, re-used and redistributed by anyone. For co-creation, we adopted a rather broad definition – the direct involvement of individual users, groups of citizens and other stakeholders in the planning and delivery of public services – to cover the whole array of possible forms of stakeholder participation in public service creation, from initiation to implementation.

[2] OpenGovIntelligence ("Fostering Innovation and Creativity in Europe through Public Administration Modernization towards Supplying and Exploiting Linked Open Statistical Data") is a research and innovation action funded from the EU's Horizon 2020 program under grant agreement no 693849. The project aims to modernize public administration by connecting it to civil society through the innovative application of linked open statistical data and service co-production. The project is implemented by 12 partners in seven countries. More information is available at http://www.opengovintelligence.eu/.

Our research approach, understandably, has its limitations. As the literature review was conducted with the purpose of generating background knowledge for the next steps of the study, the overview presented in this paper by no means intends to provide a comprehensive description of what is out there. Instead, it contains selected pieces of information that we have considered important in the context of drivers and barriers for open data and co-creation. Similarly, the aim of our survey was not to provide an exhaustive list of key drivers and barriers. Rather, the paper gives a good overview of the issues raised by selected experts and practitioners, which helps us identify areas that deserve further research.

III. OPEN DATA-ENABLED PUBLIC SERVICE CO-CREATION: DRIVERS AND BARRIERS

A. Drivers and barriers in literature

1) Drivers and barriers to open data

Open data has been part of the policy agenda for more than a decade now but is still relatively young as a research field [16]. According to a review published in 2014 [16], most research in this field involves conceptual papers, empirical case studies, and descriptions of technological solutions, with little systematic and theoretical research on the drivers and barriers to open data. A poor understanding of the barriers is a problem as it can lead to 'myths' about the ways in which the benefits of open data can be realized in practice [8]. Therefore, there has recently been an increase in research discussing barriers to open data. Apparently the impediments are manifold and are related to the availability of data, ease of access, usability, quality, compatibility, interaction between data providers and users, and many other factors [5].

It is interesting to note that when examining the drivers and barriers directly related to open data, drivers tend to come from forces external to the government whereas barriers tend to come from within the government [17]. For example, some of the major drivers which were identified by Huijboom and Broek [17] relate to "citizen pressure, market initiatives, emerging technologies and the ideas of thought leaders". This directly relates to drivers which were discussed by Gonzalez-Zapata and Heeks [18]: "economic value through new products, services, revenue, profits and jobs; better governance through increased transparency, accountability, participation, and empowerment; improved government data infrastructure; improvements in public services". Though many drivers come from external forces, one of the primary internal driving motivators is the Public Sector Information Directive which has played a major role in driving open government data policies in many European Union countries [19].

Within the literature there are many barriers which are consistently cited, and as previously mentioned, these often times lie internally within the government. In this paragraph we will briefly discuss barriers related to open data and open data policies which have been outlined in previous works. The first barrier, which is consistently discussed by government agents in opposition to open data, is the unpredictable nature of their government's support for this sphere, and the lack of political communication between providers and re-users of open data [13, 14]. This lack of political enthusiasm may lead to a low priority being given to open data based public sector innovation policies, which would then lead to legislative barriers. These barriers arise from the ambiguity or lack of regulatory open data policies which convolutes the understanding of open data sets, challenges the flow of data from government agencies to other actors, and leaves agencies feeling no incentive to publish their data [20]. However, even if these legislative barriers were not present, civil servants may expect to find guidance in the form of strategies; so if these strategies do not exist it may act as a major barrier for open government data [21]. A barrier, which is not strictly related to internal government forces, is the role of privacy and security in relation to open data. Many actors may feel that there need to be well-defined barriers between public and private information or that open data automatically will lead to a breach in privacy [17, 22]. So, information security, confidentiality, and right to privacy also act as major barriers for widespread adoption of open data strategies and policies.

Though a majority of work relates to government barriers, some works have been carried out in relation to barriers from the user perspective. For example, Zuiderwijk et al. [5] find that usability of open data, misinformation, and unfriendly user interfaces pose significant barriers to the adoption and usage of open government data by non-government actors. Johnson [23] also discusses barriers which users may face in relation to open government data and identifies that a lack of a user perspective vision, ability to access the data, and ability to understand the data all act as major barriers.

2) Drivers and barriers to co-creation

A collaborative approach to public service production has emerged as an important way to innovate public services that have traditionally been provided by public administrations in a top-down manner. The engagement of users in the service production process is seen to increase the efficiency and effectiveness of services by aligning services to users' needs and expectations. It is also seen as a way of fostering an open and transparent government [24]. There is a whole stream of literature on 'co-production' and 'co-creation' that has emerged from public management and service management research which study the participation of users and stakeholders in public service creation [9]. It might be important to note that the lines between the concepts of co-production and co-creation are unclear and the terms are often used interchangeably. The only slight difference is that co-creation is more often associated with creating value for service users and the public [9, 12].

In principle, co-creation with users can happen in any stage of the public service production, from co-design and co-decision to co-implementation and co-evaluation [25]. The emergence of open data can be seen as an important enabler for co-creation: access to data and some analytical skills easily allow citizens to take the role of explorers who discover problems and needs,

idea-generators and co-initiators of solutions, co-designers of services, or co-implementers and diffusers of service innovations (see [26] for a more detailed discussion of data-driven co-creation).

However, a collaborative model of service creation is not particularly easy to implement in real life. A number of barriers prevent co-creation from becoming a widespread practice. Some of them emanate from the organizational context of public sector organizations, including: organizational structures and processes that are incompatible with the process of co-creation, lack of open attitude to citizen participation, risk aversion characteristic to the public sector [12], lack of willingness to change, administrators' fears of losing status and control, lack of necessary skills (e.g. knowledge of effective participation methods, facilitation skills), lack of funding for the whole array of activities that may be needed for effective co-production, and simply low perceived value of co-production [15] to name but some. Other drivers and barriers are related to the user/citizen side. These include, for example: the internal motivation of participants [27], personal characteristics and values, awareness of participation opportunities, participation skills, perceived capacity to participate in co-creation initiatives, perceived responsibility for improving public services, social capital, trust in the co-creation initiative [12], relative importance given to the service that is being co-produced, money, time and other resources [28], ease of participation [11], etc.

As one of the key factors, existing research underlines the importance of collaboration willingness and mutual trust between government and citizens [29, 30]. The importance of attitudes, trust and (clashing) interests as a factor affecting participation and collaboration has not only been discussed in relation to service co-creation but citizen participation in general (see, for example, [31] and [32]). At the same time, studies have also found that if citizens are given the opportunity to participate and reassurance that their input is taken seriously, people will want to get involved [33]. One of the key challenges that this shift to collaborative models poses to the public sector is the need to redefine the traditional roles of public and private actors in the policy process. Collaborative innovation in the public sector requires politicians to cease seeing themselves as all-powerful providers and instead become agenda-setters through dialogue with a number of actors. This makes public managers the ones responsible for collecting innovative ideas and managing collaborative arenas, rather than sole experts. Thus, it requires private companies and civil society organizations to become partners in pursuing public value through creating innovative solutions, viewing citizens as co-creators rather than clients or customers [34]. These perceptions, as noted in [34], are difficult (though not impossible) to change. Moreover, successful co-creation also requires a deep transformation of organizational processes in the public sector and the processes whereby public services are produced. There is ample evidence in literature of the complexity of organizational change – the implementation of new processes in organizations occurs in multiple steps, takes considerable time, and is likely to involve mistakes that further slow the process of change [35].

B. Survey results

Not surprisingly, our empirical study largely confirmed the drivers and barriers mentioned in literature. Whereas the literature looks at open data and co-creation as two distinct phenomena, our study provides insights into the particular challenges that come out of the complexity of data-driven co-creation. Table 1 presents an overview of the drivers and barriers that were mentioned most often by the survey respondents within the study[3]. These drivers and barriers were further broken down into four categorizations: Data and technology, Stakeholders, Organizations, and Legislation and policies. It is also important to stress that often times a given driver is the opposite of the given barrier. For example, B.DT1 and D.DT1 show "availability of open data", in this situation a lack of access to open data acts as a barrier for data driven service co-creation, whereas having access to open data acts as a driver for data driven service co-creation. This interesting pattern was seen repeatedly in the survey results. In the following sections, a more detailed overview of the drivers and barriers will be presented by providing insight into each categorization.

[3] The drivers and barriers have also been coded so that they are able to be referred to individually in the rest of the paper; this will allow for more substance to be given to arguments and policy recommendations made

TABLE I. OVERVIEW OF DRIVERS AND BARRIERS FROM SURVEY.

Barriers	Drivers
Data and technology	
B.DT1 – Lack of availability of open data	D.DT1 - Availability of open data
B.DT2 - Lack of data quality, fragmentation of datasets	D.DT2 - Provision of high-quality easy-to-use datasets, provision of datasets of key importance
B.DT3 - Messy data formats and lack of metadata	D.DT3 - Harmonization of data and metadata
B.DT4 - Missing infrastructure to support open data	D.DT4 - Open Data Portal
Stakeholders (perceptions, attitudes, culture)	
B.S1 - Political environment	D.S1 - Citizen demand and visionary policy-makers
B.S2 – Lack of awareness of open data and benefits	D.S2 - Awareness of open data and benefits
B.S3 - Technological skillset missing	D.S3 - Training and skills development
B.S4 - Requires trust and participation	D.S4 - Participation
Organizations	
B.O1 - Existing business models	D.O1 - Development of new business models
B.O2 - Missing innovation orientation in public sector	D.O2 - Presence of innovative orientation in public sector
B.O3 - Incompatible organizational processes	D.O3 - New organizational processes required
Legislation and policies	
B.LP1 – Legislation on data sharing and licenses	D.LP1 - Legislation on data sharing and licenses
B.LP2 - Limited legal obligation to publish open government data	D.LP2 - Strengthening legal obligations to publish government data as open data by default
B.LP3 - Privacy and security concerns	D.LP3 - Increases transparency and accountability

Source: Authors

1) Challenges and barriers

a) Data and Technology Barriers

The use and provision of open data is inherently technical, due to this technology-related factors were quite often cited as barriers for data driven service co-creation. The overarching technological barriers are presented in Table 1 as B.DT1–4. These barriers also represent a classification of smaller barriers, for example, underneath B.DT3 barriers such as missing values, lack of metadata, encoding issues, and outdated data could all be included. What these barriers lead to in practice, according to survey respondents, is data sets being published which are unusable, have low value, are not machine-readable, are not understandable by humans, or are highly fragmented. Thus, these technological barriers can lead to a situation where data is being released, but it can simply not be used to assist in driving the co-creation of new services.

b) Stakeholder Barriers

The second categorization of barriers is related to the beliefs and behavior of different public and private stakeholders, such as policy-makers, data providers and users, service providers and users, as well as other groups involved with the co-creation of new services. One of the most commonly mentioned barriers was B.S2, a lack of awareness of open data and its benefits. In essence, many respondents noted that others did not know what open data was, did not have a clear concept of how it could be used, or were unaware of the benefits which open data provides to data driven service co-creation. This, in turn, leads to B.S1 where due to the perceived lack of benefits a lack of political support for open data service co-creation occurs; it follows that this further leads back to B.DT1 – a lack of availability of open data. As mentioned previously, open data and data driven service co-creation requires a technological skillset and this skillset is not often present. Furthermore, the survey respondents frequently noted that due to a lack of technological knowhow open data could not be used for service co-creation. In regards to the co-creation aspect of data driven service co-creation the most common barrier was B.S4, essentially what survey respondents articulated was that co-creation requires participation, participation means time, and many were hesitant to offer their time. This argument is also heard, though in a slightly different format, as service users believing that the government is

the service provider and therefore if the government is asking for citizen input and participation it means the government is failing in its duties a service provider.

c) Organizational Barriers

The third categorization that emerged from the survey results is related to organizational barriers. One of the biggest barriers within this section is B.O3 – the incompatible organizational processes. Examples of barriers which may fall underneath this are: reluctance to release data due to confidentiality procedures, incompatible routines and processes, lack of feedback loops, resistance from the public sector to change, lack of trust, lack of political priority, and inadequate resources. Another significant barrier is B.02, when there was a missing or lack of orientation towards innovation within the public sector organizations were less likely to become involved or get behind the idea of open data. In many cases, a broader use of open data is hindered by existing proprietary business models that are based on selling key data (B.01) – by making data open, a number of organizations would lose an important source of revenue. Moreover, regardless of the business model, publishing open data is associated with high costs, which are often seen to exceed the foreseeable benefits. However, even more importance is given to the perceived incompatibility of existing administrative procedures and organizational practices with co-creation and collaboration. Co-creation requires the transformation of public sector processes to allow government to receive and react to feedback from citizens, which public sector organizations are so far not used to.

d) Legislation and Policy Barriers

Several respondents mentioned legal issues as a barrier, in particular existing legislation related to sharing and licenses (B.LP1). Interestingly, legislation-related barriers seem to involve two types of factors – those that arise from the actual legislative provisions, and those that have to do with the way the existing legislation is perceived and interpreted. Several respondents referred to "privacy and security concerns" in relation to legal barriers and some explicitly mentioned "misunderstandings" about privacy and identity-related information. This implies that any attempt to overcome these barriers should not only be limited to reviewing the legislation in force but also involve raising public awareness of what the law actually means.

2) Enablers and drivers

a) Data and Technology Drivers

As was mentioned previously, many of the drivers related to data driven co-creation are the reciprocal of a given barrier. What was made known through the study was that, of course, having access to high quality open-data (D.DT1, D.DT2) with the proper metadata and standards in place (D.DT3) was a major driver. What was noted was that when these drivers were in place it also often meant that an open data portal existed, which was actively maintained and contained data which was usable to end users. If usable data was present, it allowed for third parties to take the lead in initiating new services bottom-up, even if the government itself is unwilling or unable to create these services. Respondents also highlighted the importance of building and disseminating concrete applications to demonstrate open data solutions, facilitate data analysis and enable easy visualization and exploitation of the data.

b) Stakeholder Drivers

Many of the enabling factors for data driven service co-creation were associated with stakeholders' attitudes, actions and mutual interaction. A major precondition for any open data innovation seems to be that different kinds of stakeholders perceive open data as valuable in the first place (D.S2). Some of the key benefits that were mentioned as driving open data innovation include the perceived ability of open data to support administrative efficiency and automation of organizational processes, improve access to information and enhance evidence-based policy-making. With regard to policy-making, open data is seen to facilitate the creation of services that answer real needs and generate genuine public value. Important benefits were also associated with open government goals, as open data is seen as a way to increase government transparency and citizen participation (D.S4). Lastly, open data is believed to create economic opportunities by enabling the creation of cheaper and simpler web applications and commercialized solutions driven by the private sector. Here, the role of the demand side should not be underestimated – the survey revealed that a clear demand for open data from the private sector, individual users and the broader community could be an important driver that can pressure the public sector to publish open data (D.S1). In fact, the role of individual people, their beliefs and behavior was among the most frequently mentioned drivers in the survey. Visionary policy-makers and administrators are considered a powerful force driving the exploitation of open data, regardless of the country context (D.S1). However, in addition to vision and good will, knowledge and skills are believed to matter a great deal – any innovative reuse of open data requires digital and analytical skills, which according to the respondents remain scarce so far.

c) Organizational Drivers

Based on the survey, key drivers at the organizational level concern, above all, strong innovation leadership and capable change management (D.02). Administrations and organizations which give open data and open innovation a high political priority, and have sufficient buy-in among senior staff, are also the leaders of data-driven co-creation. This may be reinforced by the existence of relevant capacities in the organization – management skills, digital literacy, skills of data management and collaborative innovation. In addition to that, the survey brought out the importance of resources and funding, including the need

to develop new business models that make creative use of open data (D.01). As existing business models were often cited as an important barrier to open data innovation, any progress in this respect indeed requires organizations to reorganize their resources and rethink their business strategies. It is interesting to note that variables related to organizational processes were only mentioned among barriers and not drivers; thus, it leads to the assumption that existing routines and practices in public sector organizations may be understood as being incompatible with innovation in regards to data driven service co-creation. This suggests that an enabling organizational context is one of the critical preconditions for successful open data-driven co-creation (D.03). However, due to the complexity of organizational change, this is clearly one of the areas where quick changes are unlikely to occur.

d) Legislation and Policy Drivers

Lastly, enabling legislation, policies, government strategies and initiatives were considered important drivers by the majority of respondents. Such drivers include legislation on the provision of government information and data, legal obligations to publish open data, open standards policy, open data action plans, European open data policy and many others. Some also mentioned the importance of a broader openness and transparency agenda and benchmarks with other countries as a measure to foster open data policies. The availability of funding schemes for the release and innovative reuse of open data was seen as an additional driver, whereas many cited the dissemination of best practices and real use cases as a way to inspire and give guidance to other administrations and organizations. In fact, regulations and policies constitute a particularly interesting group of drivers. Not only are they seen to hold a considerable potential to drive open data innovation, they are also something that – unlike beliefs, habits and administrative routines – are easier to change. Therefore, a couple of successful examples highlighted by the survey respondents will be given a closer look in the next paragraphs.

Two good examples that were frequently mentioned have a supranational or cross-border character. One of them is the European open data policy, in particular the Directive on the re-use of public sector information (known as the "PSI Directive") and the Directive establishing an Infrastructure for Spatial Information in the European Community (the "INSPIRE Directive"). European Open Data Portal was also outlined as a valuable initiative for open data publishers and users. The European Union's approach is believed to be successful because of its comprehensive and strategic nature: the PSI Directive imposes an obligation to Member States to publish public sector information as open data by default, while the open data portal creates a supportive technical infrastructure. This general approach has been supported by initiatives in particular policy fields that have helped release and harmonize key datasets, pilot new solutions and share best practices. Such areas are, for example environmental information, marine data and cultural heritage. The EU is also making efforts to enhance data interoperability and data protection through new technical and regulatory measures, which promise to further stimulate the reuse of open data.

The other international example is the global Open Government Partnership (OGP), launched in 2011, which many see as an important trigger for national-level policies on open data and open government. The value of OGP is seen in its global scope as it allows to compare the status of countries and share best practices with a number of other countries that have joined the partnership. In discussing the success factors of OGP and the EU policies, survey participants noted that both have been top-down driven initiatives that have been backed by strong political will. We believe this should give some food for thought also for policy-makers at the national level.

The survey also highlighted several national-level policies as success stories that could set an inspiring example to others. One that repeatedly came up was the UK open data policy, including the Information Principles for the UK Public Sector (2011) and Open Data White Paper (2012), which are seen to have successfully driven the publication of open data by the public sector. The UK has also made efforts to promote open data publication among local governments. Examples of this are the local government transparency code and local government open data incentive scheme. The survey participants from the UK saw the latter as a good way to encourage local authorities to publish open data as it provided standardized schemas for certain datasets and financially rewarded the effort of publishing open data.

In the study, the Greek Transparency Program ("Diavgeia") was mentioned several times, reconfirming it as an important national-level example. The program requires all government institutions to publish their acts and decisions in a public online portal since 2010. Following an update in 2013, no regulation or decision can enter into force unless published online. The Transparency Program is reportedly the largest horizontal action throughout the Greek public sector, and is perceived to be successful because it is at once "practical and visionary", combining regulatory measures with technical solutions and giving birth to a whole surrounding ecosystem of smaller applications. The Greek respondents also praised a user-friendly search interface (although some noted the actual usage level has remained below their expectations). Last but most importantly, the success of the Transparency Program is associated with its importance to citizens – as transparency is seen as a serious problem in the Greek public administration, the program directly addressed a demand from the broader community.

All of these successful policy measures seem to have some common features. First, they have a clear focus and ambition, and a strategic, systematic and comprehensive approach. Policies that have combined regulatory actions (obligation to publish) with technical solutions (portals) and financial incentives seem to be held in particularly high esteem. Secondly, successful initiatives have often been driven top-down at the highest political level. Thirdly, these policies have demonstrated clear value for citizens and governments – they have been executed in a user-centric manner, addressed topics that are important to citizens, enabled the publication of datasets that are relevant for users, demonstrated the added value of open data, reduced transaction costs for data publishers and users, provided good interfaces, and in many cases been backed up by consistent communication.

Lastly, in the case of international initiatives, the element of best practice sharing and promoting competition has also worked well in driving open data innovation in individual countries.

Although the survey yielded a long list of good examples, the full potential of policy drivers still needs to be unlocked. For example, although the survey respondents were generally happy with the European open data policy, they insisted that much more could be done to enforce the directive at the national level. Some even suggested the directive should be updated to pressure states to make all government information public free of charge. It should also be noted that policies might effectively address the barriers related to open data but none of them has a direct effect on problems related to co-creation and the involvement of citizens. As our study suggests, successful co-creation is mostly a matter of attitudes, behavior, and supportive organizational processes. This area is therefore likely to require fundamental organizational and cultural transformations which are more difficult to achieve through policy measures.

IV. CONCLUSIONS AND POLICY RECOMMENDATIONS

The aim of our study was to explore the phenomenon of open data-enabled co-creation as a new model which is believed to transform the way public services are produced. As existing literature allowed us to assume, high barriers are associated with both open data and co-creation. Our empirical survey indeed reconfirmed the importance of the barriers frequently cited in literature. However, it also gave us a deeper understanding of the complexity of this model – it seems that in situations where both open data and co-creation are at play, the barriers related to both add up. Somewhat surprisingly, our results also suggest that country context matters less than might be expected. The barriers and drivers seem to be very similar in countries with more advanced open data ecosystems and in those that are only beginning to discover open data (except for the supply of open data, which is understandably a bigger problem for latecomers). Nonetheless, the way things currently stand, open data-driven co-creation is not (yet) the revolution we hoped it would be – it is rather a complication of things that are already complicated.

Regarding individual barriers, the availability of relevant, good-quality and easily usable open data is the number one hurdle that should be addressed in order to make data-driven service creation possible. However, data is not a sufficient driver on its own. What seems to be necessary is that the publication of open data goes hand in hand with increased awareness of open data and a full recognition of its many benefits. As long as the value and potential uses of open data are poorly understood, there seems to be a vicious circle of governments not releasing data and citizens not demanding it. At the same time, there is a burning need to enhance data-related skills among data providers and users. Such skills include general digital literacy as well as specific knowledge about data formats and standards, appropriate licenses, data protection requirements, tools for analysis and visualization, etc. A shared understanding of the value of open data together with relevant skills seems to be a winning combination that can trigger further changes and remove other hurdles on the way.

Similar awareness and skills are also needed for co-creation. The existing culture, attitudes and practices in public sector organizations do not exactly support the engagement of citizens, businesses and other stakeholders in the creation of public services. Any change in the service creation process first requires all stakeholders to see clear value in co-creation and to have the skills for engagement, participation and collaborative service design. At the same time, skeptical or even hostile attitudes are not easily replaced by openness and trust. It is likely that data-driven co-creation is only possible in contexts where a certain level of trust already exists between different stakeholders and where public administrators believe that good things can come of unknown sources. As our survey demonstrated, the willingness to give up control can yield benefits for all – even if the government is reluctant to initiate new projects of service co-creation, it might even be helpful to just make the first step and release government information as open data. This allows non-governmental parties to take the lead in initiating new services bottom-up and possibly create new successful business models that public sector organizations themselves could adopt.

As the study implies, many of the drivers and barriers are closely interrelated. The supply of open data depends on its perceived value, whereas the perception of value depends on awareness of the benefits of open data. A key instrument in building such awareness is believed to be the sharing of best practices and successful models. This therefore promises to be one of the most effective measures that can be taken to drive open data innovation. On the other hand, a similar chain of relationships can also be observed for co-creation. The starting point for organizational changes and new processes is the perceived value of co-creation, which in turn depends on prior awareness and knowledge of its benefits. Here, too, best practice sharing is seen as an important means to improve awareness. If this is supported by conscious efforts in building relevant skills and capacities, we have a combination of drivers that is likely to create a favorable environment for open data-enabled co-creation.

Another pleasing finding is that regulations and policy instruments can also act as a powerful driver, in particular at the supply side of open data. As existing successful examples suggest, this potential should be used much more actively, in particular at the national level. This does not only mean the creation of new policy instruments but also the enforcement and reinforcement of existing ones such as the PSI Directive. Furthermore, our study points to the importance of devising a comprehensive and strategic policy agenda that includes strict regulatory measures as well as softer coordination initiatives and instruments for technical and financial support. Such a holistic approach has been proven to create a more favourable environment for the provision of open data by addressing several important barriers at once.

In light of these observations, we suggest public administrations to take an active role in unlocking the potential of data-driven co-creation by addressing the barriers preventing this potential. The recommendations which follow will refer back to Table 1 and attempt to address each barrier which was presented.

1. Make open data a clear political priority. Our study highlighted the power of political leadership and visionary policy-makers in driving positive changes top down. **Barrier addressed:** B.S1
2. Take a comprehensive, systematic and strategic political approach to open data and open government. This includes making open data part of a broader openness and transparency policy, integrating the technological state of the art and emerging trends, combining regulatory measures with technical infrastructures (e.g. open data portals), hands-on guidelines, dissemination of best practices, and funding schemes to support the publication of open data. **Barriers addressed:** B.DT4, B.S1, B.S2, B.02, B.03, B.LP1, B.LP2.
3. Publish key datasets as open data. The study revealed a demand for government datasets that non-governmental actors could use to initiate their own services. Data of particular value to re-users are, for example, datasets with large geographical relevance. These datasets should be provided in ready-to-use formats to make them easy to analyze and link to other datasets. **Barriers addressed:** B.DT1, B.DT2, B.DT3
4. Review data licensing and copyright regulations to ensure their compatibility with open data goals, public interest and new business models. This includes a more widespread adoption of free software licenses with minimal restrictions and maximum compatibility. **Barriers addressed:** B.LP1, B.LP2, B.01
5. Engage in cross-border collaboration for the harmonization of data standards to add value to open datasets. **Barriers addressed:** B.DT2, B.DT3
6. Increase public officials' awareness of personal data protection regulations and ways to publish data without compromising privacy and security. **Barrier addressed:** B.LP3
7. Introduce a legal obligation for government institutions to make public sector data open by default. For EU governments, this may mean strengthening the implementation of the provisions of the PSI Directive. According to the survey, imposing a statutory obligation to publish open data is a good way to exert much-needed pressure on public organizations. **Barriers addressed:** B.LP1, B.LP2
8. Remodel existing processes for public service production to integrate co-creation. As the first step, this could be done by creating innovation teams around internal change-agents, who should be given sufficient freedom to experiment with open data and collaborative service creation models in innovative ways. . **Barriers addressed:** B.01, B.03
9. Provide and disseminate concrete applications to display open data solutions that could be taken up by public and private organizations. **Barrier addressed:** D.DT4
10. Initiate capacity-building and training programs for public sector officials to build data-related knowledge and skills. This could be done by offering specialized training programs on open data and digital skills, publishing handbooks that explain open data, providing guidelines and sharing best practices. **Barriers addressed:** B.S3, B.S4, B.02

In addition to government's efforts, there are also small things that citizens, private and non-governmental actors can do to encourage data-driven co-creation. Among other things, these include the following:

1. Raise awareness of the value of open data as an enabler of improved services, better informed decisions, government transparency, civic participation, and economic opportunities. Among other means, this value can be demonstrated and communicated by prototyping and disseminating applications for data analysis and interactive data visualization, disseminating the success stories of particular initiatives, and sharing best practices.
2. Take initiative in using the existing open data to build small applications and services to show how data can be employed to meet user needs. The key role of individual innovators and leading by example clearly came out in our study.
3. Express a clear demand for open data. Vocal grassroots groups who demand open government data can become an important motivator for public sector organizations to publish government information and datasets.
4. Initiate capacity-building and training programs for employees and volunteers in the private and non-profit sector to develop the necessary skills, knowledge and abilities to work with open data and participate in public service creation.

These policy recommendations are based upon the conducted survey, but more data should be collected in order to gain a better understanding of how to overcome the current barriers for data-driven co-creation. Existing studies do give us a useful perception of the key barriers but do not say much about how these can be overcome. It is therefore vital to collect more empirical data on actual cases of data-driven co-creation, both successful and unsuccessful, to learn what factors affect this process and how barriers can be surpassed. The pilot projects conducted as part of the OpenGovIntelligence project aim to generate exactly these kinds of lessons that can build our knowledge of the problems and solutions. The need to share lessons and best practices turned out to be a recurrent theme in our study – the dissemination of stories, tools and methods is believed to be a key driver that can foster data-driven co-creation. This discovery is a rather optimistic one since such dissemination is something that can be easily implemented with the help of existing networks and collaboration platforms such as the Open Government Partnership.

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Contributing to a Digital Single Market for Europe: Barriers and Drivers of an EU-wide Once-Only Principle

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ABSTRACT

One of the key obstacles on the way to a full-fledged European digital single market is the administrative burden imposed on companies conducting business activities across country borders. The once-only principle (OOP) states that any standard information that one public administration has already collected should be shared with other public administrations, within or outside the country. The European-wide adoption of the once-only principle is seen as a promising way to relieve businesses from the burden of submitting the same data to different public administrations multiple times, as it would enable EU Member States to share and reuse the data that another state has already collected. However, the cross-border implementation of the OOP is hindered by a number of barriers and challenges. This paper presents the first results of an analysis of the barriers and drivers associated with the OOP, conducted as part of a large-scale European initiative involving 50 organizations in 21 countries. Our findings point to the prevalence of legal, interoperability and resource-related concerns among the perceived barriers. The study also shows the importance of political will, evidence of benefits, and demand from end users as drivers of OOP.

CCS CONCEPTS

• **Information systems → Information systems applications**; • **Social and professional topics → Management of computing and information systems**; • **Software and its engineering → Extra-functional properties**;

KEYWORDS

once-only principle, cross-border e-government, data reuse, drivers and barriers, interconnection, interoperability

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1 INTRODUCTION

In the digital age, the European Union's efforts to build a single market are increasingly digital in nature. While substantial benefits are associated with a borderless digital single market, amounting to a €415 billion contribution to the European economy [1], a number of barriers still need to be overcome to provide European companies fair access to the market and allow businesses to "operate as effectively anywhere in Europe as it is at home" [2]. One of the key questions in this regard is how to reduce the administrative burden of companies who conduct business across borders, i.e. how to enable a swift movement of data and information between European public administrations to save businesses from the need to supply the same information to different administrations over and over again. In order to take steps towards administrative simplification, EU Member States have agreed to implement the once-only principle (OOP) in national and cross-border digital public services, reinforcing their commitment in the recent Tallinn ministerial declaration [3]. The once-only principle states that any standard information that one public administration has already collected should be shared with other public administrations (within or outside the country), instead of overwhelming businesses and citizens with multiple requests for the same information. This allows data to be collected only once but reused as many times as needed, respecting data protection requirements and other applicable restrictions. The OOP is believed to bring a positive economic impact for businesses by saving time and reducing the administrative costs. It also has the potential to provide administrative gains by reducing the need for redundant data collection and enabling a faster processing of requests [4].

In order to facilitate data sharing between information systems in different countries, a large-scale European initiative ("The Once-Only Principle Project", TOOP) was launched in 2017 by the European Commission, 19 EU Member States and two associated countries to develop and test a federated technical architecture that is able to interconnect national databases and data exchange layers. The architecture is tested by running real-life pilots in the course of 2018-2019 in the areas of company data, cross-border e-services for business mobility, and online ship and crew certificates (see [5] for more details). In addition to the technical work, the project also works on identifying the legal, political, organizational and other relevant barriers and drivers that affect the implementation of the OOP at a cross-border level. Although OOP as a general principle concerns both individual citizens and companies, the scope of this

initiative is limited to the cross-border sharing of business-related data.

This initiative provides a unique transnational testing ground for a concept that has so far only been implemented to a varying extent in some individual countries [6] and almost not yet at a cross-border scale [4]. Furthermore, the pilot tests also present an opportunity to empirically research the drivers and barriers that affect the emergence and implementation of cross-border e-government services – a topic which is still under-explored in e-government research. The implementation and implications of the OOP have so far only been explicitly discussed in two policy studies ([6] and [7]) and a few conference papers (most notably [5],[8]). Furthermore, most of existing research on cross-border e-government services has a highly technical focus, with just a few studies (e.g. [9–11]) that have undertaken a broader analysis of the context factors that affect such solutions.

In order to fill this research gap, the TOOP project involves a two-phase study of the drivers and barriers of the OOP. The first phase of the study was conducted in 2017 before the start of the pilots to explore the piloting organizations' perceptions of the barriers and drivers. In the second phase, a follow-up study will be conducted at the end of the piloting period in 2019 to collect data on the drivers and barriers that the pilots experienced in practice. The current paper presents the results of the first phase of the study, which involved a literature review and an empirical study comprising an e-mail survey among pilot participants and focus group interviews with pilot coordinators.

The rest of the paper is structured as follows. Section 2 gives an overview of the methodological approach to the study, Section 3 presents the results of the literature review and Section 4 summarizes the findings of the empirical study. In Section 5, the results are discussed with regard to their broader implications on the implementation of the OOP in Europe, followed by recommendations and conclusions.

2 RESEARCH DESIGN

2.1 General Approach

The first phase of the study was conducted over the period of January-August 2017. Three main kinds of data sources were used for the research: a literature review, focus group interviews with the coordinators of the TOOP pilots, and an e-mail survey among the public sector organizations from various countries participating in the pilots. The nature of our inquiry was mostly qualitative, i.e. the aim was to identify the various factors that the piloting organizations perceived as inhibiting (barriers) or supporting (drivers) the implementation of the OOP. Despite the use of some quantitative measures in data analysis as potential indication of the perceived importance of some barriers and drivers over others, the design of the study does not allow for making any statistical generalizations.

It is also important to emphasize the fact that the study was conducted before the start of the actual implementation of the pilots. Our research was thus limited to examining the pilot participants' perception of the key barriers and drivers. The actual experience of the pilots will be documented in the follow-up study which is to be conducted at the end of the pilot implementation in 2019.

2.2 Research Process

As the first step, a review of existing academic and policy literature was conducted in January-April 2017 to search for influential factors that may affect the cross-border implementation of the OOP. Since the OOP is still scarcely discussed in literature, the literature search was expanded to involve academic papers and policy reports on interoperability, e-government, public sector innovation and technology acceptance. As a result, an inventory of potential barriers and drivers was compiled, covering interoperability issues, organizational, user aspects and other relevant factors. This inventory was then used as input for the development of survey questions for the TOOP pilots.

For the second step, data was collected from pilot partners from April-July 2017 via an e-mail survey comprising both open-ended and multiple choice questions about the pilot participants' perception of various barriers and drivers. Out of the 18 pilot countries to whom the questionnaire was sent, responses were received from 15, yielding an overview of the piloting organizations' understanding of the main barriers and drivers. Due to using a non-representative sample, the survey results were analyzed in a generalized manner, without drawing country-specific conclusions.

In parallel, to gain deeper insight into the perception of the barriers and drivers for different pilots, three 90-minute focus group interviews with pilot area coordinators were carried out in April 2017. Input from these focus groups was used to expand and corroborate the results of the survey.

As the final step, preliminary findings from the survey and focus group interviews were discussed in two 120-minute group sessions with 30 pilot participants in May 2017. As a result, a refined inventory of the key barriers and drivers was compiled and recommendations for mitigating some of the key barriers were formulated.

3 BARRIERS AND DRIVERS OF CROSS-BORDER OOP: LITERATURE REVIEW

Due to the lack of research on OOP, our literature search involved several closely related disciplines, such as interoperability, e-government, public sector innovation and technology acceptance literature. An interdisciplinary approach was also motivated by the mounting evidence in e-government research of the variety of factors that affect e-government projects. Based on existing accounts, e.g. [7], [12–14], the main factors relate to technology, interoperability, the organizational, administrative, institutional and political context of public sector organizations, legal environment, as well as the demand and acceptance of e-government solutions by citizens and businesses.

3.1 Technical and Interoperability Factors

Due to the heterogeneity of existing information systems and models, technical and interoperability barriers are recognized as some of the most challenging problems for cross-organizational information systems [15]. According to [7], the main technical challenges for cross-border OOP pertain to the following issues:

- Data: data and metadata quality, different data models, inconsistent definitions of data elements;
- Databases and data handling systems: unclear ownership of databases, fragmentation, differences in data handling systems;
- Interoperability: heterogeneity of existing ICT systems, lack of interoperability at national level, semantic interoperability issues, language differences, national differences of concepts and meanings;
- Broader ICT infrastructure: availability and accessibility of digital services, national OOP maturity.

Out of these barriers, technical and semantic interoperability barriers deserve a special attention. Technical interoperability barriers to cross-border OOP involve local solutions that might not meet OOP requirements, different local and national approaches to handling specific types of data, and limited possibilities to develop common access tools for non-base repositories, access to distributed data sources and query-based access to data [7]. The TOOP project defines semantic interoperability as the "ability of software to accept data from external sources so that the software does not draw invalid conclusions about the state of affairs about the shared reality" [16]. According to [16], the semantic interoperability between the IT systems of different governments is one of the main challenges for the OOP.

Alongside technical barriers there are also technical drivers that are believed to support the implementation of the OOP. For instance, national systems of base registries are seen as an important enabler, as is prior successful experience with OOP implementation at the national level [7]. Technical interoperability barriers can also be reduced by making sure that the architecture for cross-border OOP builds on existing interoperability frameworks and building blocks [16].

3.2 Organizational, Administrative and Political Factors

Studies on ICT-driven innovation in the public sector frequently emphasize the organizational, administrative and political context as a source of innovation drivers and barriers. Since the application of the OOP requires changes in organizational workflows and coordination between different organizations, it faces a number of organizational barriers. Such barriers involve, for example, existing governmental silos and lack of communication, the complexity of organizational change, and concerns about high implementation costs [6].

The same constraints are also present at the cross-border level. According to [7], the implementation of OOP across Europe is hindered by the complexity and cost of substituting legacy systems and changing organizational structures, limited mechanisms for cost-sharing, difficulty of reorganizing business processes, strong organizational inertia, weak political will, cultural resistance to change, cautious attitudes towards data sharing, and a generally low awareness of the benefits of OOP. The latter can be considered one of the key impediments to OOP – the political will to implement OOP tends to depend on the existing national experience with OOP and the extent to which OOP has demonstrated clear benefits for individuals, businesses and public administrations [7].

These findings are also supported by the results of previous studies in e-government and public sector innovation. Studies have found that the innovation capacity of public sector organizations depends on a number of organizational factors, such as organizational structures, intra- and inter-organizational collaboration and coordination, organizational culture, leadership styles [17, 18], resources [19], qualified personnel [20], etc. Public sector organizations are also strongly affected by the legal culture and administrative traditions of the state [19]. Moreover, the inherent complexity of public sector organizations and their accountability to a multitude of stakeholders make the implementation of organizational changes much more difficult in the public sector than it is in the private sector [21].

Although the public sector context generates more barriers than drivers to innovation, some drivers still exist. Firstly, drivers may be generated by external triggers, such as competitive pressure by other organizations, countries or international bodies [19], legal obligation [7], political priority and public demand [17]. At the organizational level, innovation can be driven by participation in cross-organizational and cross-border knowledge transfer networks [22], and strong leadership by administrative and political managers [19].

3.3 Legal Factors

The regulatory and legal context is perceived to be important in several respects. On the one hand, existing regulations often stifle innovation; on the other, regulations can also promote innovation, for example by imposing a legal obligation to implement certain solutions [17]. With regard to the OOP, the legal context is extremely important as it sets the rules and limits for data sharing and personal data protection. According to [6], resolving legal obstacles and establishing a sound legal basis for OOP is one of the most important strategic issues next to technological and political issues.

For a European-wide OOP, regulatory aspects play an even more important role as cross-border data sharing not only needs to be allowed but also practically enabled by Member States' legislation. The implementation of OOP at the European level requires addressing gaps in national legislation on data protection, data sharing, information management, etc., as well as harmonization and coordination at the EU level. Although some EU directives and regulations (e.g. eIDAS, Services Directive, most recently the General Data Protection Regulation) support different aspects of interoperability, a common legal basis at the EU level may be necessary to fully support an EU-wide OOP [7].

The legal analysis conducted within the TOOP project [23] has identified several legal challenges for cross-border OOP. The implementation of the OOP needs to follow the principle of accountability, i.e. ensure all participants' awareness of their obligations and the right to restitution of damages caused by noncompliance. According to the principle of justice, the OOP solution must ensure the right to recourse for the persons relying on the OOP, and include appropriate enforcement mechanisms. Privacy, data protection and confidentiality requirements demand the establishment of safeguards that ensure privacy and the protection of personal data, as well as confidentiality and business secrecy for companies. According to the principles of equality and solidarity, OOP

must be implemented in a non-discriminatory way and provide universal accessibility, including to persons with disabilities. The principles of lawfulness and compliance demand evidence to be transferred only if there is an adequate legal basis, and in compliance with any applicable legal requirements. The control principle demands for the evidence exchange mechanism to contain appropriate controls to ensure that the evidence is relevant and incidents can be detected and addressed. The cross-border implementation of the OOP also needs to ensure the legal value and validity of the evidence exchanged, the protection of data against accidental or unlawful destruction, alteration or unauthorized access, as well as data accuracy. The legal barriers and challenges thus pose specific requirements to the technical architecture for cross-border data exchange.

3.4 Demand Side Factors

The study by Cave et al. [7] highlights the importance of demand by citizens and businesses as an influential factor for cross-border OOP initiatives. The study also suggests that the actual level of demand is strongly linked to factors such as the inflow of foreign citizens and businesses to a country, citizens' cultural awareness of OOP, trust in data providers and re-users, and the overall maturity and accessibility of digital service infrastructures. Although the study does not assess the level of demand for cross-border OOP-based services, it does seem to hint that this level may substantially vary among countries and domains.

In order to understand what factors affect the demand and acceptance of OOP solutions, research on the acceptance and use of technology can provide valuable insights. The general point of departure of such literature is the understanding that there are a number of factors that influence the user as to whether or not to adopt a novel technology. One popular approach for mapping those factors is the technology acceptance model (TAM), which argues that acceptance is determined by the perceived usefulness and ease of use of a technology [24].

TAM's derivative, the Unified Theory of Acceptance and Use of Technology (UTAUT) is more elaborate and incorporates additional factors, explaining how a decision is formed about the use of an information system. The theory builds on four key constructs: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions 25, 26.

In the context of the OOP, performance expectancy refers to the degree to which citizens, businesses and public administration officials believe that the OOP will bring them gains, such as time and cost savings, greater accuracy of data, faster processing of requests, improved quality of services, etc. Benefits can also include more general public policy targets, such as supporting the digital single market. Effort expectancy relates to the degree of ease associated with the use of a technology. This means that the technical solution for cross-border OOP needs to be easy to use both for public administrators and businesses. It also needs to be compatible with existing IT systems used in different countries and domains. Social influence indicates the degree to which important others are perceived to believe one should use the system. In the case of OOP, the influence and perceived attitudes of other companies, governments or international bodies can either encourage or discourage the use of OOP solutions. Lastly, acceptance may also be shaped by other facilitating conditions, such as the existence of a supporting organizational and technical infrastructure, ICT skills, experience with a specific technology, or voluntariness of use, to name but some.

4 PERCEIVED BARRIERS AND DRIVERS FOR TOOP PILOTING ORGANIZATIONS

The survey and focus groups with TOOP pilot participants revealed that barriers were perceived in all categories discussed in Section 3, although some were clearly considered more worrisome than others. At the same time, the study also pointed to the existence of drivers that stimulate OOP adoption. When survey respondents were asked to state up to three main drivers in an open answer, the following key drivers emerged as a result of grouping answers from 15 country representatives (see 1):

- Reduction of administrative burden and increased efficiency for businesses;
- Improved service quality;
- Administrative simplification and efficiency for the government;
- Better governance (including various governance-related aspects, such as agile and adaptive governance and increased transparency);
- Legal obligation (this was mentioned somewhat less frequently, probably due to the absence of OOP-regulating law in many countries and at the EU level);
- The existence of a technical infrastructure and prior technical experience with the OOP (seen as a driver only in some occasions).

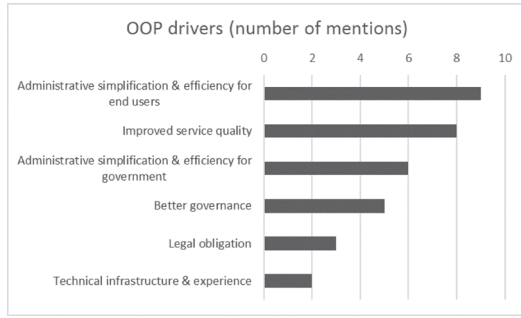

Figure 1: Key perceived drivers for TOOP pilots

In another open answer question, respondents were asked to indicate the most important barriers to the implementation of the OOP. Several conclusions became evident (see 2):

- The answers are more heterogeneous compared to the perception of drivers;
- Legal concerns are perceived as a key barrier. The answers refer to particular concerns about lawfulness, privacy, data protection and confidentiality aspects;

- Several countries mentioned low potential take-up and financial constraints as an implementation barrier;
- Lack of political and managerial support was considered as a key barrier in a few countries, so were possible coordination problems at the national level;
- A few countries also mentioned procedural differences and heterogeneous data pricing models between countries.

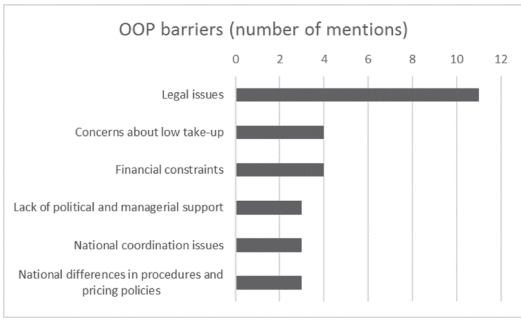

Figure 2: Key perceived barriers for pilots

According to literature, the willingness and ability of public sector organizations to implement innovative solutions are strongly shaped by their motivation and openness to change. Therefore, piloting organizations were asked to evaluate their openness towards some of the key aspects of the OOP, such as data sharing, and technological and organizational alignment in order to enable OOP. Based on the responses, pilot participants seem to be very open to sharing data with other organizations in their country but are somewhat less willing to share data with other countries, although the level of caution was assessed to be moderate rather than high (see 3).

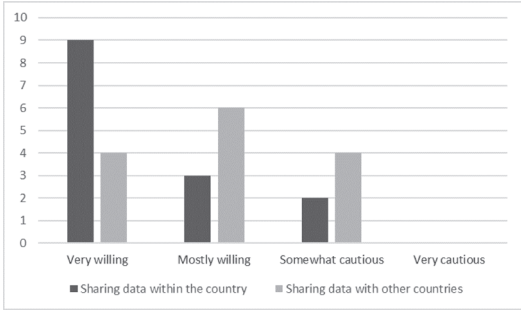

Figure 3: Pilot organizations' openness to sharing data

Organizations are rather motivated to undertake technological and organizational changes (i.e. changes in structures, processes, workflows) for the sake of enabling the OOP at the national level. At the same time, they are slightly less willing to implement similar changes in order to enable OOP in cross-border transactions. There seems to be more willingness to implement changes at the level of organizational processes rather than technological solutions.

Participants were also asked to indicate the extent to which they felt the implementation of cross-border OOP is a political priority for their organizations and national administrations. The responses show that the OOP is mostly a rather high priority for the pilot organizations, whereas none of the respondents considered it to be a very high priority for their national administration (see 4).

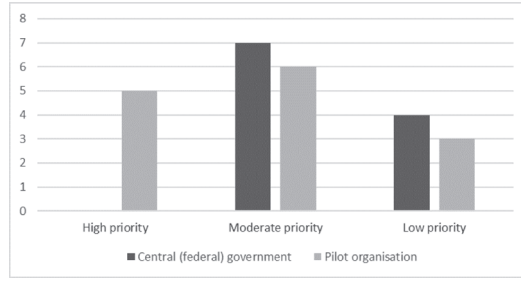

Figure 4: Political priority of OOP in piloting organizations and national administrations

With regard to particular technological, legal and organizational factors that emerged from the literature review, data protection requirements are seen as the most likely challenge – 8 respondents evaluated this factor as "very likely" or "quite likely" to be challenging (see 5). Another major concern is limited financial resources, which 7 respondents rated as a likely challenge. Although the cost of sustaining the pilot results in the long term seems to be less of a concern, it was still mentioned as a potential challenge by several respondents. Next in importance are the perceived lack of human resources and the difficulty of implementing organizational and technological changes. At the same time, communication and cultural factors were mostly not perceived as a problem.

Figure 5: Key challenges for pilot implementation

Looking at the answers to different survey questions about barriers, we can see that legal barriers (in particular those related to data protection) and financial constraints consistently emerged as major concerns. Respondents also highlighted concerns related to organizational interoperability and alignment. In addition to this, the open-ended questions demonstrated that pilot organizations also foresee some political and demand-side barriers.

As regards the impact of these barriers on different domains, the focus groups with pilot coordinators and workshops with a broader circle of TOOP participants revealed some additional insights. First, in pilot areas that involve the retrieval of data from business registers (the Cross-border e-Services for Business Mobility and Updating Connected Company Data pilot), existing differences in data pricing policies were highlighted as a potential barrier to the cross-border application of the OOP. Semantic interoperability, national differences in document and data formats and language issues (transliteration of characters and the legal value of automatically translated text) were also considered a possible problem. Some also raised the need to investigate to what extent eIDAS provides a solution to the current absence of EU-wide unique identifiers for companies, which otherwise may turn out to be a challenge.

At the same time, the third pilot area – Online Ship and Crew Certificates – faces rather specific barriers. As maritime certificates are currently produced in paper-based formats, national differences in the level of digitization of the relevant data may prevent a transition to a purely online data exchange. The nature of some of the data elements on the certificates also raises the challenge of securing the privacy and confidentiality of certificate data. However, an even greater challenge is seen in the implications of the global scale of the maritime sector – the application of the OOP is only perceived to yield real benefits if it is adopted by a critical mass of flag states beyond the EU.

According to the data collected, some key barriers seem to be common for all pilot areas. These involve different national OOP maturity levels, concerns about the strength of political interest in the OOP and most importantly, uncertainty about the benefits of the OOP and the actual level of demand from businesses. It is therefore not surprising that the key drivers for the implementation of the OOP at the European level were seen in establishing an EU-wide legal obligation to implement the OOP, strengthening the political commitment, and conducting further studies to collect evidence of the actual benefits and demand for the OOP by citizens and businesses.

5 DISCUSSION

The literature review and the empirical study pointed to a number of context factors that affect the cross-border application of the OOP, both positively and negatively. As it appears, the biggest barriers are associated with legal interoperability and compliance with legal requirements; technical interoperability; lacking empirical evidence and low awareness of the benefits of the OOP; unclear demand from businesses; limited resources; low political interest; and the difficulty of changing existing organizational processes, information systems and commercial policies. The next section discusses the main challenges and proposes some possible ways to address them.

5.1 Legal Challenges

Legal issues are clearly perceived as a key barrier to the implementation of the OOP at the European level. The main concerns are related to ensuring the lawfulness of data transfer, the legal value and validity of evidences exchanged, personal data protection, confidentiality, and professional and business secrecy. As a short-term solution, the legal analysis conducted in the TOOP project [23] suggests to set up federation agreements that govern the functionalities of the area in which data is shared, including limitations in terms of scoping, identification and authentication requirements, legal recognition, traceability and revocation. Data providers and consumers could accede to this federation through specific accession agreements. However, such a solution would come with high transaction costs for all parties. They would have to determine if there is an adequate national legal basis to join such federations and if it complies with national legal requirements. This could also mean 'bargaining costs' to come to an acceptable agreement.

In the longer term, therefore, a different solution is needed. Our study suggests that there is a high expectation for a legislative push at the EU level which would regulate data sharing and reuse between Member States. To some extent, the Public Procurement Directive and eIDAS Regulation have already reduced barriers for the cross-border movement of business data. However, a specific European-wide OOP regulation is believed to have a strong potential to create the necessary incentives for Member States to adopt the OOP. In addition to that, the current proposal for a Single Digital Gateway Regulation will also play a crucial role in facilitating the implementation of the OOP in certain areas.

5.2 Technical and Interoperability Challenges

Technical and interoperability barriers were considered very important by the stakeholders, also because potential solutions for many other problems (e.g. legal issues) depend on the technological solution for cross-border data sharing. The main barriers stem from the heterogeneity of existing ICT systems, as well as differences in data quality, data models, data elements and data handling systems. In some domains where not all data is stored digitally (e.g. maritime certificates), data accessibility may also pose a barrier.

Existing European-level interoperability reference architectures, technical building blocks and TOOP's work on developing a federated OOP architecture are likely to provide solutions to some of the interoperability concerns. However, an important conclusion of our study was that public administrations are generally not willing to undertake major technological and organizational changes in order to enable OOP. Therefore, the OOP architecture needs to ensure a very high level of compatibility with existing technical solutions at national and organizational levels.

5.3 Challenges Related to Understanding OOP Benefits and Impacts

Administrative simplification and efficiency for end users are perceived as the key driver for the cross-border implementation of the OOP. Other expected benefits include administrative simplification

and efficiency for government and improved quality of public services. Whilst OOP has the potential to bring a number of positive impacts to European businesses and administrations, its benefits and impacts are still somewhat poorly understood, likely because of the novelty of the concept and the lack of cross-border OOP initiatives so far.

In order to understand the impacts and challenges of the OOP it is advisable to launch further regional or European-wide OOP pilots in different domains. These should be accompanied by ex-ante impact assessments regarding concrete services to be developed, and ex-post impact assessments to learn from the pilots and derive recommendations for scaling up OOP-based solutions. In the further development of OOP at the European level, a clear priority should be given to developing services that would benefit large number of end users and governments and/or bring considerable benefits for certain priority target groups.

5.4 Organizational and Political Challenges

With its focus on simplifying administrative processes for citizens and businesses, the implementation of the OOP assumes some fundamental changes to the ways public administrations work. Our analysis pointed to organizational barriers in several aspects. Firstly, due to their internal complexities, public sector organizations tend to exhibit an in-built inertia which limits the extent and pace at which new practices can be adopted. Secondly, since public sector organizations are driven by political goals, political commitment (or lack thereof) is an extremely important factor that can drive or inhibit their willingness to invest in OOP solutions. Thirdly, the cross-border implementation of the OOP requires alignment between a number of organizations, requiring the consolidation of processes and policies that have so far been implemented in a highly heterogeneous manner. The application of the OOP is also constrained by resource limitations, which may prevent the quick scale-up of pilot initiatives to new countries and domains.

The key solution to overcoming organizational resistance is seen in the expression of a clear political commitment to the OOP at the national and European level in the form of ministerial declarations, action plans, etc. Political support can be built by demonstrating the benefits of cross-border OOP, in particular by conducting real-life pilots. As our survey implies, political will at the national level may also be strengthened by launching a legislative initiative at the EU level.

Some measures may also be taken to reduce the implementation costs of OOP for individual organizations. The federated architecture developed by TOOP aims to enable the interconnection of heterogeneous systems and architectures, which minimizes the need for the substitution of existing systems. Costs can also be kept lower by reusing the CEF building blocks and existing interoperability frameworks (e.g. EIF). In order to mitigate the effect of resource limitations, the EU may also consider providing financial incentives to Member States to support their technical readiness for cross-border OOP.

6 CONCLUSIONS

The EU-wide adoption of the once-only principle is becoming an increasingly important goal in the EU e-government policies and movement towards a digital single market. However, as this study suggests, the road to OOP is paved with challenges of various kinds. Our literature review identified potential barriers in four main areas: 1) technical and interoperability issues, 2) organizational, administrative and political context, 3) legal aspects, and 4) demand-side factors. The empirical study of the public sector organizations participating in the ongoing EU-wide OOP pilot initiative further pointed to legal concerns as the key barrier, followed by resource constraints, and technical and organizational interoperability issues. Barriers are also seen in the lack of evidence and low awareness of the benefits of implementing OOP at the European level. As the study showed, cross-border data exchange is not made easier by the perceived difficulty of aligning the work processes and service pricing policies across organizations.

Solutions for some of these problems are already under way. However, in the long term, a strong political and legislative push at the EU level is perceived as the main driver that is needed for a European-wide application of the OOP. Currently, the key driver of OOP is seen in the benefits (e.g. administrative simplification, efficiency, service quality) that the OOP promises to citizens and businesses. This said, many public administrations are concerned about the current lack of empirical evidence of these benefits and the lack of knowledge of the actual demand for OOP by European businesses. This points to the need for further pilot initiatives and impact assessments to document the real benefits and identify the areas in which OOP-based services would yield the most benefits.

ACKNOWLEDGMENTS

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Cross-border e-Government Services in Europe: Expected Benefits, Barriers and Drivers of the Once-Only Principle

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ABSTRACT[1]

Moving towards the cross-border mobility of e-Government services is a political priority of the European Union, but the provision of such services remains fragmented. This paper builds on the first research results of "The Once-Only Principle Project" (TOOP), launched in 2017 by the European Commission and 51 organizations from 21 European countries to advance cross-border e-services through exploring and testing the cross-border application of the once-only principle (OOP). According to this principle, public administrations should collect information from citizens and businesses only once and then share this information with other administrative bodies. On the basis of a literature review, survey, focus group interviews and workshops, this paper presents a preliminary take on the benefits associated with cross-border OOP, as well as the barriers and drivers that affect the emergence of OOP-based cross-border e-Government services.

CCS CONCEPTS

• Information systems → Information systems applications; Software and its engineering → Extra-functional properties; Social and professional topics → Management of computing and information systems

KEYWORDS

once-only principle, cross-border public services, interconnection, interoperability, benefits, drivers and barriers

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1 INTRODUCTION

According to the once-only principle (OOP), public administrations should collect information from citizens and businesses only once and then share this information with other administrative bodies while respecting privacy regulations and other constraints. Although many Member States of the European Union (EU) have started to implement OOP at a national level, its application is still evolving and fragmented [1].

The Once-Only Principle Project is a large-scale European project that runs from 2017 to 2019 and aims to facilitate the cross-border application of OOP, focusing specifically on information related to business activities. TOOP aims to contribute to a solution where business would need to provide certain standard information to a national or supra-national public administration only once and public administrations in different countries would be able to share and reuse this information, respecting privacy regulations and other relevant constraints (see [1] and [2] for a more detailed overview of the project aims and activities).

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To achieve this, TOOP aims to develop a generic federated architecture that supports the interconnection of national registries across state borders. In order to test the architecture, several pilot projects will be conducted in the fields of company data, cross-border e-services for businesses, and ship and crew certificates.[2] The project also pays careful attention to identifying key legal principles and legal challenges in different OOP use cases. However, next to the technical and legal aspects, there are other factors that affect the adoption of OOP. These include the perceived benefits associated with OOP, but also the political context, the structural, organizational and cultural features of public sector organizations, and demand-side factors. [1] The aim of the ongoing research presented in this paper is to identify the benefits that OOP is expected to deliver, the drivers that enable or support cross-border OOP, and the barriers that may challenge this process.

2 METHODOLOGICAL APPROACH

This research task makes use of a combination of research methods, including literature review, focus group interviews and online surveys. The empirical data collection predominantly focuses on the perceptions and actual experience of the organizations participating in the TOOP pilots. Four steps have been taken so far.

First, a review of existing academic and policy literature was conducted to search for influential factors that may affect the cross-border implementation of OOP. Since OOP is still scarcely discussed in literature, the most notable exceptions being the EU-funded studies [3] and [4], the literature search was expanded to also involve related streams of research, extracting information on potentially relevant barriers and drivers from academic and policy studies on topics such as interoperability, (cross-border) e-government, public sector innovation and technology acceptance. The literature review consisted of two search streams: one related to the expected benefits of OOP, and the other one to the barriers and drivers that may affect its implementation. This resulted in a list of benefits commonly associated with OOP as well as an inventory of barriers and drivers covering interoperability issues, organizational barriers, user and business aspects and other relevant factors. This inventory was then used as an input for the development of specific survey questions for the TOOP pilots.

For the second step, data was collected from pilot partners from April to July via an online survey. The questionnaire was distributed and responses were collected via e-mail. Out of the 18 pilot countries to whom the questionnaire was sent, responses were received from 15, yielding an overview of the main benefits, drivers and barriers, as perceived by the piloting organizations. In parallel, to gain deeper insight into the perception of pilot-specific benefits, barriers and drivers, several workshops and focus groups were carried out. First, generic benefits and barriers were discussed at the TOOP kick-off meeting in Tallinn on 26 January 2017. More in-depth pilot-specific discussions took place in three 90-minute focus group interviews with pilot area coordinators in the project workshop in The Hague on 19 April 2017. Finally, the preliminary findings from the survey and focus group interviews were discussed in depth in two 120-minute sessions with some 30 pilot participants in Rome on 23 and 24 May 2017. It is important to note that real piloting activities had not yet started at the time of data collection – therefore, the results only reflect the partners' initial perception of potential challenges and obstacles.

Finally, the analysis and synthesis of the results was carried out. Based on this, a refined inventory of key barriers and drivers for TOOP pilots was compiled, while the expected benefits were integrated into the pilots' impact assessment framework as evaluation criteria.

As the next step, these initial findings will be empirically tested in real-life settings based on the implementation of the TOOP pilots throughout 2018 and 2019. A second round of data collection from the pilot participants is scheduled to take place at the beginning of 2019, which will result in a refined inventory of the barriers and drivers based on the actual experience of cross-border data exchange in the three pilot areas.

3 RESULTS OF THE LITERATURE REVIEW

3.1 Expected benefits of OOP

The main benefit associated with OOP is administrative burden reduction, i.e. simplification of processes that need to be taken for a business to comply with administrative procedures (for detailed results, see [5]). The availability of digital data across borders is believed to lead to a decrease in time and costs [4] of administrative processes, but also to their uniformity and consistency [6], data interoperability [4], better data quality, reliability and validity [6].

OOP is also expected to improve the quality of public services. Service quality has several dimensions. One of them is transparency and accountability, which means that individuals and businesses can easily understand decisions and query inconsistencies [4]. Another is non-discrimination, which can be achieved by a reduction of asymmetries between the treatment of domestic and cross-border businesses in service provision [7]. Service quality can also mean ubiquitous services development, which refers to access from any platform, at any time, from any physical location [8].

Thirdly, OOP is associated with improved government efficiency. On the organizational and business process level process optimization has been defined as a main benefit for the organizational and business process aspect, which is the reduction of delays associated with data-intensive service requests [4]. On the legal level, the implementation of OOP enhances the government's ability to determine liability for accuracy and use of information (e.g. as data controller). Technically, OOP reduces the duplication of tasks [4], while the development and use of standards for data exchange [6] improves interconnectivity and increases the efficiency of data exchange. Furthermore, OOP is also believed to contribute to fraud reduction by reducing the possibility of obtaining services by means of inaccurate or

[2] See http://toop.eu/pilots for a detailed description of the pilots

contradictory information, and by improving the government's ability to detect such attempts [4].

3.2 Barriers and drivers

Various studies looking at the implementation of ICT in the public sector suggest that the adoption and success of public sector ICT projects depends on a range of different factors not only related to technology and regulations but also the managerial, organizational, political and broader institutional context (see, for example, [9], [10]). For cross-border OOP, the authors have identified gaps and barriers across several categories, including legal, organizational, semantic, technical and "other" issues, the latter category involving diverse factors from lacking political will to the difficulty of measuring the costs and benefits for users (for detailed results, see [11]). Following this broad approach, our literature review examined barriers and drivers in four main categories: 1) Technology and interoperability; 2) Organizational, administrative and political factors; 3) Legal factors, and 4) Demand-side factors.

3.2.1 Technology and interoperability

Some of the most challenging problems for cross-organizational information systems are associated with technical and interoperability barriers [12]. Due to its cross-organizational and cross-border nature, various technical and interoperability problems are also associated with cross-border OOP. According to [4], the existing heterogeneity of ICT systems in different countries and organizations generates barriers such as local solutions that might not meet OOP requirements, legacy systems, different approaches to handling specific types of data, lack of critical mass, and limited possibilities to develop common access tools to various data sources.

3.2.2 Organizational, administrative and political barriers

As the application of OOP presumes alignment and coordination between heterogeneous organizations, a number of organizational barriers come into play. According to [3], key barriers to OOP include organizational silos and lack of communication between government departments, the complexity of change in organizational structures, working practices and cultures, and high implementation costs. The same constraints are present at the cross-border level, coupled with limited mechanisms for cost-sharing, weak political will, cultural resistance, cautious attitudes towards data sharing, and low awareness of the benefits of OOP [4]. Many of these barriers have to do with the particular constraints and complexities characteristic to the public sector (see, for example, [7] [13], [14]). In addition to organizational features, public sector organizations are strongly shaped by the legal culture and administrative traditions of the state [7] and are highly susceptible to political turbulence and external crises [15].

3.2.3 Legal and regulatory factors

In the context of public sector innovation, regulations are seen to work two ways – on the one hand, rigid regulations may stifle innovation, while regulatory change can also promote innovation, for example by imposing legal obligations on administrations to implement innovative solutions [13]. With regard to OOP, the legal context sets the rules and limits for data sharing which are essential for personal data protection. According to [3], resolving any legal obstacles and establishing a sound legal basis for OOP is one of the most important strategic issues next to technological and political issues. At the cross-border level, existing national legal frameworks not only need to allow national administrations to consume and share data but also enable data sharing and reuse across borders. Although some directives and regulations have been adopted to support interoperability at the EU level (e.g. eIDAS, Services Directive and most recently GDPR), a common legal basis at the EU level is still needed to support a genuinely cross-border OOP [4], [16].

3.2.4 Demand-side factors

According to [4], demand for cross-border services can be a significant driver for cross-border OOP. However, the actual demand is strongly linked to factors such as the inflow of foreign citizens and businesses to a country, citizens' awareness of OOP, trust in data providers and re-users, and the overall maturity of digital service infrastructures. Here, research on acceptance and use of technology may offer valuable insights into the factors that affect the demand and acceptance of OOP-based solutions. Based on the Theory of Acceptance and Use of technology put forth in [17], it is important to analyze if OOP-based services will provide gains in performance and if the technical solution for cross-border OOP is perceived easy to use (and compatible with existing IT systems in different countries and domains). In addition to that, other conditions such as organizational and technical infrastructures, ICT skills or experience may facilitate adoption.

4 PILOT STUDY: PRELIMINARY RESULTS

In order to validate the findings of the literature review, data was collected from the coordinators and participant organizations in the TOOP pilots through an online survey, focus groups and workshops. The results confirmed the relevance of many of the findings but also highlighted some domain-specific differences.

4.1 Expected benefits of the pilots

The study of the pilots revealed that the most important end-user benefits are considered to be administrative burden reduction and time savings, which are both considered equally important. This is followed by improved ease of access. The end-user benefit considered of the least importance is increased number of users. The most important government benefit is increased data quality and reliability, followed by avoidance of duplication of tasks. The benefits that are considered least important are increased collaboration between agencies and fraud reduction. However, differences between the government benefits turned out to be very small. This means that, despite the small differences, all of the above-mentioned benefits are considered generally important.

4.2 Barriers and drivers

The study yielded barriers and drivers from all four categories examined. The most burning concerns are related to the challenge of ensuring that data sharing and reuse happens in compliance with regulations and is able to ensure personal data protection and the confidentiality of business secret. All pilot areas also emphasized the need for a legal push by the EU (in the case of the ship and crew-certificates, by the International Maritime Organization) that would mandate and facilitate the use of OOP. Technical and semantic interoperability barriers were also perceived very important. As public sector organizations are generally unwilling to undertake major technological changes in order to enable the OOP at a cross-border level, any technical solution for OOP needs to be highly compatible with existing national and local solutions. The study also pointed to organizational inertia and reluctance to undertake major organizational changes for the sake of implementing OOP. This is partly related to the low political priority of OOP, but also the difficulty of balancing the interests of multiple stakeholders involved in the pilots (this was especially emphasized for the business mobility pilot). Quite expectedly, barriers were also seen in limited resources, low interoperability between different organizations, different pricing policies (emphasized in particular for the company data pilot), current lack of knowledge of the actual demand for OOP among businesses, and concerns about possible low take-up of the solution.

Hence, the key driver for OOP was seen in the end user benefits. Piloting organizations considered it crucial to prioritize the development of OOP in areas where the gains for businesses (mostly administrative simplification) are seen highest and where positive impacts would be demonstrable. Almost equally important are the expected benefits for public administrations (mostly government efficiency and service quality). In this context, the area of ship and crew certificates stands out for its global ambition – in order for benefits to really exceed the implementation and transaction costs in the maritime domain, OOP-based data sharing should become the norm not only in Europe but worldwide.

5 CONCLUSIONS

The once-only principle is a concept which is associated with three important benefits – administrative burden reduction, government efficiency and improved service quality. However, due to its fragmented implementation so far, there is a general lack of knowledge and evidence of these benefits. The barriers which prevent governments from implementing OOP in national and cross-border interactions can be found at several levels, from technical to legal, organizational, political and demand-side factors. Of these, the key barriers for the OOP are associated with legal interoperability and compliance with legal requirements, lacking empirical evidence and low awareness of the benefits of the OOP, and the difficulty of changing existing information systems, organizational processes and service pricing policies.

As the next step, these preliminary findings will be put to an empirical test in the pilots conducted in three selected areas. This will allow us to learn which barriers and drivers turn out to be the most influential in the process and what differences may exist between different domains where OOP is implemented.

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Systemic change, open data ecosystem performance improvements, and empirical insights from Estonia: A country-level action research study

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Abstract. The purpose of this paper is to provide an overview of how Estonia used action research and systems theory to improve the performance their Open Government Data (OGD) ecosystem. This paper understands performance of OGD ecosystems of as consisting of three parts: 1) OGD supply, 2) OGD use, and 3) communication, interaction, and linkages between OGD suppliers and users. It was believed that by taking a holistic approach, encouraging transparency and co-creation, and manipulating feedback loops it was possible to improve the performance of the ecosystem. The research uses and validates previous research on open government data ecosystems and by doing so also achieved increased levels of performance in Estonia's OGD ecosystem. The paper's main contributions are the creation of a framework based on systems theory, systems thinking, and action research for enacting strategic change in OGD ecosystems, conceptualizing feedback loops as a core part of OGD ecosystems, and the conceptualization of performance in OGD ecosystems. The paper concludes by offering nine core insights related to OGD ecosystems and their performance.

Keywords: Systems theory, open data, open data ecosystem, systems thinking, feedback loops, system performance, e-Government

Key points for practitioners:

- The paper brings forth a six-step framework for enacting strategic change within OGD ecosystems.
- Mental models are important, if the current mental models in government do not support the goal of the system, change is unlikely to occur.
- It is possible to take advantage of bottom-up initiatives to drive increased performance of OGD ecosystems by engaging in communication, transparency, and co-creation.
- By intervening at specific feedback points, it is possible to improve the performance of an OGD ecosystem.

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Introduction

In the current academic debate, much attention has been devoted to studying and understanding Open Government Data (OGD) with a wide variety of methodologies, approaches, and focuses being adopted. Some studies focus on understanding the drivers and barriers to the use and release of OGD (Barry & Bannister 2014; Young & Yan 2017), some look at what can be done with OGD (Foulonneau et al., 2014; Khayyat & Bannister, 2017), while others take a more holistic and systemic approach to OGD, acknowledging that OGD is not just about specific technologies (Alexopoulos et al., 2014; Dawes et al., 2016; M. Najafabadi & Luna-Reyes, 2017). The research in this paper studies the Estonian (national) OGD ecosystem, falling into the latter camp, arguing that OGD is not just a technology, but part of a larger open system, co-evolving with its environment over time (McBride, 2020). Estonia is a country that is known around the world as a leader when it comes to digital government (Kalvet, 2012; Kitsing, 2011), but, when it comes to OGD, it is consistently labeled as a catching-up country with limited levels of performance (e.g. European Data Portal, 2018b; OECD, 2018a).

Performance is a subjective term: it does not have an objective existence, but, rather, it is a shared mental construct that is created through discussion between stakeholders involved in a given system (Brudan, 2010; Wholey, 1996). In a more system's specific view, all systems have a goal or function, they are supposed to do something (cars move you from A to B, air conditioning units keep a room cool, winter jackets keep you warm, etc…). The performance of these systems is related to how well they achieve that goal. What can be said about performance, then, is that it is a socially constructed phenomenon that is directly related to mutual agreement among stakeholders about the specific goal of a system. In the case of this paper, performance is related to the usage of OGD, supply of OGD, and interaction and communication about OGD amongst OGD users, OGD providers, and OGD beneficiaries, where higher levels would be associated with higher performance and lower levels would be associated with lower performance. While these measures of performance were defined within the Estonian OGD ecosystem context, they also mirror OGD performance measures discussed in the literature, such as by (Zuiderwijk & Janssen, 2014), who list three main performance measurements: usage of publicized data, risks of publicizing data, and benefits of publicizing data. Similarly, (Donker & Loenen, 2017) describe data supply, data governance, and user characteristics as performance measurements for OGD ecosystems. The performance of an OGD ecosystem is not just about the *availability* of OGD, but, rather, about the *usage* of OGD as it is only through its use that OGD is able to create public value (Janssen et al., 2012). Therefore, it follows that interventions in OGD ecosystems that boost the usage of OGD are likely to also lead to performance improvements.

Coming back to Estonia and its poor historical performance on OGD indices, previous research has identified why this is the case (e.g. McBride et al., 2018b). This participatory action research (Baskerville, 1999) started in 2018 and was conducted in an attempt to improve the poor performance of Estonia's OGD ecosystem. An opportunity for launching the action research initiative presented itself thanks to the decision of the Estonian Ministry of Economic Affairs and Communications to contract an external partner

to implement Estonia's OGD policy and improve the provision and usage of open data in Estonia. Open Knowledge Estonia, a non-profit community organization, won the three-year contract and engaged researchers from a local university in the work.

The starting point of the action research was the question "How to improve the performance of Estonia's OGD Ecosystem?" At the beginning stages of the research the researchers outlined and studied the main components, internal (systemic) and external (environmental), of the Estonian OGD ecosystem (this paper deals with OGD at the national level, the national OGD portal, and thereby also addresses primarily the national OGD ecosystem). Following this initial analysis, the researchers identified the drivers and barriers of OGD in Estonia, reusing and expanding on the findings of their prior work. The researchers also analyzed core weaknesses limiting the performance of the system. Building off of this knowledge, a widespread and systemic action-research-based approach has been conducted in cooperation between researchers, Open Knowledge Estonia, and government policymakers to make specific interventions with the intended purpose of improving the performance of Estonia's OGD ecosystem. This paper presents the findings of this research initiative based on the results obtained by the first half of 2020. By that time the Estonian OGD ecosystem had begun to show considerable performance improvements, evident from the results of external evaluations (international OGD indices), stakeholder feedback, and via concrete quantitative indicators.

Admittedly, action research is often written off as 'less scientific' due to its applied and context-specific nature (Davison et al., 2004). That being said, it is also generally well understood that action research is highly relevant, able to lead to development of new knowledge in ways traditional Newtonian science cannot (Susman & Evered, 1978) by "co-creating shared knowledge of the causal conditions of the social/behavioral world and its attendant difficulties" and, furthermore, that this new knowledge is theoretical in nature (Friedman & Rogers, 2009).

While this paper presents an overview of the transformation process of Estonia's OGD ecosystem and validates previous e-Government research on OGD ecosystems, its contributions are wider in scope than a case study or replicative research. The first, and major, contribution of this paper is its empirical demonstration at the country level of how a holistic and systemic approach to studying OGD ecosystems may be used to drive increased levels of performance via specific targeting and identification of feedback loops. Secondly, the paper develops and tests a framework for enacting systemic change in OGD ecosystems. This framework provides new theoretical knowledge that is likely to be of use for academics and the research community at large when it comes to studying OGD ecosystems, and, additionally, new practical knowledge that can be utilized by practitioners embarking on OGD ecosystem transformation projects. A third contribution is the conceptualization and further development of the concept of 'performance' when it comes to OGD ecosystems. A final contribution is the development, inclusion, and analysis of feedback loops as a specific systemic attribute within OGD ecosystems. Through these contributions, the paper and its results are likely to be of interest for any stakeholder working with OGD, specifically policy makers, academics, and NGOs who work directly with OGD are likely to find the results of this research to be beneficial.

In the following sections of the paper the research question is answered by, firstly, starting with an overview of its theoretical foundation. This foundation relies heavily on systems theory and system dynamics. Additionally, the OGD ecosystem model first proposed by (Dawes et al., 2016) that is adopted for this study of Estonia's OGD ecosystem is discussed. Following the presentation of the theoretical foundation, the participatory action research methodology is presented. After this initial discussion, the context related to OGD in Estonia, Estonia's OGD ecosystem, the identified weaknesses and performance problems, and the specific measures and changes made in an attempt to remedy the identified issues is described. Finally, the paper concludes by discussing the first results of these interventions and what changes in performance, positive or negative, in Estonia's OGD ecosystem have accompanied them. Additionally, the paper provides reflections on the used theory and highlights the main contributions of the research.

Theoretical Background

Epistemologically, this paper takes an alternative to the traditionally popular positivist approach in e-Government research and draws primarily from pragmatism. Pragmatism acknowledges that there are different ways to view the world, and that these views are never complete or completely accurate. When talking about pragmatism it has been noted that "pragmatism is concerned with action and change and the interplay between knowledge and action. This makes it appropriate as a basis for research approaches intervening into the world and not merely observing the world" (Goldkuhl 2012, p. 2). Theoretically, this research draws on concepts and ideas that are often associated with pragmatic studies: systems theory, systems thinking, systems science, and system dynamics. Systems theory is more holistic in nature, focusing on a system and its emergent behavior, the whole, rather than the parts within it. One of the most common approaches today that allows for systems theory to be applied is systems thinking. Systems thinking provides a way to approach and study systems, and, more specifically, acknowledges that "system structure is the source of system behavior" and furthermore that "structure is the key to understanding not just what is happening, but why" (Meadows 2008, p. 89). Additionally, the theoretical section of this paper presents an overview of OGD and OGD ecosystems. As OGD has often, but not always, been described or analyzed from an ecosystem-based perspective, it follows that a theoretical lens intended specifically for the study of such systems would be suitable. It is for this reason that the specific systems approach has been chosen for this research. By drawing on insights from the previous literature, this section outlines a six-step process that was used for the analysis of Estonia's OGD ecosystem.

Open Government Data

Whilst there is not yet a widely agreed upon definition for OGD, there are a number of key concepts that appear to be important to the definition, such as freely usable, licensed, government created/provided, and machine readable (McBride et al., 2018b). One common definition states that OGD is "non-privacy-restricted and non-confidential data which is produced with public money and is made available without any restrictions on its usage or distribution" (Janssen et al., 2012, p. 258). In contrast to this techno-centric

definition, the OECD notes that OGD is "a philosophy – and increasingly a set of policies – that promotes transparency and accountability and value creation by making government data available to all" (OECD, 2018). At this point, it is important to look at the name of 'OGD' itself, as "the name of a technology identifies what it means to the people who use it" (Nardi & O'Day, 1999). Interestingly, it appears that a normative value statement is being made here where 'opening' government data is viewed as inherently good. In line with this, Janssen et al., 2012 note that by opening up data the relationship between public sector and the public is changing, where citizens and other stakeholders are becoming empowered by the availability of data. Taking this into account, this paper understands OGD as an open system, influenced by its context and environment, where actors use human understandable, machine-readable, government collected and maintained data to drive transparency and the creation of public value.

While it is argued in the academic community that higher levels of transparency and creation of public value are core to the understanding and importance of OGD, numerous other benefits associated with OGD have been discussed. For example, the Open Knowledge Foundation notes that OGD may lead to new services, innovation, and improved efficiency and effectiveness of government services (Open Knowledge International, 2018) and the European Data Portal highlights three main sectors that OGD impacts: government performance, economy, and social issues (European Data Portal, 2018a). In the scholarly literature, some of the benefits most often studied relate to community empowerment (Huber, 2012; Schrock & Shaffer, 2017), the innovative potential of OGD (Juell-Skielse et al., 2014), the creation of new public services (Foulonneau et al., 2014), and transparency (Corrêa et al., 2017).

In one recent example, (Mcbride et al., 2018), present a case study where OGD was used to develop and co-create new services that provide public value. One of the main findings there was that an approach based on agile and lean development led to a more effective service. The study further highlights that agile and lean development methods appear to play a key role in allowing the successful development of OGD-based co-created public services as they allow for more potential co-creation to occur throughout the iterative development cycles.

Though there are examples of when OGD does provide public value, and these expected benefits have materialized, there are often barriers that inhibit these benefits from occurring. These barriers occur at the data, data user, and data provider level, and can be further classified into barriers related to technical, organizational, legal, and personal aspects (Toots et al., 2017). Users of OGD may have a lack of technical understanding to exploit the data and/or may not have time to properly engage with data if it is not clean (Janssen et al., 2012; Young & Yan, 2017; Zuiderwijk et al., 2012). For those releasing the data, there may be no political motivation or incentive, the benefits may not be understood, transparency may not be viewed favorably, there could be legal barriers to releasing data, and the technical skills may not exist to open up data (Conradie & Choenni, 2014; Gonzalez-Zapata & Heeks, 2015; Janssen et al., 2012; Wang & Lo, 2016). Finally, the data itself may be a barrier if it is not clean, lacks metadata, contains many missing values, and is generally of poor quality (Young & Yan, 2017). In order to overcome these barriers, some proposals have been made, such as showing the positive impact of OGD, demonstrating working examples of services built with OGD, engaging in co-creation, developing a self-organized/bottom-up demand for OGD, and making

OGD a political priority (Foulonneau et al., 2014; Juell-Skielse et al., 2014; Kassen, 2013; Khayyat & Bannister, 2017).

The notion of co-creating public services with OGD has emerged recently in the literature as one of the most potentially powerful methods for increasing the usage of OGD (McBride et al., 2018). Studies have shown that by involving different stakeholder groups throughout the process of public service development, it is possible to achieve higher levels of public value from OGD (McBride, 2020). One of the primary reasons for this is that the availability of OGD lowers the barriers for co-creation, by allowing any user to take advantage of OGD to create services that are meaningful to them. In order to take advantage of this phenomenon, some governments are beginning to look towards encouraging co-creative behavior within the context of OGD by embracing hackathons, encouraging communication and interactions, opening their code bases, and placing a stronger emphasis on interactivity in the service design. This new shift could allow for higher levels of OGD usage, which would, in turn, lead to a higher level of performance when it comes to OGD ecosystems.

Systems Theory Background and Core Concepts

Systems theory focuses on understanding the behavior of a system by looking at it as a whole, rather than at its specific parts, and acknowledges that the behavior of a system is largely driven by its architecture or structure. When talking about a 'system', this paper adopts the definition where "a system is a set of entities and their relationships, whose functionality is greater than the sum of the individual entities" (Crawley et al. 2015, p. 9). Additionally, every system will have a **function**, what it does (performance is also mapped to function, and is understood as how well the system does the thing it is supposed to do), a **form**, what the system is, and **concept**, how form maps to function (Crawley et al., 2015). For OGD ecosystems, the function is normative, decided by the society where the ecosystem exists, however, generally speaking, the function of an OGD ecosystem is likely to be related to the availability and usage of OGD. The form is what the system looks like and how the "parts" are put together; for OGD ecosystems specifically, the form is discussed in more detail in the following section of the theoretical background. Finally, concept is how the system's form is used to achieve the function. In the case of OGD ecosystems, the concept may be controlled primarily by political and societal narratives and is highly context dependent. In order to better understand the performance of a system, system architects and those working with systems theory can draw on insights offered from systems thinking, which is an approach that has been developed to understand better the performance of a system by focusing on its function, form, and concept.

While systems thinking provides a way to understand better the system itself, one must also understand their own and society's 'mental models' as it has been posited that "everything we think we know about the world is a model", yet "our models fall far short of representing the world fully" (Meadows 2008, p. 86). Meadows (2008) argues that it is these models that we use to make our decisions; furthermore, it is these shared mental models that dictate our current paradigm, and, as such, also influence how a system behaves and functions as it is from our shared mental models that the nature of reality and system goals originate. Thus, understanding shared mental models and how they influence the system is a critical step when it

comes to studying and analyzing the performance and behavior of a system. Another important contribution to systems theory is that of system dynamics, which provides a framework to study systems over time and cause change by intervening at specific points (Forrester, 1991). System dynamics posits that "systems of information-feedback control are fundamental to all life and human endeavors" (Forrester 2013, p. 15) and highlights the importance of feedback loops in systems. A feedback loop is either balancing or reinforcing and represents a dynamic way for the system to receive "feedback" as an input into its behavior. The purpose of a balancing feedback loop is to maintain system stability; these often trigger if a system is shocked, their goal is to reverse or oppose change (Meadows, 2008). In opposition to this are reinforcing loops, which focus on growth and evolution and encourage change in a given direction (positive or negative) for a system (Meadows, 2008). By studying the dynamics of a system, and identifying the different loops at play, it is possible to better understand the emergent behavior of a system and also identify potential places to intervene, known as leverage points, to alter its behavior or performance.

OGD Ecosystems

The idea of "OGD ecosystems" is relatively new and is still being actively debated and studied with different models of said ecosystems being proposed. In the academic community, there have been a few different approaches to understanding OGD ecosystems: those originating from a business perspective (Heimstädt et al., 2014b; Immonen et al., 2014b; Kitsios & Kamariotou, 2017), those drawing from sociotechnical perspectives (Dawes et al., 2016; Donker & Loenen, 2017; Harrison et al., 2012; Reggi & Dawes, 2016; Styrin et al., 2017; Zuiderwijk et al., 2014), and those which approach it from an innovation ecosystem perspective (Ham et al., 2015; Juell-Skielse et al., 2014). In order to demonstrate the different understandings of OGD ecosystems, Table 1 has been produced that shows a number of different authors' perspectives on the core characteristics of OGD ecosystems.

(Table 1 about here)

There are two core approaches here. The first, as shown in (Immonen et al., 2014a; Kitsios et al., 2017), looks at the OGD ecosystem as a "black box" of sorts, and focuses more on the different actors that are involved in the ecosystem; these sources tend to lie primarily within the business perspective. On the other hand, Dawes et al., 2016, Harrison et al., 2012, and Zuiderwijk et al., 2014 all take a different approach, looking not just at the individual stakeholders, but also taking into account interactions, relationships, and different environmental constraints. However, what is important to point out here is that all of these papers share the view that OGD must be thought of as a system, with (Styrin et al., 2017) making it clear that from their analysis all OGD ecosystems are "dynamic and evolving". Writing in 2012, (Harrison et al., 2012) put forth their understanding of an OGD ecosystem that consists of government policies, innovators, and users working together with OGD. While the authors do not explicitly outline more precise components of the ecosystem, they do provide great value to the OGD ecosystem discussion through their proposal of "strategic ecosystems thinking", which:

> "presupposes a keen understanding of ecosystem components and the linkages between them, and an evolving appreciation for how the interactions among those components are related to the services, programs, and other outcomes of value that are produced, either within a government organization or by organizations external to government but internal to the ecosystem" (Harrison et al., 2012, p. 923).

The authors further argue that by using "strategic ecosystems thinking" it should be possible to enact change through targeting specific weak points within the ecosystem to encourage a change in ecosystem behavior. It must be pointed out that there is a clear relationship between "strategic ecosystems thinking" and the previously mentioned concepts from systems theory, such as system dynamics and systems thinking. So, when talking about "strategic ecosystems thinking", what is meant is the application of systems thinking to OGD ecosystems. However, in order for this application of systems thinking to OGD ecosystems to be successful, two items are needed. Firstly, a more concrete understanding of the different relationships and behavior of OGD ecosystems, and, secondly, a framework or process for not only thinking strategically about OGD ecosystems, but actually enacting change as well. In regard to the first point, two key ecosystem models stand out in the literature.

Firstly, Zuiderwijk et al. 2014 proposed their model which identified five main characteristics of OGD ecosystems: design, context, interdependences and interactions, participants, and data resources and tools. Based on these characteristics, the authors find that an OGD ecosystem should allow for publishing of data, searching of data, cleaning data, and discussing data. When summarizing how OGD ecosystems develop, it was noted that the development or growth of OGD ecosystems takes place through three main processes: user adaptation, feedback loops, and dynamic interactions (Zuiderwijk et al., 2014). This is interesting, and is also mirrored by (Styrin et al., 2017), who note that OGD ecosystems "occur naturally" in the wild, but it is only possible through promotion, incentivisation, and evolution for OGD ecosystems to grow and prosper.

The second model comes from a more recent study that analyzed OGD ecosystems and was conducted by Dawes et al., 2016. In their research, a model was created which provides a clear overview of OGD ecosystems, taking into account the systemic attributes and parts, as well as the external environmental and contextual influencing factors. This model sees three main actors: OGD providers, OGD users, and OGD beneficiaries. Additionally, the model demonstrates how different factors influence the behavior of the ecosystem. As previously mentioned, one of the key factors for conducting "strategic ecosystems thinking" would be clearer insight into the OGD ecosystem at hand. Thus, for the purpose of this research paper, the model proposed by Dawes et al., 2016 has been used as the starting point to analyze Estonia's OGD ecosystems. In regard to the second requirement (a clear framework or process) a six-step process can be derived from the literature on systems thinking, system dynamics, OGD ecosystems, and "strategic ecosystems thinking".

The six steps of this process are as follows:

1. Model and understand the form, function, and concept of the system.
2. Analyze the shared mental models influencing the system.

3. Study and understand the current behavior of the system.
4. Identify the feedback loops in the system.
5. Intervene in system at identified feedback/leverage points.
6. Watch, observe, and monitor changes in performance/behavior.

In the first step, the model proposed by Dawes et. al., 2016 is used to model and understand the form and concept of the OGD ecosystem. The function and the performance are more subjective and dependent on the goals in a given context for the OGD ecosystem. Steps 2 and 3 are influenced by ideas from systems thinking and systems theory and aim to provide a better understanding about how and why the system modeled in step 1 is performing as it does. Steps 4 through 6 are heavily influenced from systems theory and systems dynamics and focus on identifying the feedback loops within the ecosystem that are responsible for inhibiting or driving the ecosystem's behavior. This entire six-step process can be understood as a process or framework for engaging in "strategic ecosystems thinking". This framework was applied in this research, and an example is given later in the discussion section of the paper. It is argued in this paper that by following this six-step process, researchers, policy makers, or those playing a role in the development of an OGD ecosystem should be able to: firstly, understand their own OGD ecosystem better; secondly, analyze how different mental models affect the performance and function of the ecosystem; thirdly, understand the importance of feedback and non-linear behavior for OGD ecosystems; and, finally, to generate the confidence and capability to enact strategic change in OGD ecosystems by making specifically targeted interventions that aim to improve the performance of the ecosystem.

In order to further operationalize and guide the research, some core hypotheses were formulated that drew on insights offered from the proposed six-step framework for engaging in "strategic ecosystems thinking" and by reflecting back on the insights offered from the theoretical background. These hypotheses are all related to the goal of improving the performance of OGD ecosystems and are as follows:

1. Due to the systemic nature of OGD, a **holistic approach** addressing the different institutional, political, social, and technical dimensions is likely to support both the provision and usage of OGD and thus lead to higher levels of performance.
2. With a view to enhancing the interaction of stakeholders within the OGD ecosystem (data providers, users, beneficiaries), and thereby encouraging the production of public value from OGD, following an approach based around **co-creation** for an OGD ecosystem should lead to higher levels of performance.
3. Meaningful co-creation requires high awareness and easy access to the co-creation process. Hence, higher levels of **openness and transparency** of the process should lead to higher levels of performance.
4. For the purpose of fostering feedback loops in the ecosystem, an iterative approach based around **agile and lean development** is likely to lead to higher levels of performance.
5. By **understanding the system**, it should be possible to identify the present feedback loops and make strategic changes to encourage positive reinforcement loops to drive higher levels of performance.

Methodology

The action research intervention started in February 2018. However, preparatory research that made the intervention possible was conducted already in 2016-2017 when the researchers were engaged in studying and working with Estonia's OGD ecosystem as part of the EU Horizon 2020 funded OpenGovIntelligence project. Throughout that project the researchers were directly engaged with a wide variety of stakeholders to understand how OGD was being used in Estonia and, more specifically, how new services could be built through the exploitation of OGD. The preparatory stage in 2016-2017 involved collecting data from national stakeholders on their perceptions of the barriers and gaps in the Estonian OGD ecosystem through an online survey, personal interviews and workshops (see the details in Table 3). These data were reused and expanded on later during the action research initiative.

In November 2017, the Ministry of Economic Affairs and Communications (MoEAC, the Estonian ministry responsible for the development and maintenance of Estonia's OGD initiatives and information society) launched a procurement titled "Promoting the Use of OGD". Their aim was to engage an external partner to support the implementation of Estonia's open data policy and help improve the provision and use of OGD in the country. The contract for the three-year collaboration (2018-2020) was won by Open Knowledge Estonia, a local Estonian NGO founded at the end of 2016, who then approached the researchers with an explicit goal of bringing research competence to the project team. The action research for this paper started at this stage.

As the researchers had the opportunity to shape the development and implementation of the project activities, a research design based around action research was adopted. Action research starts from an understanding that "complex social systems cannot be reduced for meaningful study" (Baskerville 1999, p. 3) and "aims to solve current practical problems while expanding scientific knowledge" (Baskerville & Myers 2004, p.329). Action research has been deemed an acceptable methodology when the researcher is 1) actively involved, 2) the knowledge can be immediately applied, and 3) the research links theory and practice (Baskerville, 1999). Action research is generally conducted following a five-stage iterative model consisting of diagnosing, action planning, action taking, evaluating, and specifying learning (Baskerville, 1999). This five-step iterative process was adopted for this research and the overarching approach is demonstrated on Figure 1.

At the start of the research, an overarching understanding of the as-is situation was informed primarily from two sources. Firstly, the researchers were able to directly provide input due to their experience and previous research on the topic. Secondly, in the procurement set out by the MoEAC, a list of performance goals was set out (see Table 1 below). While each of these key performance indicators addresses something different, be it political engagement, the open data portal, or news and dissemination, they all related back to the Estonian OGD ecosystem. Thus, an overarching research question was drafted that reflected the systemic nature of OGD in Estonia and the key expectations from the MoEAC: "How to improve the performance of Estonia's OGD Ecosystem?". The definition of 'performance' adopted for the purpose of this

research relates back to the procurement requirements and to the definition offered in the introduction of this paper. In short, based on the current theoretical understanding of the key elements of OGD ecosystems and the ministry's project objectives, ecosystem 'performance' was contextualized as involving the dimensions of 1) OGD supply, 2) OGD usage, and 3) communication, interaction and linkages between OGD suppliers, users, and beneficiaries where higher levels of each would be associated with higher performance (these stakeholder category groups mirror those proposed in Dawes, et. al., 2016). The action research thus set the objective of 1) increasing OGD supply in Estonia, 2) increasing OGD use in Estonia, 3) improving communication and interaction between OGD stakeholders. The goals of the project and the related performance categories are shown in Table 2.

(Table 2 about here)

Starting from this foundation, the researchers continually iterated through the action research framework in a systematic way. When going through the five stages of the action research process depicted on **Error! Reference source not found.**1, the six-step process of analyzing and improving OGD ecosystems introduced in the theoretical section was applied in the following manner:

- In phase 1 (action planning), the *as-is* of the Estonian OGD ecosystem was analyzed to understand the form, function and concept of the system, as well as the mental models influencing the system (based on stakeholders' perceptions), current behavior and feedback loops in the system. This corresponds to steps 1-4 in the six-step framework described above.
- In phase 2 (action taking), the researchers collaborated with civil society and government policy-makers to intervene in the system at the identified feedback/leverage points. This corresponds to step 5 in the six-step framework.
- In phase 3 (evaluation), changes in performance/behavior were monitored and evaluated. This reflects step 6 in the six-step framework.
- In phases 4-5 (specifying learning and diagnosing), next steps of the intervention were planned and the approach adapted, if needed, to address the observations from the evaluation phase.

Once a month, the researchers met together with MoEAC to discuss what had been done in the past month, what the results were, what went well, what did not, and then the next month's activities were planned. The results of these meetings were made publicly available on GitHub, where anyone was able to see closed issues and future development goals. The development was heavily influenced by agile and lean development methodology with sprints being defined and explicit tasks being developed and co-created between parties. This development approach is shown in Figure 2.

(Figures 1 and 2 about here, side by side)

The evaluation of the taken actions took place in a variety of ways. There was direct feedback from the MoEAC, feedback received from experts involved in Estonia's public sector OGD working group, feedback

received from workshops and experts on OGD in Estonia, and also via comments through social media platforms and collaboration workspaces such as GitHub. After each month's sprint the specific results and learned knowledge were recorded. Based on these data, an ongoing monitoring of the situation took place once a month, while a more thorough evaluation of the results of the intervention was conducted in August-September 2019, when the researchers analyzed the overall progress in relation to the initial project and research objectives.

In terms of data collection, a wide variety of different sources have been used: direct participation, GitHub issue and pull request history, semi-structured interviews, official government policy documents, internal government discussions, meeting minutes, workshop feedback, and survey information. Overall, a large amount of empirical data has been gathered and consulted in order to ensure higher levels of internal validity of the study and to better support and relay the research to readers. The data sources, along with their role in the research, are summarized in Table 3.

(Table 3 about here)

One of the main strengths of the action research approach – researchers' involvement with the case they are studying and unique access to insider information – also entails possible limitations and risks that may challenge the validity of the research findings (Davison et al., 2004). The most obvious one is the risk of subjectivity and bias in interpreting the results of the intervention. In order to mitigate the risks and minimize issues with internal validity, the research made use of multiple sources of evidence to validate the findings (see Table 3 above). The triangulation of data sources and collection and analysis methods is commonly considered an appropriate counter-mechanism to validity issues, which often arise in studies involving the examination of one single context. When validating the findings, the research team also heavily relied on evidence obtained from external, objective sources, such as the EDP's and OECD's comparative evaluations of the state of OGD in different countries.

Estonia's OGD Ecosystem

OGD Ecosystem Before Intervention

Setting. Estonia, a small country of 1.3 million inhabitants, has the reputation of being one of the world leaders in digital government (Kalvet, 2012; Kitsing, 2011). Despite Estonia's high level of e-government development, historically it has been one of the worst performing European countries when it comes to OGD (McBride et al., 2018a). At the same time, Estonia is generally considered to provide good conditions for public access to government information – it has a Public Information Act in place since 2000 and consistently receives the highest scores for government transparency in international rankings such as the Freedom in the World report (Freedom House, 2017). The main problem with regard to public sector information has thus not been citizens' access to information as such but in government data being mostly

available in formats which do not allow for downloading, easy processing and reuse of the data (McBride et al., 2018a).

One of the keys to understanding the public governance and policy-making setting in Estonia is its small state context. Estonia's tiny population has been associated with particular characteristics of public administration and policy, such as a high level of personalism and reliance on informal structures rather than highly formalized processes (Sarapuu, 2010). This may explain why a small group of civil society activists and individual experts had been able to acquire an important role in influencing the development of OGD in Estonia even before the start of the Open Knowledge Estonia's official cooperation project with the MoEAC.

Global and national influences. The fact that OGD entered Estonia's policy agenda in the first place is largely due to international influences. While digital access to public information existed since the early 2000s, the concept of OGD as it is understood today was first introduced into policy discussions through the global Open Government Partnership process, which Estonia joined in 2012. Estonia's OGD policies have also been influenced by the OECD's analyses, the G8 Open Data Charter and EU-level interoperability initiatives such as the ISA program (Vabariigi Valitsus, 2014). Although there was external pressure to conform and offer OGD, Estonian policymakers still saw little value in OGD and made minimal efforts to improve.

Policies and strategies. Due to Estonia's limited resources, its e-government policies have been highly driven by the government's goal of creating a minimalist and efficient state (Kitsing, 2011) and, as "OGD has been viewed as a tool for transparency and openness towards the citizenry instead of something that could easily generate revenue or savings" (p. 622), OGD has not been high on the government's priority list (McBride et al., 2018a). However, due primarily to external pressure from the international community and some local experts and civil society, OGD was taken up in the policy agenda in 2012. This led to the adoption of a Green Paper (government policy document) on OGD and the subsequent release of a national OGD portal later on in 2015. While the creation of the portal and official policy guidance on OGD was being created, the Estonian Information System Authority created a new funding opportunity to support the publication and reuse of OGD. However, until the closure of the scheme in the summer of 2019, these funds were severely under-used by public sector organizations.

By 2015, Estonia therefore had a legal framework for OGD, a policy strategy in the form of the Green Paper, a central repository for OGD and funding measures. However, due to the lack of active policy coordination and limiter human resources at the MoEAC, public sector organizations were largely left to their own devices in publishing OGD and made very little actual progress in complying with the policy.

Data publication. Until the start of this research, public sector organizations had mostly been passive in publishing OGD. At the beginning of 2018, only 70 datasets were available in the national open data portal. Estonia's IT interoperability framework and the Green Paper required data holders to create an open data catalog on their official website with all information and metadata on their open data as well as online forms

for requesting open data. Data holders were also required to link their website to the national OGD portal. In many cases this was not done in practice – individual organizations such as the Land Board had a number of open datasets available but not linked to the portal. As an example, the Land Board provided their own website and online (map) applications for accessing their data but the data was often not available in downloadable and machine-readable formats. Therefore, in many cases, users interested in getting access to public data needed to go through a cumbersome process of individually e-mailing the data holders to request the data and sort out the conditions on which the data could be used. In the experience of some the authors of this paper, this process could take as long as several months.

Previous research has identified the existence of the national interoperability infrastructure, the 'X-Road', as one of the reasons for the lack of open data (McBride et al., 2018a). As government institutions commonly use the secure data exchange layer X-road for exchanging data and reusing data within the public sector, they have lacked the urgency of publishing their datasets as open data.

Data use. At the beginning of 2018, the national OGD portal contained information on four applications that had used OGD. Some more reuse cases existed in practice, such as some applications that were developed in 48 hours during an Open and Big Data Hackathon organized by the MoEAC at the end of 2016. However, almost all of them remained one-off exercises which were never continued after the end of the hackathon. Government institutions themselves were also providing data-driven applications and services to the public (e.g. the Land Board's map applications or the Ministry of Finance's overview of state budget). However, the data used in these applications was often times not 'open' and reusable by other parties. The lack of open data reuse was of course quite natural given the low availability of OGD to begin with.

Feedback and communication. One of the core weaknesses in Estonia's OGD ecosystem was the lack of feedback and interaction between OGD users, OGD providers, and OGD beneficiaries. As a characteristic of a small state, some informal and personal communication existed between individual people working with OGD in the government or civil society. Occasional events such as the Open and Big Data Hackathon in 2016 served as platforms for dialogue and collaboration but the feedback mechanisms were not strong nor sufficiently institutionalized to create a genuine understanding of the mutual needs and possibilities on both sides.

Benefits. Writing in 2017, researchers reported that the benefits of OGD were poorly understood in Estonia (Toots et al., 2017). Due to the existence of the data exchange layer X-Road and lack of well-known cases of OGD reuse, Estonian experts and policymakers remained skeptical of OGD being able to provide benefits that would exceed the costs of opening the data. Although the Green Paper mentioned several potential benefits of OGD based on international research, the government had made no attempt to develop an approach for understanding the benefits of OGD in the Estonian context.

Identified Weaknesses

Based on the initial analysis of the system, there appeared to be a few areas of weakness that were limiting the performance of Estonia's OGD Ecosystem. One of the clearest weaknesses related to the **prevailing mental model** in place in Estonia that viewed OGD as outdated, or something not needed for a digital society. For example, Taavi Kotka, the Estonian CIO often credited with bringing Estonia's digital government solutions to the world, noted that "Open data in the meaning that you're actually going to take data out from the database and put it somewhere in the portal, it's just so last century" (MeriTalk, 2016). To some extent, this view made sense based on how Estonia's digital society operated and interoperability through the X-Road platform allowed government agencies to freely and easily exchange data. In previous studies, the existence of the X-Road for the movement of data has been shown to be one of the biggest (mental) barriers when it came to the use or release of OGD (Toots et al., 2017). As OGD was not viewed as a high priority area and, by many, viewed as some form of backwards progress, many government agencies did not feel the need to participate in the release of OGD.

A second weakness identified relates to the **legal situation** of Estonia. While, in fact, organizations are required by the Public Information Act to make any public data available if it is requested, many organizations viewed it as easier to be *reactive*, only providing data when requested, rather than *proactive*, providing data in advance. As there is no law in Estonia requiring government organizations to provide access to their OGD via an open data portal, there was little to no incentive to do so. Secondly, due to the nature of Estonian law, any sort of license applied to an OGD set, for example CC4.0, technically becomes more restrictive. Due to the ambiguity of licensing of OGD in Estonia, many organizations have been hesitant to release data or provide a license, thus limiting the **reusability** of OGD.

The third identified weakness is related to the **awareness and use of OGD**, both of which were low. The first real attempt at boosting the use of OGD came in 2016, when the MoEAC organized a hackathon that focused on using OGD. During the organization of this event, it became clear that there were some OGD sets available in Estonia, but they were not in the same place. In order to remedy this, a crowd-sourced Google document was created that listed different available datasets and where they could be found. Interestingly, almost none of the datasets used were actually available on the official OGD portal of Estonia. When it comes to awareness of OGD, this remained low across businesses, civil society, and at the governmental level. Since the data did not exist, people could not use it or did not know what OGD meant. On the private sector side, there was some knowledge of OGD, but use remained limited due to there being a small supply of OGD that could be used, and, additionally, because of Estonia's small market size no viable business models had been found to utilize OGD. At the governmental level, as OGD was not viewed as a priority, there was little to no use of it, no successful examples of OGD creating public value in Estonia, and little demand for it. It was not given much attention, even though in 2014 the Green Paper on OGD was released and in 2015 the first OGD portal was launched. Finally, it must also be noted that, while funding and cost is often highlighted as a barrier for the release of OGD, this was not the case in Estonia. In fact, a

fund was created with money available explicitly created to help agencies open up their data, but this fund received almost no use, primarily due to lack of interest.

The final weakness that was identified was technical in nature and related to the **OGD portal** of Estonia which was built in 2015. This portal was built following a waterfall-based approach, released to the public, but not maintained or updated. Additionally, as there were no requirements for government agencies to put their data on the portal, its use remained minuscule, with only 10 out of some 3,000 government agencies adding their data there at the earlier stages (Kuul, 2015). The portal was based around the United Kingdom's Drupal – CKAN OGD Platform and allowed for ministries to add their data to the OGD Portal. However, due to lack of maintenance, the portal quickly broke down and many features that made CKAN useful, such as data harvesting, were never used. Interestingly, as noted previously, many OGD sets were available, just not on the portal. Thus, it was hypothesized that one of the main reasons for the lack of use of the OGD portal was due to either technical confusion about how to access and add data to the portal, or due to the extra time required to invest in keeping data uploaded and up-to-date as it was something not readily-includable in the normal business process. Since the portal did not have many datasets available, it also did not receive a high number of users, thus continuously driving a reinforcement loop in a negative direction. That is to say, there was no data available, so people could not use data, this then appeared as lack of demand, which further drove lack of access to data.

Though the weaknesses here are discussed on their own, what is clear is that many of these weaknesses were being reinforced in a negative fashion via **feedback**. So, any attempt to address these weaknesses to improve the performance of Estonia's OGD ecosystem needed to be systematic in nature and, also, aim at either the creation of new positive reinforcement loops or changing the negative reinforcement loops into positive loops.

System Interventions

As previously noted, the initial Estonian OGD Ecosystem suffered from a negative reinforcement loop between OGD users, OGD providers, and OGD beneficiaries. Though funding was available, due to the lack of political interest and high levels of technical complexity, there was no real incentive or requirement for data holders to make their data available on an OGD portal. On the other hand, potential OGD users did not know what data existed or what the quality of the data was and, as such, were unable to clearly understand what data they could potentially access or how it could be used. Thus, data that was published and made open was often times due to a sense of duty, a strong belief in openness by an agency's employee, or due to an explicit command. Interestingly, there is one primary exception to this rule, and that is data maintained by the Estonian Land Board, which as part of the INSPIRE initiative ran their own fully functional OGD portal due to EU regulations, further demonstrating the power that proper legal frameworks can have on driving the release of OGD.

In order to counter this feedback loop between OGD users, OGD suppliers, and OGD beneficiaries, an explicit feedback mechanism was designed to allow the data holders to have a more functional dialogue

with the open data community. As the OGD ecosystem is, by definition, a complex adaptive system, the feedback loop was designed to be lightweight and adjustable to that it can be easily developed and altered as the system reacted. This feedback mechanism took the shape of a GitHub repository, where all discussions related to particular datasets available, or requests for datasets not yet available, could be harbored and directed to the appropriate data holders through a series of flags and tags. In addition to this, a grooming process was implemented that intended to go over each data request and channel them to the appropriate implementation mechanisms. As part of the GitHub issue-tracker process, data holders (government agencies) have created GitHub accounts and play an active role in the discussion process, these GitHub accounts are mapped to the organization and the employee to ensure transparency. For example, if someone requested data from Ministry A, the request would be sent to Ministry A's GitHub contact and dealt with. Interestingly, while initially designed to facilitate communication between data holder and data user, what has been noticed is a strong bottom-up/crowdsourced approach, where a data user asks a question or makes a request and other users step in to provide answers. This has, thus, not only helped to drive communication between OGD users, OGD providers, and OGD beneficiaries, but also helped create new interactions between data users thus expanding the network of Estonia's OGD Ecosystem's data users. Between May 25th of 2020 and February 16th 2017 a total of 237 issues have been filed, with 137 of them having been closed and the other 100 being discussed or waiting for answers/updates still. Although the number of issues processed is not large in relation to the weeks that have passed, the issue tracker has served as a key condensation nucleus for the OGD community, the data holders, policymakers, and drivers of the ecosystem. This is signified by numerous issues being followed by long threads of conversation involving members of each of the mentioned stakeholder groups.

As Estonia's OGD Ecosystem began to grow, a shift in the mental model of OGD by the government in power became increasingly clear. In September of 2018, the Minister of ICT and Entrepreneurship, Rene Tammist, said that if Estonia wanted to advance and truly be a leader in e-Government, OGD must be made a priority (Tammist, 2018). Around the same time, Estonia hired its first Chief Data Officer, in August of 2018. This shift in understanding about the importance of OGD led to a large increase in the awareness of OGD and also led to many articles being published in Estonian media that either discussed OGD or used OGD sources for data journalism. While, undoubtedly, there are other drivers behind the political and mental model shift about OGD, it is also clear that the rapidly developing ecosystem played a role. One exchange clearly demonstrates this shift. On 14th January, an article discussing Estonia's lackluster performance on international rankings related to OGD was released (Lõugas, 2019b), and, the same day, five hours later, the Chief Data Officer responded to the media noting that there is now an active GitHub environment with clear demand for OGD, and that agencies in Estonia were not fulfilling their obligations to offer OGD, so, from that point, agencies that received structural funds from the European Union and were legally obligated to open up their data would be required to do so (Lõugas, 2019a). This shift also has been influenced by Estonia's commitment towards becoming an AI-driven government, known as the Kratt initiative, which will require data of higher quality to be available and maintained within the country. There is, therefore, increased focus on data governance, data maintenance, and data availability to lay the framework for future

AI-based projects within Estonia. This shift created a new area of feedback in Estonia's OGD Ecosystem, where there was now a political and legal requirement to open up data, thus helping to drive the availability of new datasets.

Another faulty feedback mechanism identified was related to the OGD portal itself. At the beginning, it was not clear if the operating portal was the problem, or rather the lack of awareness and lack of political priority was causing low use. Thus, the initial idea was to simply update and maintain the OGD portal. However, it quickly became clear to all involved that there were numerous severe technical challenges facing the first OGD portal and it was only possible to update and maintain it through a relatively complex and costly process for both the OGD holders and the OGD portal maintainers. These barriers were both technical (responsiveness, source code problems, architectural issues, technical debt, lack of flexibility, etc.) and process-related (authorization process for data publishers, access and handover, strict publishing criteria, etc.). As a result of these issues, the portal was slow to respond to the rapidly growing expectations and needs of the community. Thus, it was decided to expend energy on the creation of a more transparent, agile, and faster-moving feedback mechanism, a new OGD portal based around JKAN (https://jkan.io/, accessed 29.05.2020). As stated in the methodology, the development of this portal took place following an approach based on lean and agile development. The first version was released in November 2018 as an MVP, and, since then, more development sprints have been conducted, with each sprint improving the quality of the portal and taking into account different requests, feedback, and needs from both OGD users, OGD providers, OGD beneficiaries, and the government. As lack of transparency, low responsiveness to change, and lack of flexibility were identified as key inhibitors of Estonia's OGD Ecosystem and the previous portal, the technology used for the new portal was explicitly chosen for its radical transparency (the entire codebase, datasets, changes, uploads, dataset deletions, etc. are available as open source online for anyone to contribute to or monitor), simplicity, and the speed of development. Additionally, the portal is front-end only, allowing for the portal to pivot easily as needed to keep in touch with the demand of the ecosystem. It was noticed that almost every Estonian government agency had some form of OGD available on their own webpage, so, the decision was made to simply create a portal that served as a directory, allowing Estonian government agencies to keep their data on their own servers, and simply have users directed there from the Estonian OGD portal. This minimized the business process disruption to Estonian government agencies (simply add a link to your dataset once and the data will always be up to date) and allowed for quick and rapid growth, thus providing increased levels of performance and providing higher levels of value to the OGD Ecosystem.

The transition to the new portal did not align well with the status quo both in Estonia and in the international community about how OGD should be done, thereby facing high levels of resistance initially. However, by January 2019 (3 months after the launch of the MVP), it became clear that the portal was seeing increased levels of usage and engagement with a 95% increase in average session duration, a 32% increase in session count, and a 30% increase in pages per session. Additionally, as of April 2019 (6 months after the launch of the new portal), the number of datasets available increased from 70 to 170 and the

number of applications using OGD from 4 to 17. Both figures increased even more throughout the next year (As of May 2020 there are 61 applications and 582 datasets on the portal). These improvements also materialized as a large increase in Estonia's ranking in the European Data Portal's Open Data Maturity Index where Estonia increased from 27th to 14th place in the rankings (European Data Portal, 2019). Thus, by decreasing the barriers to adding data to the portal, increasing transparency, and encouraging interaction and communication, the OGD Portal of Estonia has rapidly grown and seen increasingly high levels of performance.

While the previous changes happened primarily online, the final change implemented happens in-person. Previously, there was little face-to-face discussion about OGD or events focusing specifically on OGD. Thus, three different forms of face-to-face interaction have been organized to help bolster Estonia's OGD ecosystem. At the higher political level, an expert working group has been established that brings together high level stakeholders from Estonian governmental agencies to discuss OGD and strategize about approaches. The working group meets three times a year and shares information via e-mail in between meetings. Secondly, public events have been organized, such as the annual informal Open Data Day and the more high-level Open Data Forum, which allow for anyone interested in OGD to listen about developments in the OGD ecosystem and interact with other data users and holders, thus further increasing the interaction between members of the ecosystem. In the two years that the Open Data Forum has been organized, more than 100 participants from the public, private, non-governmental and academic sectors have taken part each year. Finally, the grooming sessions for the open data issuer tracker are open to the public, with any interested party able to come and discuss the current issues related to OGD availability and actively contribute to Estonia's OGD ecosystem. Thus far participation has been low in this area, but is slowly increasing with members of private sector companies and concerned citizens increasingly attending the meetups.

Discussion and Findings

The primary aim of this research was to both simultaneously improve the performance of Estonia's OGD Ecosystem, and also to research in an academic manner whether or not an ecosystem-based approach could provide a viable framework for OGD ecosystem performance improvements. This research offered a conceptualization of performance for OGD ecosystems on a three-dimensional basis – OGD supply; OGD usage; and communication, interaction, and linkages between OGD suppliers and users – where higher levels of these dimensions would indicate a higher level of performance. Reflecting back on the status of the OGD ecosystem at the beginning of the research, as demonstrated in Table 2, it is possible to see that a large increase in performance can be identified:

- The number of datasets has increased from 70 to 582;
- There is a large increase in the usage of the OGD portal in terms of unique users (Before the procurement, in the period of January to May 2017 there were a total of 6300 unique users, during the same period in the year 2020 there were 12877 unique users, an increase of 204%);

- The number of applications on the portal has increased from 4 to 61;
- A public sector working group has been reestablished and meets three times a year at a minimum;
- There are numerous OGD events being held, including those coming up in a self-organized manner, with no involvement from the government or OKEE;
- News articles have emerged on OGD in Estonia. Primarily these cover blog posts published to the open data portal, current events in OGD, new applications, or different political issues around the availability or lack thereof when it comes to OGD;
- There are two primary Facebook pages for OGD in Estonia, OpenESTdata, which has 635 members and facilitates discussion about open data in Estonia, and Open Data Estonia, which has 738 likes and serves as a central information point for events and updates about OGD in Estonia. The number of participants in these communities has substantially increased but not yet reached the procurement goal (1000);
- Estonia has increased in the international rankings. In the European Data Portal's Open Data Maturity report, Estonia has risen from 27th to 14th place (European Data Portal, 2019).

In addition to this, the source code for the portal itself is used and viewed widely, with both government employees and OGD data users making pull requests, raising issues, and providing suggestions on how to improve the overall quality of the portal and the OGD available. There has been empirical examples of citizen or interested stakeholder input creating value for the OGD portal through their suggestions, and this is only possible due to the transparent and open-source nature. This, when combined with the online issue-tracker discussion area, which was highlighted as a positive innovation in a recent OGD report (Blank, 2019), has led to a strong network of data holders and data users actively pushing for more and better OGD in Estonia. Interestingly, one of the unintended side effects of this work has been the rapid spillover effect with OGD being actively taught to government ministers, in university education, and leading to the creation of new courses. Furthermore, awareness in Estonia about the topic of OGD has also grown rapidly as local media outlets have begun covering the topic and even beginning to utilize OGD in their data journalism efforts. Data users have also been able to drive important conversations in Estonia through their use of OGD. One such article by Peek, 2018 demonstrated how many companies at the same address owed tax debt, this led to multiple interviews and in-depth investigations by the mainstream media. Finally, the in-person events relating to OGD have also become increasingly popular: the last Open Data Forum event had over 200 people express interest in attending, but there was only room for 100, further demonstrating the current interest about the topic in Estonia.

While the results are promising, what is likely to be of more interest is the *process* that was undergone to get to this point. To this end, the research framework that was adopted to influence and change the performance of Estonia's OGD ecosystem does seem to be effective. This framework consisted of six main points:

1. Model and understand the form, function, and concept of the system: For this stage, the researchers adopted the model put forth by Dawes et al., 2016, which was effective for understanding the form and concept of the system. The function and performance was more specific to Estonia's context.

2. Analyze the shared mental models influencing the system: With the initial model in place, it was noticed that there was a shared mental model among Estonian government ministries that OGD was not needed or was even an antiquated idea. Thus, one of the most important steps of the research was to actively change this mental model. This was done by integrating the importance of OGD into Estonia's identity as an e-State, where OGD became a core component of this identity, thus becoming something necessary rather than optional.

3. Study and understand the current behavior of the system: At the beginning of the research, the system was not functioning or performing well. There was a limited level of usage. OGD users, OGD providers, and OGD beneficiaries were not communicating, and there were almost no examples of actual impactful use cases of OGD in Estonia.

4. Identify the feedback loops in the systems: three main negative reinforcing loops impacting the performance of Estonia's OGD ecosystem were identified: 1) communication between OGD users, OGD providers, and OGD beneficiaries, 2) mental models associated with OGD, and 3) the use of the OGD portal by data users and data holders.

5. Intervene in the system at identified feedback/leverage points: As these three feedback loops were self-destructive and reinforcing negative behavior, interventions were targeted at these points. Firstly, it was clear that communication and flow of information was key. To this end, communication between OGD users, OGD providers, and OGD beneficiaries was set up through numerous mediums, both online and in-person (such as increased events, open source of the OGD portal code, and the open data issue tracker). Other ways of addressing communication and dissemination issues included writing blog posts that dealt with societally relevant topics and relied entirely on OGD, issuing press releases, and building applications that used OGD. Another intervention targeted the mental models that were inhibiting the usage or release of OGD. While this was addressed via increased dissemination about OGD, another intervention targeted the legal compliance of organizations with regards to opening up their data by reminding governmental organizations of their legal obligation to open up data. This helped to change the behavior of many organizations. In regard to the loop associated with the portal, a new light-weight solution was developed in a way that reduced its burden on data holders while simultaneously improving the accessibility of data for data users.

6. Watch, observe, and monitor changes in performance/behavior: As it stands, the changed feedback loops appear to be positively reinforcing the performance of Estonia's OGD ecosystem driving higher levels of use, more data, more applications, and more interaction between OGD users, OGD providers, and OGD beneficiaries.

Though this research presents results from Estonia, the researchers argue that this framework should be useful for any stakeholder who wants to understand better or enact change within their own OGD ecosystem. Reflecting back on the initial hypotheses, it is possible to make some claims that, based on this

case, appear to be empirically validated. In regards to the first hypothesis, it does appear to be the case that a holistic approach is beneficial for increasing performance in OGD ecosystems. By decreasing barriers to the access of OGD, encouraging transparency, increasing awareness, and creating events that focused on OGD, it raised it as a political priority, which led to increased levels of data availability, which further drove usage and awareness.

Similarly, in regard to the second and third hypotheses, by maintaining the source code in an open-source manner and by encouraging interaction and user involvement, stakeholders played a direct role in helping to develop the OGD ecosystem, which further created a feeling of ownership or importance. By utilizing GitHub for the OGD portal, every government agency had to have an individual create the datasets on GitHub, and interact with citizens on GitHub about OGD, it made something that had previously been an abstract or unpopular concept more tangible, the data owners wanted people to use their data, they wanted to know how it was used, and they wanted to look good publicly. On the non-governmental standpoint, citizens and businesses were able to easily access and communicate with data owners and thus played a direct role in helping to open up data, and, through the use of data, further demonstrate its value.

The fourth hypothesis claimed that an iterative, agile, and lean development approach would lead to higher levels of performance. By decreasing the development time, it was possible to adapt easier to stakeholder feedback, ensuring that the portal was able to do its job, providing data, in as an efficient way as possible. Interestingly, one side-effect of higher levels of transparency and increased attention given to OGD has been the **negative feedback** received by users which has effectively led to even **higher** levels of engagement and performance. As the initial OGD portal was released as an MVP, users noticed where the shortcomings were, and actively provided feedback or made direct contributions as well, improving the overall quality and performance of the portal. In a similar vein, those who felt that they should not have to open up their data or those who demanded more data than were available, began to contribute to discussions at in-person events and online at even higher levels.

Finally, hypothesis five, argued that it is possible, by understanding the parts and behavior of the system, to identify where feedback loops did or did not exist. In the case of Estonia, three primary feedback loops were identified as causing negative behavior in the system 1) lack of feedback and interaction between OGD users, OGD providers, and OGD beneficiaries; 2) the mental models associated with OGD; and 3) the OGD portal's behavior. With these feedback loops identified, it was possible to propose systematic changes that would hopefully alter the behavior and lead to improvement in performance. These changes focused on increasing communication, interaction, and adapting to current data owner business practices, thus removing paint points from the OGD users, OGD providers, and OGD beneficiaries which encouraged increased levels of information flow and interactivity.

Conclusions

The aim of the research in this paper was to answer the question: "How to improve the performance of Estonia's OGD Ecosystem?" and provided an overview of how Estonia's OGD ecosystem was transformed

in a systematic way by drawing on ideas from Systems Thinking, Systems Dynamics, and Systems Theory. Starting from an understanding that Estonia's OGD ecosystem was performing poorly and could be improved, a systematic approach was undertaken to understand why this ecosystem was not performing as one would expect, especially in a country that is known internationally as a leader when it comes to all things "E".

Previous research has identified key drivers and barriers that effect OGD, but often times these barriers and drivers are viewed individually, not within their systemic context. Thus, it was argued that in order to truly understand the issues facing an OGD ecosystem, a more systemic approach was needed. To this end, the authors adopted a previously constructed model of an OGD ecosystem which provided an overview of the different environmental and systemic actors and relationships and provided a strong starting point for the analysis of Estonia's OGD ecosystem. Dawes et al., 2016 posited that their model should aid and assist those who wish to design, plan, analyze, or understand OGD ecosystems and, to this end, the research conducted here does appear to validate their model.

While the research question for this paper is highly focused and relevant for Estonia itself, results of this research appear to be of scholarly value and relevant for any stakeholders involved in OGD as it makes new and relevant contributions to the current literature and understanding about OGD ecosystems. The first contribution of the paper is its role in empirically validating that an ecosystem based approach to OGD does indeed appear to be useful when it comes to enacting strategic change in OGD ecosystems. The ecosystem approach allows for a more in-depth understanding to be gained of how different interactions and relationships influence of the system at large and assists researchers in not only identifying the parts of the ecosystem, but understanding how their interactions effect performance. The second contribution of the paper is the development of a six-step framework that draws on systems thinking, system dynamics, and OGD ecosystems to propose a process for understanding OGD ecosystems and make strategically targeted interventions to achieve performance gains. Additionally, this framework was mapped back onto the action research framework shown in Figure 1, which should allow for other researchers interested in the process to replicate it.

A third contribution of the paper is related to the conceptualization of performance as it relates to OGD ecosystems. Performance is defined as consisting of three parts: OGD availability, OGD usage, OGD communication. These three aspects behave in a systemic/dynamic way, that is to say, they are not linear. An increase of X in OGD availability does not necessarily lead to an X increase in OGD usage. It is, therefore, important to gather a deep understanding of the OGD ecosystem, utilizing the framework in the second mentioned contribution, to understand how small changes in each of these metrics effects the other. Finally, the fourth contribution, is the identification of what appears to be a key component of OGD ecosystems: feedback loops. This paper highlights the importance of identifying where feedback loops currently exist, or where they should exist, but are currently absent. Following this identification and understanding, it is possible to make targeted changes to these loops that should help to change the behavior of the system at large. In this paper, three primary loops were identified and targeted for manipulation.

In addition to these contributions, based on the initial results of this research, it is possible to make some initial insights that are likely to be useful for anyone interested in studying or working with OGD ecosystems:

1. Mental models are important. If the mental model does not support the goal of the ecosystem, change and performance is unlikely to occur.
2. Change the rules and challenge the paradigm if needed, sometimes the status quo limits a system's ability to function and perform as it should.
3. While top down political support is important, it is also possible to drive higher levels of performance by designing a system to support self-organization: encourage new ideas, new ways of participation, and new ways of thinking.
4. High levels of transparency and decreased barriers for co-creation help to create a stronger network within the ecosystem, a sense of ownership around OGD, and increase performance.
5. Communication, discussion, and feedback are key. Interestingly, sometimes negative feedback can be one of the strongest drivers, by bringing awareness to the situation and encouraging stakeholders to participate.
6. Releasing an MVP and following an iterative/agile development approach encourages feedback and communication.
7. A weaker technology that reinforces the desired behavior of the system appears to be better than a stronger technology that goes against the desired behavior of the system.
8. Understand the location and direction of reinforcement loops. By encouraging positive reinforcement feedback or changing the architecture of the system to include new positive reinforcement loops, it is possible to experience performance gains.
9. Make sure information is flowing. If information is not moving, or inadequate/incomplete information is being used, the system will not function or perform properly.

The conducted research was unique in nature in that it represents an action research approach that provides empirical evidence of how an OGD ecosystem of an entire country may be transformed. Furthermore, it documented and created a theoretically grounded framework based within action research so that the insights from this case could be applied and trialed elsewhere. The paper also demonstrated a process in which researchers can work together with the government, society, and private sector to enact systematic change within an OGD ecosystem and create public value. Future researchers, policy-makers, and those interested in OGD ecosystems may find this research useful for improving the performance of their own OGD ecosystems. Additionally, the paper provides some new insights into factors that appear to drive higher levels of performance when it comes to OGD ecosystems. As this paper presents the study of one ecosystem, that of Estonia, future research should be conducted to validate the initial arguments offered here. More empirical evidence about OGD ecosystems, their behavior, and their performance would be of high interest for the scholarly community. Furthermore, research that explores the existence of common or

similar feedback loops in different OGD ecosystems, and comparing the effects of these within their own context, could lead to new insights for the field and scholars of OGD.

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Table 1. OGD ecosystem characteristics in literature

Source	Ecosystem Characteristics
(Harrison et al., 2012)	Legal, Policy, and Economic Context; Government Policies and Practices; innovators: Technology, Business, and Government; Users, Civil Society, Business
(Lee, 2014)	Data audit, dataset selection, address and map data, data privacy, licensing, publishing high-quality data, data access, data discovery, supporting public bodies, engaging data users, encouraging economic reuse, evaluation
(Zuiderwijk et al., 2014)	Design, Context, Interdependencies and interaction, participants, data resources and tools
(Heimstädt et al., 2014a)	Data suppliers, intermediaries, data consumers, nested levels, cyclical, demand-driven, sustainable
(Immonen et al., 2014a)	Data providers, data brokers, service providers, application developers, infrastructure and tool providers, application users
(Dawes et al., 2016)	OGD beneficiaries, OGD Users, OGD Providers, Benefits, Community Characteristics, Data use & products, feedback & communication, Data publication, OGD Policies & strategies, Motivation for OGD development, Advocacy & interaction
(Kitsios et al., 2017)	Data providers, service providers, application users, application developers
(Styrin et al., 2017)	Policy, Society, Management

Table 2. Goals of the project "Promoting the Use of OGD"

Situation in 2017	Future Goals for 2018-2020	Relevant performance category
There are only 70 datasets on the OGD portal.	Every year for the procurement there should be at least 20 new OGD sets added to the portal.	OGD supply
The OGD portal is accessed only 800 times a month.	By December 2020, there should be an average of 2000 users of the OGD portal a month.	OGD usage
There are only four applications using OGD on the portal.	Every year for the procurement at least five new applications that use OGD should be added.	OGD usage
There is a public sector working group on OGD in Estonia, but it is no longer working.	The public sector working group on OGD in Estonia must meet at least three times a year.	Communication & interaction
There is an average of one OGD event a year.	Every year, starting from 2018, there should be at least three events related to OGD.	Communication & interaction
There are no news articles about OGD in the Estonian OGD portal.	Every year there should be at least six articles about OGD in Estonia in both English and Estonian.	Communication & interaction
There is no social media for raising awareness of OGD in Estonia.	By 2019 there should be a Facebook account for Estonian OGD with at least 1,000 likes.	Communication & interaction
Estonia has been covered in three international OGD rankings, but performs poorly.	The results of Estonia's OGD ranking should be improved by the end of the procurement, assuming the methodology of the rankings does not change.	All categories

Table 3. Data sources used for research

Data source	Time of data collection	Type of information obtained
Data collected during action research:		
Official government policy documents (Public Information Act, OGD Green Paper, Digital Agenda 2020, State Information Systems Interoperability Framework)	February-April 2018	Estonian OGD policy goals, formal regulations, requirements, expectations and restrictions pertaining to OGD
Direct participation of the researchers	February 2018-September 2019	Insider information on OGD-related activities and developments in Estonia; personal perceptions and reflections on the developments in the ecosystem
Meeting minutes from public sector OGD working group (5 meetings in total during the period) (15 to 20 attendees in each meeting)	February 2018-September 2019	Status of OGD provision and existing capabilities in public sector organizations; public sector stakeholders' perceptions on the barriers, challenges and needs regarding OGD supply and use
GitHub issue tracker history (https://github.com/okestonia/opendata-issue-tracker/issues, accessed 25.5.2020)	February 2018-September 2019	OGD-related issues and proposals raised by OGD stakeholders; dynamics of dialogue between stakeholders
Estonian official OGD portal and the issue and pull request history of the new portal's GitHub repository (https://github.com/okestonia/opendata.riik.ee, accessed 25.5.2020)	February 2018-September 2019	Statistics of published datasets and OGD applications; information on functionalities enabling interaction with data and between users
Monthly project team meetings (participation open to anyone interested) (average of 5 attendants)	March 2018-September 2019	Review of OGD-related issues and proposals raised by OGD stakeholders; project team's reflections on the progress
Project events and workshops (incl. 2 OGD forums with 100 participants and 1 technical stakeholder workshop with 30 participants)	February 2018-September 2019	OGD-related issues and proposals raised by OGD stakeholders; stakeholders' feedback to project activities and developments in the Estonian OGD landscape
Additional sources:		
Online survey of OGD experts and practitioners conducted as part of OpenGovIntelligence, an EU-funded project, in 6 European countries. The survey contained 11 open-ended questions on the perceived drivers and barriers of OGD supply and usage and yielded responses from 9 Estonian experts (out of 63 respondents in total)	May-June 2016	Experts' and practitioners' perceptions of OGD drivers, barriers, needs and opportunities in Estonia
Stakeholder co-creation workshop conducted by the researchers involved in this study as part of OpenGovIntelligence. The workshop was attended by seven public sector agencies and two private companies and followed the Nominal Group Technique method. The 1st session involved the discussion of problems and challenges to the creation of OGD-driven services and in the 2nd session user stories and personas were co-created for a selected pilot service.	September 2016	Public and private sector stakeholders' experience and views on OGD usage related problems and challenges in Estonia
Six personal semi-structured interviews with four public officials and two NGO representatives. The interview was based on five open questions on public service creation and OGD.	March 2017	Public sector and non-governmental stakeholders' perceptions on the opportunities and barriers regarding the usage of OGD in Estonia
International OGD indices: European Data Portal's Open Data Maturity Landscaping survey 2018 and 2019, OECD's Open Government Data Survey 3.0 and 4.0, an 4th edition of the Open Data Barometer	2017, 2018, 2019	External comparative evaluation of different dimensions of the OGD ecosystem (data provision, quality, usage, OGD policy, impact)

Figure 1. Five stages of action research. Source: Authors based on Baskerville (1997)

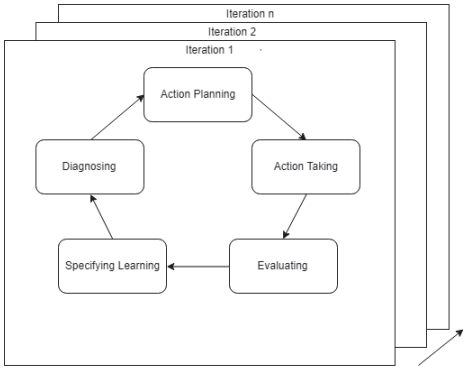

Figure 1

Figure 2. Agile and lean development process. Source: Authors

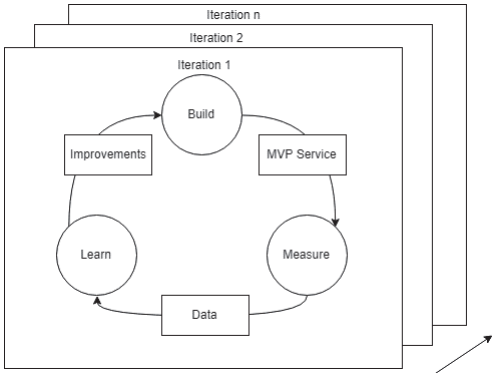

Figure 2

Publication VIII

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A Framework for Data-Driven Public Service Co-production

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Abstract. Governments are creating and maintaining increasing amounts of data, and, recently, releasing data as open government data. As the amount of data available increases, so too should the exploitation of this data. However, this potential currently seems to be unexploited. Since exploiting open government data has the potential to create new public value, the absence of this exploitation is something that should be explored. It is therefore timely to investigate how the potential of existing datasets could be unleashed to provide services that create public value. For this purpose, we conducted a literature study and an empirical survey of the relevant drivers, barriers and gaps. Based on the results, we propose a framework that addresses some of the key challenges and puts forward an agile co-production process to support effective data-driven service creation. The proposed framework incorporates elements from agile development, lean startups, co-creation, and open government data literature and aims to increase our understanding on how open government data may be able to drive public service co-creation.

Keywords: Open data · Public services · Co-production · Co-creation · Agile development

1 Introduction

Currently, there is a trend among governments to try to become more 'open'. One aspect of an open government is opening up government data [1–3]. However, it is known that simply providing open government data (OGD) does not automatically result in significant value for society [1]. The literature often cites the many potential benefits of OGD [1, 4–6], however, the point still holds that these benefits will not be realized unless data is actually used. Thus, a concrete understanding of barriers that prevent OGD from being utilized to produce public value is essential. As a continuance to this, a framework is needed to guide the use of OGD in an effective and efficient manner producing as much public value as possible.

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This paper aims to address the current gap in literature related to the usage of OGD for the co-production of new public services. To this end, the paper proposes a conceptual framework based on current knowledge from literature, as well as an empirical survey conducted within six EU countries, and aims to help make sense of the ways that OGD may be turned into services that create public value. The survey was carried out with the aim of eliciting responses on the core needs and expectations for service co-production; the survey also sought understanding of how the co-production of public services may be applied to the production of data-driven public services. Once the survey results had been received, analyzed and interpreted, work on the proposed framework began.

The proposed framework takes a unique approach in three main areas: Firstly, we suggest a change in understanding from the traditional definition of a public service as something produced and provided by the government to society. Secondly, we argue that OGD-driven service creation is, by its nature, a process of co-production, conducive to collaboration between different kinds of stakeholders such as public administrations, citizens and businesses. Thirdly, the framework proposes to consider the use of agile development practices in the creation of data-driven services.

The paper is structured as follows. Section 2 presents background information on key elements of OGD-driven public service delivery based on a review of relevant literature; this is then followed by a brief overview of the empirical results. Section 3 outlines the proposed framework for data-driven public service co-production. This is followed by Sect. 4, which provides some reflections on the framework. Lastly, Sect. 5 gives conclusions and suggestions for further research.

2 Background

The initial starting point and goal for this research was to define and understand OGD. To this end, a literature search was conducted for articles that contained the phrases "open data" or "open government data" in the e-government reference library as well as Google Scholar. Though there are many different ways to interpret OGD, for this paper the definition proposed by [1] is used: "non-privacy restricted and non-confidential data which is produced with public money and is made available without any restrictions on its usage or distribution". To further expand on this, OGD should also be machine readable, discoverable, and usable by end users (see, for example, [7, 8]).

There is rich evidence stating that OGD has the potential to drive innovation [1, 9, 10, 36], it allows for increased levels of transparency [1], helps drive the creation or implementation of new public services [1, 4, 9, 36] and helps empower citizens and communities [1]. However, there are also barriers that seem to inhibit these benefits from manifesting. Some of the main barriers in the literature include issues with data quality [1–3, 36], lack of government willpower [1–3, 11, 26], confidentiality issues [5, 10, 12], and absence of understanding of OGD [1, 3, 11, 13, 36]. It is clear that OGD may be used to drive innovation and change how public services are created. This in turn could, potentially, empower citizens by providing easier ways to interact with government data and play a role in the public service creation process.

An important use of OGD is in its potential contribution to public services, though this is another area where future research is needed. As Janssen et al. (2012) suggest "little is known about the conversion of public data into services of public value. Hence, we strongly suggest further research in this area" [1]. A recent paper by Foulonneau et al. (2014) finds that there are three main roles which data plays in a new service: "the service is based on data, the service uses data as a resource, and the service is validated or enriched with data but the data is not directly used or is not directly visible in the service." [4]. They also find that OGD is currently underutilized, and applications that create public value only utilize a small number of datasets. Charalabidis et al. (2016) find that OGD can allow services to be co-created by non-typical service producers which results in the building of new and innovative applications [12]. Thus, OGD may be used for the co-creation of public services. The process of using OGD in public service co-production may be summarized as follows: governments make open data available, potentially anyone can use this data to create a new service, and it is this interaction that allows a service to be 'co-produced'.

Co-production was initially defined by Elinor Ostrom in 1972, and it can be understood as "the process through which inputs used to provide a good or service are contributed by individuals who are not 'in' the same organization" [14]. Since this initial definition, co-production has gained increasing attention in the academic literature. What is, generally, agreed upon is that the value of a public service is very much determined by not just the provider of the service but also by the interaction between the consumer of the service and the provider [14–16]. Since OGD allows many new interactions to take place between government and society, it follows that these interactions have the potential to lead to 'co-produced data-driven public service'.

When looking at the current literature on co-production, two different categorization schemes can be extracted. The first categorization takes a more hierarchical approach where co-production is categorized based on different levels of co-production within a service (for examples, see: [2, 16–18]). In contrast to the first categorization, the second defines co-production differently depending on what stage it occurs in during the creation or implementation of a new public service (for examples, see: [15, 19, 20]). What can be seen from this is that the idea of 'co-production' is still heavily debated, but it does provide an important way to look at and understand how public services are designed, created, implemented, maintained, and used.

As the literature study was ongoing, the survey was also started. The goal of this survey was to collect empirical data on the practical challenges that have been met by different actors in using OGD for the co-creation of new services. The survey elicited responses from experts and practitioners and was conducted in 6 EU countries (Belgium, Estonia, Greece, Ireland, Lithuania and the UK)[1]. In addition to their differences in terms of the political system and public administration tradition, these countries also differ for their government data exchange systems and level of open data maturity, involving early adopters, such as the UK, as well as laggards, such as Estonia or Lithuania. The survey yielded 63 responses from public administration, business, civil society and research

[1] The study was conducted as part of the OpenGovIntelligence project, a research and innovation action funded from the EU's Horizon 2020 program under grant agreement no 693849.

actors and revealed a number of barriers and drivers that are seen to affect OGD-driven service co-production (a more detailed overview of the study has been published in [36]). Some of the key barriers that came out of the survey include lack of availability of open data, little awareness of the benefits and uses of OGD, lack of feedback loops between public service providers and users, missing data-related skills in the public sector, lack of collaboration between stakeholders, low political priority and organizational resistance in the public sector, etc. The drivers seem to be polar opposites of the barriers, for example, lack of funding is a barrier whereas access to funding or external funding acts as a driver. Other examples are seen as well, for example, low political priority or lack of awareness of OGD benefits may be a barrier, but a clear demand from citizens and demonstrating tangible benefits can be used to counteract this.

From the literature it does appear that OGD may be used to help drive public service co-creation, but from the survey it is also clear that there are many barriers that stand in the way. It seems that a new approach is needed in order to help overcome these barriers so that OGD-driven public service co-creation may begin to thrive. This new approach should allow other stakeholders to take the driver's seat in exploiting OGD to create services and generate public value. In Sect. 3, one possible solution – a co-production framework for OGD-driven public service co-creation – is presented.

3 Proposal for a Co-production Framework for Data-Driven Public Services

3.1 The Concept of Open Government Data-Driven Public Service Co-production

In order to understand the building blocks of OGD-enabled public service creation, it is useful to look at services as open systems that are inseparable of the environment in which they operate. According to an emerging view in service management research, the production of a service is a "product of a complex series of, often iterative interactions, between the service user, the service organization and its managers and staff, the physical environment of the service, other organizations and staff supporting the service process, and the broader societal locus of the service" [21]. This view is supported by the current trends in public sector innovation and e-government literature, where the importance of context is increasingly emphasized (see, for example, [22, 23]). This framework for data-driven public services, therefore, looks at OGD as part of a broader service ecosystem that consists of the technological infrastructures needed for the publication and exploitation of OGD, interactions between stakeholders, and the social, organizational, cultural, legal and political environment where services are created.

Traditionally, public services have been understood as something designed and delivered by public administrators to the public. In this traditional system, public administrators act as "brokers" between society and the political system, attempting to feed society's needs to the relevant political bodies who, in turn, produce public services to meet these needs [24]. This understanding is beginning to erode both in the political realm (e.g. [25]) and research (e.g. [26, 27]), being supplemented or even replaced by a co-production-oriented approach where governments are encouraged to open their data

and service creation process to non-governmental stakeholders. However, there are also more radical visions; the European Commission [28] proposes an approach according to which public services are any services which are offered to the general public with the purpose of developing public value, regardless of the role that the public sector plays in the process. In this view, the creation and provision of public services is no longer a monopoly of the public sector. Instead, any public or private actor may take the lead in developing a new service that creates public value, and any actor can participate in the co-production of this service. This is believed to lead to more user-friendly, proactive and personalized services, increased trust in administrations, and empowerment of citizens [28].

The concept of OGD naturally fits this scenario. When government data is made accessible and reusable by the public, it is possible for any interested party to use this data to offer new data-driven public services. If a problem or need is perceived, citizens and businesses are able to easily take the initiative and build their own services based on OGD, engaging other stakeholders in the process of co-production as needed. In the context of such services, data may have different roles, as explained by Foulonneau et al. [4]. Data may also come from various sources and in various volumes – from large open government datasets to data provided by individual users. In short, it may be said that any service that provides public value by using or exploiting data may be considered a data-driven public service.

The adoption of a collaborative model of data-driven service creation entails the need to redefine the traditional roles of public and private actors in the process. The concept of New Public Service [29] provides useful guidance in this respect. This approach places citizens at the center, emphasizing serving over steering, the importance of public interest, a view of service users as citizens not customers, and the value of people and partnerships. As suggested by Hartley et al. [22], collaborative innovation requires a thorough rethinking of the roles of all stakeholders: politicians need to redefine their role from "political sovereigns who have all the power and responsibility" to ones setting the agenda through dialogue with relevant actors; public managers should redefine their role from experts-technocrats to "meta-governors" who orchestrate collaborative arenas; private companies and voluntary organizations need to become "responsible partners in the production of innovative solutions for public value" rather than promoters of their own interests; and citizens should assume the role of "co-creators and co-producers" rather than "clients, customers, or regulatees". Therefore, a co-produced data-driven public service not only needs data to be provided and used, but also stakeholders need to assume new roles in the creation of public value.

3.2 The Process of Open Data-Driven Public Service Co-production

Co-production of Data-Driven Services. Pollitt and colleagues 2006 divide the service co-production process into four phases: co-planning, co-design, co-delivery, and co-evaluation [20]. It has been found vital to sustain close collaboration with users and stakeholders throughout this cycle to ensure the quality of services [30]. In the context of data-driven services, this collaboration involves the provision and use of data in these different phases. While public organizations have the key role in publishing government

datasets as open data, citizens can also contribute their data in different ways, depending on their level of interest and skills. For instance, any citizen may notify the government about problems such as potholes or graffiti using smartphones or web apps. Such crowd-sourcing models are used in the well-known services of FixMyStreet and StreetBump[2]. At the same time, citizens with more advanced skills can engage in mining and analyzing OGD to explore patterns or discover problems [31]. As an example, residents of an area could scan data provided in waste collection plans and report problems to improve the collection schedule or locations [32]. Citizens may contribute to service design and partake in the development of data mashups and apps to address needs that have been discovered [31]. Similarly, citizens may be co-implementers of services by contributing user data (e.g. through sensors) or giving feedback for monitoring and evaluation [32]. Although citizens and other stakeholders may be valuable data providers, the provision of OGD remains a key driver in this process due to the volume and value of government datasets.

Agile Development and Continuous Improvement. In order for OGD-driven co-production to be effective, we suggest to move away from the traditional waterfall-like service development model (see: Fig. 1) and learn from the agile approach. The agile approach has become the norm in private sector ICT projects, but is still relatively new to the public sector. In the traditional waterfall model there is a linear approach to development where the project requirements are all outlined at the beginning and the development happens late into the project design cycle. In this traditional model, the public administrators are steering and controlling the whole process with citizen input being occasionally, but not necessarily, sought. In the traditional model, a service is slow to create, not easily adaptable, and may not have many adequate ways to receive feedback from the service user.

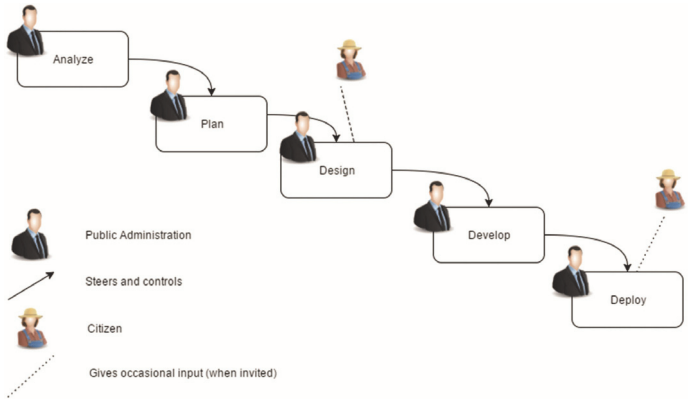

Fig. 1. Traditional model of public service creation

[2] See www.fixmystreet.com; www.streetbump.org.

Agile development focuses on being able to adapt quickly to changes by following an 'agile' approach that is based on multiple sprints made up of four main stages: plan, build, test, release [33, 34]. One concept within agile development is the idea of the Minimum Viable Product (MVP). The goal of an MVP is to develop a product or service, at its most basic and functional form, and release it as quickly as possible. Once the MVP has been released, it allows for fast feedback from service users. Ultimately, this allows for rapidly generated understanding of service use, which may then be used to adapt and change the service; this also leads to a cheaper service that is more in tune with the users' wants and needs.

Society's Feedback. Feedback from users and stakeholders is a core aspect of the data-driven public service. This feedback comes in many forms, but ultimately has one goal: improving the offered service. Feedback may be received in relation to the data that is being offered, the exploitation methods, and the new services themselves. Many different methods could be utilized for obtaining feedback. Some of the most likely feedback forms are (1) feedback mechanisms for user-provided data built directly into the public service, (2) social media, and (3) user workshops. A successful process for feeding feedback into the new public service will likely utilize some combination of these proposed feedback mechanisms.

User-Provided Data. When creating a new public service, it is important to make sure that the proper feedback mechanisms are in place. For a data-driven public service, users should be able to either upload their own data, suggest changes to datasets, or be able to participate directly in data creation for a service (this could be done via a phone app, sensors, etc.). The goal is to make sure that service users have some direct role in the creation/design of a service, and that they are able to provide continuous feedback into the service that is listened to and utilized.

Social Media. Social media allows feedback to be received almost instantaneously from a large amount of users. One way to use social media, which stands out in terms of effectiveness, is data mining, such as opinion mining or sentiment analysis. When there is an increase in usage of a newly created service, tweets, Facebook posts, etc. could be followed and notifications could be received any time a post related to the new public service is created. These posts could be automatically understood as positive or negative or neutral, from there further investigation could provide insight into what part of a service was well executed, and what part should be changed on future implementations.

User Workshops. One of the best ways to include end-users in service design is through the organization of user workshops; user workshops usually combine individual ideation with group discussion. These workshops should be repeated throughout the lifecycle of the new data-driven service. In terms of outcomes, user workshops should be able to produce a list of issues with the new service, a list of potential solutions, basic thoughts on the usability and functionality of the service, user stories, a list of user personas of individuals who could use the service, and any other information that may come out of the workshop organically. This information will allow government and citizens to work together and get a better understanding of the content, functions and goals of the service.

Towards Agile Co-production of Open Data-Driven Services. When examining the aforementioned definitions, it is important to pick up the commonalities between these different ideas: focus on the service user, be agile, develop quickly, listen to the service user, and be able to adapt quickly to changing needs. The service innovation process can be summarized with the following points:

- The government and citizens should be partners at all stages from ideation to creation to implementation of the new data-driven public service.
- There should be an initial release of the public service at an early stage, or an 'MVP' of the public service, which allows the cycle to be started as quickly as possible.
- The public service should be able to respond to user feedback from the initial launch.
- User input should be sought and utilized at all stages of the public service creation.

4 Discussion

In public service provision, a shift from a public administrator-centric view towards wider collaboration and interaction made possible by technological advances is observed [35]. We present a framework (Fig. 2), for data-driven public services that includes a wider view of stakeholders and is built around two key elements – co-production and agile development.

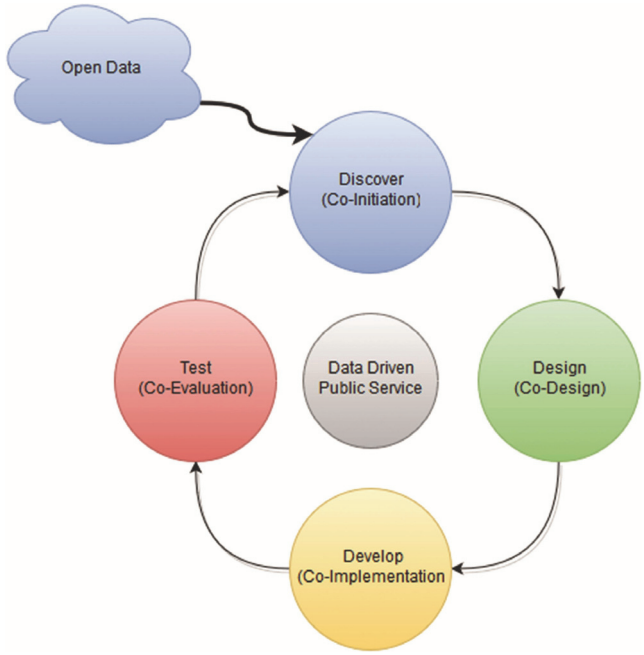

Fig. 2. Agile co-production framework for data-driven public services

Addressing these elements properly may help to drive innovation in the public sector, private sector as well as in the non-governmental sector, increase transparency, empower

citizens and other stakeholder groups as well as achieve more effective and efficient public service delivery, and thus enhance public value.

The framework places a large focus on agile development and co-production/co-creation. It is believed that the focus on these attributes may allow for barriers that emerged from the literature and the survey to be overcome. The co-production element may help to overcome several data and technology related key barriers, such as limited supply and fragmentation of OGD (as other stakeholders could complement public OGD with their own data) and the overall development of data infrastructures, standards as well as specific tools, applications and demos that facilitate service creation. The agile development focus would help to keep the cost down for developing OGD driven applications while also allowing for more opportunities for co-creation of the service to emerge. This would, potentially, initiate a virtuous circle – if better data infrastructures and services are made available, new services could be built on the basis of those. Also, they potentially fuel the demand for additional services.

Agile development and continuous improvement are principles widely used in private sector ICT projects; it seems that they may also be incorporated in public service creation to help realize the future of public service delivery. The implementation of this framework would enable a new understanding of the costs and benefits of OGD services more promptly, open opportunities for further synergies (as contributions from other stakeholders can be incorporated immediately into public service), and make the delivery more effective and efficient, potentially increasing the legitimacy of public sector and lowering resistance to OGD as well. As the performed expert survey revealed that stakeholders' attitudes currently constitute the biggest barrier as OGD generally lacks tangible benefits, this last point on lowering resistance seems to be important.

The use of co-production and agile development surely would not help directly overcome other important barriers, such as possible legal and political barriers. However, by improving the overall understanding and demonstrating the value of OGD-driven services, it could help put the topic higher on the political agenda and lower fears.

5 Conclusions

It has become clear that there is a discrepancy between the hopes attached to OGD as an enabler of new services, and the reality where the creation of these services is facing a number of challenges. Studying how these challenges could be overcome, we find that any viable solution needs to tackle several issues at once: there needs to be a supply of OGD, but we also need a fundamental rethinking of the concept of public services, the service creation process, and the roles of different actors in the process.

The framework presented in this paper aims to make an initial contribution towards the understanding of how OGD may be used to co-create new services that produce public value. Furthermore, we argue that the traditional government-driven top-down waterfall-like method of public service production no longer fits the increasing demand for needs-based, customized and responsive services. The framework puts forth an innovative process, based on the ideas of co-production and agile development, in the

hope that it may lead to the creation of new services in a more efficient and collaborative way.

The framework views service development as part of an ecosystem that consists of different actors, processes, and drivers and barriers related to the broader environment. While we strongly believe in the value of a systemic approach, we also acknowledge the limitations of our current understanding of the obstacles that may affect the implementation of this framework in practice. As the next step, it is therefore vital to test this on real-life cases in different contexts, so that further development and refinement of the framework may take place as new lessons are learned.

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Publication IX

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Turning Open Government Data into Public Value: Testing the COPS Framework for the Co-creation of OGD-Driven Public Services

Keegan McBride, Maarja Toots, Tarmo Kalvet, and Robert Krimmer

Abstract This chapter aims to demonstrate and understand how open government data can generate public value by allowing any actor to co-create an open government data-driven public service. The chapter takes a holistic approach to understanding open government data-driven co-creation and follows a content-context-process approach for the framework development. The framework proposes a public service co-creation cycle based around the ideas of agile and lean development that should lead to increased usage of open government data. The co-creation cycle is made up of four parts: co-initiation, co-design, co-implementation, and co-evaluation. To test the propositions put forth by the framework, a multi-case study was conducted on five different pilot projects that aimed to use open government data in the co-creation of new public services. The pilots were conducted at different levels of government and across different public domains. The results of the study seem to support the propositions outlined by the framework, though it also emerged that the pilots that engaged in co-implementation had higher levels of user engagement and satisfaction with the service; this warrants future empirical research.

1 Introduction

Open Government Data (OGD) initiatives are springing up across the globe at every level of government (Zuiderwijk and Janssen 2014). Due to this trend, OGD is seen as an increasingly powerful source of value, both economic (Gonzalez-Zapata and Heeks 2015) and public (Janssen et al. 2012). In simple terms, public value can be understood as the total societal value that is shared by all actors in society (European Commission 2013). More specifically, public value has been defined through five key dimensions: direct user value, indirect value to wider

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societal groups, social value (i.e., support to social interaction and cohesion), value to environment and sustainability, and political or democratic value (Bovaird and Loeffler 2012). However, public value is not something that automatically appears when OGD is made available. The concept of public value has a strong connection to the idea of co-creation and the co-production of services – so, public value can be seen as something that is co-created by different stakeholders such as service providers and service users through the process of mutual interaction and co-production (Osborne et al. 2016).

Though it is not the only touted benefit of OGD (see Gonzalez-Zapata and Heeks 2015; Janssen et al. 2012; Melin 2016), the creation of new and innovative services that create public value does appear to be one of the greatest potentials associated with the OGD movement (Mcbride et al. 2018). When OGD is made available to the public, all societal stakeholders, whether governmental or external, can come up with ideas for using data to solve existing problems and needs, and then co-create these solutions together (Mcbride et al. 2018; Foulonneau et al. 2014a). However, the question *how* and *by which process* OGD can be turned into services that provide public value is generally still under researched (Janssen et al. 2012). This chapter aims to address this research gap by examining how governments at different levels can co-create public value from OGD initiatives.

The chapter posits that one of the main ways of turning OGD into public value is for public administrations to encourage and engage in the co-creation of OGD-driven public services. The definition of a co-created OGD-driven public service has two core components: public service and co-creation. When talking about public services, the authors have adopted the definition recently put forth in (European Commission 2013), which states that any service, developed by any stakeholder, that creates public value may be viewed as a public service, regardless of the role that the public sector plays in it. The second component, co-creation, may be defined as the involvement of outside, non-typical, stakeholders in the initiation, design, implementation, and evaluation of public services (Toots et al. 2017a). Thus, we come to the definition of a co-created OGD-driven public service as a public service that exploits OGD to create public value and has been co-created among different stakeholders. This chapter will present a framework that outlines what exactly co-created OGD-driven public services are and how these services come into being. The framework takes a holistic approach and looks at how services are developed, but also acknowledges the importance of contextual factors on the OGD ecosystem.

The development of this framework began as part of the OpenGovIntelligence project[1], a European Union-funded research and innovation action that aimed to explore how OGD may be used to drive the co-creation of new public services. In addition to developing a theoretical framework, the project also involved the implementation of OGD pilot projects. Based on a multi-case study of these pilots, this chapter will discuss the practical applicability of the framework. The pilots

[1] See http://www.opengovintelligence.eu for details.

represent a variety of different OGD maturity levels, are conducted at different levels of government, and are creating services in a wide variety of sectors. However, they are also similar in that all pilot projects aim to develop new services by exploiting OGD and engaging in co-creation with different stakeholders. This case study research will help provide insight into the utility of the proposed framework, and will allow for a foundational level of understanding to be constructed of co-created OGD-driven public services.

The chapter is structured in the following way. First, a framework for understanding how OGD may be turned into co-created public services is presented, based on the current state-of-the-art when it comes to OGD, co-creation, and co-created OGD-driven public services. Once this is done, the case study methodology, research design, and potential limitations will be discussed. This is followed by a description of the six pilot projects where special attention is paid to the unique operational environment of each pilot. The final step will be to apply the framework to the pilots, discuss the results and implications, and conclude with proposals for future research.

2 COPS (Co-created OGD-Driven Public Services) Framework

The ideas proposed within this chapter represent a shift from a traditional understanding of public services and public service delivery. In order to better understand this change, and to acknowledge the intricacies and complexities that accompany the change, the proposed framework takes a holistic view on the co-creation of OGD-driven public services and follows a content-context-process (CCP) approach (see Pettigrew 2011; Symons 1991). In practice, this means the framework looks at the content first (what exactly is a co-created OGD-driven public service); second, the context (what are the drivers and barriers, the operating environment, agents, etc.); third, the process (what must happen in order for the concept of co-created OGD-driven public services to be realized).

The combination of the content, context, and process comes together to generate a new picture of the co-created OGD-driven public service system. The framework that results will provide a clearer understanding of how co-creation of OGD-driven public services occurs and will provide insight into how governments can drive or initiate the co-creation of OGD-driven public services. The framework draws on ideas and theories from public administration and management research (the ideas of co-creation and co-production), e-government and information systems (open government data), and strategic management and computer science (agile development) and additionally is influenced by trending ideas in the current startup ecosystem (minimum viable product (MVP) and lean development).

2.1 Content: Co-created OGD-Driven Public Services

The concept of "public service" has been defined in a wide variety of ways. For example, in Estonia, a public service is defined as something that the state or government provides at the expense of the state for the benefit of society (Ministry of Economic Affairs and Communications 2013). This is similar to how many academics, scholars of public administration, and government officials across the world perceive and understand public services. However, this is beginning to change (Denhardt and Denhardt 2000; Osborne 2009). In the United Kingdom, there has been an increased interest in the idea of "open public services." This concept aims to open up public service provision to a wide range of providers, decentralize the public service provision process, and divest control of public services to the service users thus increasing their ability to choose and customize their services to fit their needs (Minister for Government Policy 2011). In a similar spirit, a recent report by the European Commission (EC) titled "A Vision for Public Services" (2013) proposed, "public services are services offered to the general public and/or in the public interest, with the main purpose of developing public value […] The future of government is less and less in the hands of governments alone. Technology has empowered ordinary citizens by offering them a way to make their voices heard" (European Commission 2013). This framework adopts a similar understanding of public services, and it is also an understanding that many in the current scholarly debate are beginning to move toward (see Osborne 2006, 2009; Osborne et al. 2013).

Traditionally, public service providing organizations attempted to understand what issues society was facing, and then aimed to create or draft some sort of service to address the needs of society; this was often done without consulting the intended recipients and the provided service may or may not produce the intended effect (Peristeras and Tarabanis 2008). In this model, services are delivered in a top-down manner, with citizen as customer, dependent on the government, and often given little role to play in the design and implementation of the service (Peristeras and Tarabanis 2008). However, due to the development of ICTs and open and participatory governance models this approach seems to be outdated. The new understanding of public services aims to bring the provision of public services into today's modern age and many public service organizations are beginning to experiment with new ways of public service provision.

In line with the definition provided by the EC, the idea of "co-creation" has begun to flourish in academic and governmental discourse. In essence, co-creation is about stakeholders from a wide variety of groups who come work together to "co-create" something new. This means that government agencies may be working with private individuals, NGOs, companies, or other stakeholders; the government agency may or may not be the one steering the design and implementation of the service. It is believed that a public service delivery process steeped in co-creation may lead to increased efficiency and effectiveness of public services (Osborne et al., 2016; Nambisan and Nambisan 2013; Cordella 2017), it is part of the wider open government movement (Lönn and Uppström 2015), and is a necessary part of the

current movement to bring citizens into a more collaborative relationship with government (Lönn and Uppström 2015; Mergel 2015a).

The term co-creation is tightly linked to Elinor Ostrom's concept of co-production, but also has strong roots in service management theory (Osborne et al., 2016). Recently, the up-and-coming public administration paradigm of New Public Governance has embraced co-creation as an imperative part of its platform (Osborne 2006). Though there are many different understandings and definitions of co-creation, many tend to view it as a multi-faceted process with different stages, each with their own unique way of involving stakeholders in the relevant "co-" process. One such classification was put forth by (Pollitt et al. 2006) who saw co-creation as a four-stage process consisting of co-design, co-decision, co-implementation, and co-evaluation. This is similar to the classification provided by (Nambisan and Nambisan 2013), which states that co-creators can co-discover problems, co-initiate solutions, co-design the services, and co-implement the newly developed services. There is also increased interest in digitally enabled co-creation, which has been discussed by (Linders 2012; Lember 2018).

In tandem with co-creation, governments have also begun to realize that traditional waterfall model-based approaches may not be as effective as other project management styles, such as agile development. Thus, public service organizations have also begun to adopt agile development methodology and ideas into their internal processes (Mergel 2016). When talking about agile development, the following definition is adopted: agile development focuses on being able to adapt quickly to changes by following an "agile" approach based on multiple sprints made up of four main stages: plan, build, test, and release (Beck et al. 2001; Cockburn and Highsmith 2001). The agile development cycle allows projects to be designed and implemented faster and become more responsive to changes, such as customer preference or environmental factors. In the public service design context, an agile development approach is more conducive for co-creation than the traditional waterfall model. The reason for this is that an agile approach allows for input and feedback to be provided on the service at multiple points so that it can be integrated and acted upon in future sprints, whereas in the traditional approach this is largely not possible.

Though the adoption of agile development by public sector organizations can indeed be beneficial, another innovation should accompany it in order to produce the biggest value. This accompanying idea is that of lean development and the minimum viable product, MVP; in the public sector context, the product may be understood as the public service. Lean development, as proposed by Eric Ries in his book *The Lean Startup*, implements a development cycle that follows a build-measure-learn structure (Figure 1 shows this cycle, adapted for the public service context).

The core idea behind the lean development cycle is that the organization should be able to learn as quickly as possible about whether or not their product will be well received (in the public sector context, the product is the public service). As part of the cycle, an MVP is developed in an agile manner, and then presented to the customers (in the public sector context, customers are the service users). Once the MVP has been built and presented, the build-measure-learn cycle begins and the process of "validated learning" starts; validated learning may be understood as the

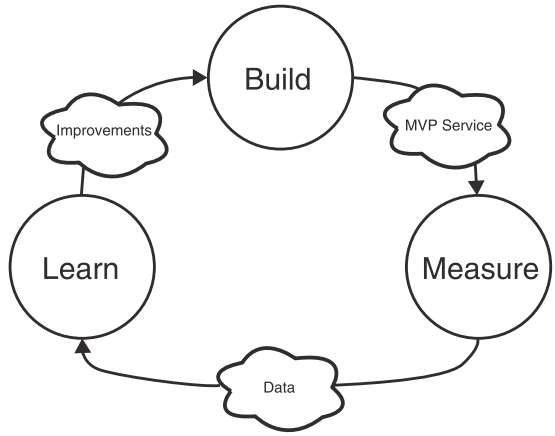

Fig. 1 Lean development cycle. (Source: authors, based on ideas by Ries, 2011)

process of understanding whether or not you are building the correct or desired service for the user (Ries 2011).

As public service organizations aim to become more agile, reimagine how they deliver public services, and embrace ideas like lean development or co-creation, a new revolution is also occurring, a data revolution: datasets are bigger, our processing power is stronger, and data is now becoming increasingly open and available to everyone (Mergel et al. 2016; Janssen et al. 2017; Bertot et al. 2014). The idea of OGD finds its roots in the broader open government movement with the aim of promoting transparency and accountability (Lönn and Uppström 2015; Mergel 2015b). In addition to these aims, and due to the growing availability of OGD sets, there has been an increased effort to define and understand what OGD is, and what the potential uses, benefits, drivers, and barriers of OGD may be (Janssen et al. 2012; Zuiderwijk et al. 2012; Toots et al. 2017b; Ruijer et al. 2017; Barry and Bannister 2014). When discussing OGD, it is generally agreed upon that in order to be classified as OGD, it must be free to reuse and redistribute by anyone, be human understandable, be government organization generated, and preferably come in a machine-readable format (Janssen et al. 2012; Toots et al. 2017b; Open Knowledge International 2018). Though studies have aimed to understand and present the potential benefits of OGD (see Janssen et al. 2012; Melin 2016; dos Santos Brito et al. 2015), it has also been found that oftentimes the availability of data does not necessarily translate to new benefits (Janssen et al. 2012). One way that OGD may provide public value is by exploiting it and creating new and innovative services on top of it (Foulonneau et al. 2014a; Toots et al. 2017a; Khayyat and Bannister 2017; Foulonneau et al. 2014b). Due to widespread availability of OGD and data analytics tools/languages, such as R or Python, any stakeholder is able to begin to analyze OGD and/or build services that rely on or utilize OGD (Mcbride et al. 2018; Foulonneau et al. 2014a). This has drastic implications for the public service delivery process as, now, a stakeholder can find their own answers or create value on their own, rather than having to rely on a government agency to provide the answer or build a service that may or may not solve the stakeholder's initial problem, for an example of this, see (McBride et al. 2019).

Though the use of OGD in the creation of new public services is an interesting area of study, in order for this phenomenon to occur at a broader level, a framework for understanding and analyzing the process is needed. Putting together all of the aforementioned changes that are currently ongoing in the public sector domain, the idea of a co-created OGD-driven public service begins to emerge. The new paradigm that accompanies this idea includes the following:

- A new understanding of public services that is based on the idea of public value and where any actor is able to participate and take the lead in the co-creation of services that create public value.
- The traditional top-down waterfall-based approach to public service development is outdated and in today's networked and IT-oriented society needs to be updated to reflect the current paradigm.
- The co-creation of new public services is likely to benefit from a process based around the concepts of agile and lean development methodologies.
- It may be possible to improve the effectiveness of public services by creating and releasing an initial MVP.
- As OGD may be exploited by any actor with sufficient technical knowledge, OGD can be used to co-create innovative services that create public value.

This leads us to the first proposition of our proposed framework:

Proposition 1 – OGD can be turned into public value through the co-creation of OGD-driven public services

To provide an initial visual aid that demonstrates how the main components of the framework (OGD, co-creation, public services, agile development, MVP) fit together, Fig. 2 has been created. Figure 2 shows that co-creation is an iterative process based around the ideas of lean and agile development and it takes in OGD. The initial result of this iterative process is the MVP; once the MVP is

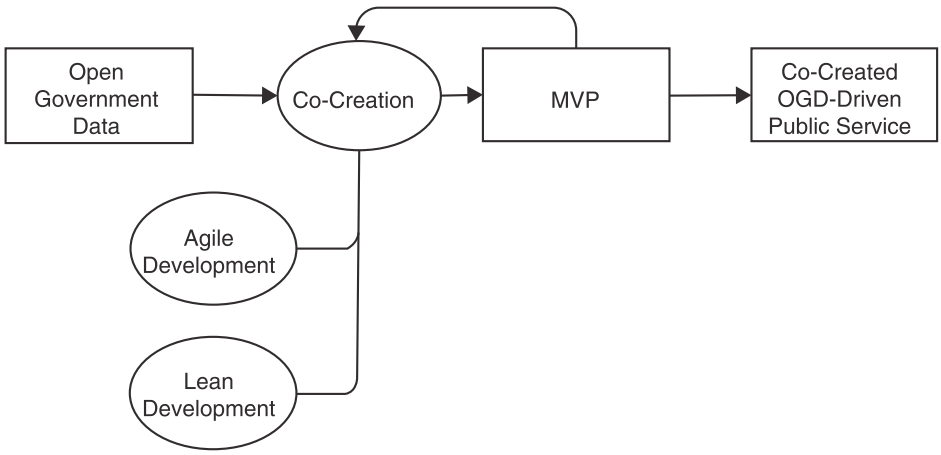

Fig. 2 Overview of framework components. (Source: authors)

released, the iterative co-creation process continues and the result is a co-created OGD-driven public service.

2.2 Context: Operating Environment, Drivers, and Barriers

The co-creation of an OGD-driven public service should be thought of as taking place within a system (see Mcbride et al. 2018; Dawes et al. 2016). The system is made up of the different agents (such as public sector organizations, citizens, etc.) that take part in the process of co-creation and of different environmental factors that support or create impediments to the functioning of the system. Public sector innovation and e-government literature often emphasize the importance of the technological, social, organizational, administrative, cultural, and political context as a source of drivers and barriers to technological innovations in the public sector (see, e.g., Angelopoulos et al. 2010; Hartley et al. 2013; Galasso et al. 2016). Thus, a second proposition can be put forward:

> *Proposition 2 – The results of the co-creation system are influenced by the contextual environment*

In the context of OGD and co-creation, the immediate environment includes the interests and abilities of the stakeholders involved in service co-creation, the data infrastructures for OGD publication and exploitation, as well as the legal, political and organizational context in which OGD-driven co-creation takes place.

Stakeholders The very idea of co-creation suggests the involvement of more than one stakeholder group in the creation of public services. The groups often mentioned in the context of OGD and co-creation are public administrations, citizens or citizen organizations, businesses, and academia (see, e.g., Charalabidis et al. 2016). These in turn can consist of various different sub-groups with different needs, interests, skills and positions, and hence different roles in the co-creation process. The new conception of "public services" proposed above sets no limitations to the role that any of these groups can take in data-driven co-creation: all of them can act as initiators of new data-driven services or as partners and co-creators of these services. This, however, not only presumes the existence of supporting infrastructures but also a favorable cultural environment for data sharing and cross-sectoral collaboration.

Stakeholders' interests, values, perceptions, and capabilities have been found to play a crucial role in co-creation. Stakeholder perceptions can be both the key driver and a major barrier to the supply of OGD and the use of OGD for service co-creation (Toots et al. 2017b). Since open data is often perceived as lacking tangible benefits while costing a lot, there is resistance in many organizations to making their data open. Similarly, the benefits of co-creation are not well understood, which manifests in the administrators' lack of openness to the idea of co-creation (Voorberg et al. 2015). This is further complicated by a widespread lack of necessary skills to open up data and make use of open data in innovative ways among all

stakeholder groups. On the other hand, stakeholders' beliefs, priorities, preferences, skills, and actions can act as a powerful driver of OGD – for example, visionary policy-makers and administrators can act as innovation champions promoting the publication of OGD, and grassroots groups and individual innovators can express demand for open data and demonstrate the possibilities to reuse OGD in innovative ways (Toots et al. 2017b).

Data Infrastructures To ensure the quality of data and easy access to datasets, infrastructures are needed that support the publication and reuse of open data. Some of the important elements of such infrastructures include (Toots et al. 2017b):

- A central free open data portal where local and national governments could publish their data. Such open data portals should have the ability to host data, sign-post to remote data, cache datasets, and provide tools for data transformation across various formats or via various web services requests.
- If necessary, data infrastructure legislation should be adopted to regulate the maintenance and access to data assets, and the rights, roles and responsibilities connected to that.
- Providing APIs (Application Programming Interfaces). Implementation of the "API First" policy means that governments should prioritize providing good APIs along with open data (rather than make external stakeholders download data dumps) to increase the reliability of data and facilitate the reuse of open government data by external stakeholders.

However, the mere existence of an OGD portal is not a sufficient driver in itself. One of the best examples of this is the national OGD portal in the United States and the municipal OGD portal of the City of Chicago. While the national portal has a large amount of data, many datasets go unused and it could be argued that the level of public value it aimed to create has not yet manifested. Meanwhile, in Chicago, there is an active civic hacking scene and new public value creating innovative applications are being created on a seemingly constant basis (see Mcbride et al. 2018; Kassen 2013). One of the primary reasons for this is familiarity with the data (Schrock and Shaffer 2017) and the relevance of the data to those who are exploiting it (Mcbride et al. 2018; Kassen 2013).

Legal Environment The supply of OGD is also constrained by legal issues around intellectual property rights, personal data protection, security, data sharing, and choosing appropriate licenses. For example, personal data protection regulations sometimes prevent the government from releasing datasets that would otherwise be interesting for service innovators. Although this problem can generally be overcome by data aggregation into larger statistical datasets, this is not always a solution if the data concerns very small groups of people. Privacy-related concerns seem to have layers: one is connected to the actual regulations and the other with the way they are perceived and interpreted by public sector organizations (Toots et al. 2017b). The misunderstandings that some public officials might have about privacy and identity-related information might also impel them to be overly cautious about publishing any data rather than figuring out ways to publish data without privacy viola-

tion risks. Similarly, limited awareness about existing data licenses can be a barrier to making data open and reusable.

Generally, the contemporary public procurement culture and contracting legislation are rooted into the short-term efficiency idea (see, e.g., Lember et al. 2014) that also restricts the use of agile development methods and implementation of risky projects by the government. Therefore, the provision of OGD may be a quicker solution than waiting for legislation and culture to change. The availability of OGD gives non-governmental stakeholders the ability to take on this risk, create services in an agile, responsive, adaptable manner, and constantly learn and improve instead of failing at a larger scale.

According to our previous research (Toots et al. 2017b), the main drivers of OGD publication can be seen in favorable data licensing and copyright regulations that are compatible with open data goals, public interest and new business models, as well as the awareness of public officials of personal data protection regulations. It has also been suggested to introduce a national-level legal obligation for government institutions to make public sector data open by default and qualify public grant submissions and public tenders against open data.

Policies Policies hold a considerable potential to further drive OGD innovation – a potential which still needs to be unlocked. Based on (Toots et al. 2017b; Janssen 2011), European open data policy, in particular the Directive on the reuse of public sector information (PSI Directive) and its open-by-default principle, is seen as a good example of how policy can drive OGD publication at the national level. However, there sometimes seems to be an implementation gap – the obligation is there but it is not enforced by member states. Another critical driver is seen in the presence of a holistic approach to open data policies, i.e., regarding open data as part of a broader open government policy and supporting this by a combination of legal, policy, and technical measures. In addition to that, OGD provision and use can be supported by data standardization policies, which should be tackled at a cross-border level, benchmarks with other countries to create peer pressure, and funding of different forms of collaboration (cross-border, cross-sectoral, inter-organizational) to enable learning and enhance cooperation between data producers and data users.

Organizational and Administrative Factors The organizational context of the public sector is a frequently cited impediment to implementing innovative technologies and practices. For example, rigid organizational structures, inertia, organizational silos, lack of collaboration, lack of incentives for innovation, risk avoidance, lacking innovation capabilities, lack of innovation leadership, and resource constraints in the public sector are often seen as barriers to innovation and co-creation (see, e.g., De Vries et al. 2016). In the context of OGD-driven co-creation, similar barriers have been noted, including incompatible organizational routines and processes; lack of feedback loops between government and citizens; lack of openness to the idea of open data and open processes, lack of trust and innovative culture; lack of political priority; lack of adequate resources (Toots et al. 2017b). In addition to that,

open data innovation is also hindered by existing proprietary business models and the fact that many public organizations make part of their revenue by selling key data (Toots et al. 2017b).

At the same time, a favorable organizational context can also drive innovation – some of the important drivers are ICT literacy, slack resources, active innovation leadership, strong political support, inter-institutional collaboration, etc. (Cucciniello et al. 2015). In the case of collaboration and co-creation with non-governmental stakeholders, additional factors become important, such as the openness of the organizational culture toward citizen input (Freeman and Quirke 2013). Some of the key ways to mitigate the existing organizational barriers to OGD-driven co-creation are as follows (Toots et al. 2017b): remodeling the existing processes for public service production to a co-creation-based approach; development of new business models on top of OGD; capable change management; and capacity-building in public sector and non-governmental organizations regarding digital skills, OGD, data management, and service co-creation.

2.3 Process

As explained above, the process of co-creating an OGD-driven public service takes place within a system. The anticipated result of the system functioning is a new co-created OGD-driven public service. However, in order for this anticipated result to emerge, a fundamental understanding of the process is needed. Thus, this section focuses on providing an overview of this process.

When talking about co-created OGD-driven public services, what is really being talked about is a new, radical, and innovative approach toward designing, implementing, and understanding public services. The most critical piece of this new understanding is the new conceptualization of a public service as any service that creates public value. The reason for this assigned importance is that, if traditional understandings are utilized, it would not be possible for any stakeholder (such as a citizen or a company) to take the lead in the public service creation process. This leads us to the third proposition of the framework:

> *Proposition 3 – Any stakeholder (even individual citizens) is able to take the lead in the public service creation process.*

As was mentioned in the content sub-section of this chapter, there has been increased movement toward agile and lean development of public services (Mergel 2016; Janssen and van der Voort 2016; Soe and Drechsler 2018). Though the literature most often looks at how these development strategies are implemented at the governmental level in a top-down manner, there are clear benefits for the uptake of agile and lean development in the context of co-created OGD-driven public services. As co-created OGD-driven public services have the explicit goal of bringing multiple stakeholders together to create a new service, it is paramount that communication,

Table 1 Agile co-creation process motivation

Agile development step	"Co-" step	Service producer/service consumer motivation
Discover	Co-initiation	What needs are not currently being met?
Design	Co-design	How can we meet this need?
Develop	Co-implementation	Is our need for X currently being met or improved?
Test	Co-evaluation	Now that we have started to meet our need for X, how can we keep out solution up to date and/or improve it?

Source: authors

feedback, and learning takes place, and it takes place often; the combination of agile and lean development makes sure this communication happens. In practice, the idea is that an initial service should be released as an MVP, this MVP is then tested and functionality is either continued and/or changed as needed, depending on the feedback received. This starts a constant sprint-like cycle where, after the initial development, the service is continuously improved and developed until it reaches completion; the fourth proposition of the framework emerges from this idea:

> *Proposition 4 – There should be an initial release of a public service at the earliest possible stage as an MVP so that the process of validated learning and development may be started as quickly as possible.*

When thinking about the concept of co-creation as a four-step process as proposed previously in this chapter it is possible to see a potential bridge between the co-creation cycle and agile development cycle. Table 1 shows the relationship between service producers and service consumers, their motivation for engaging in co-creation, and the relationship between agile development and the respective co-creation step (note the four steps in the proposed cycle have been adapted from Nambisan and Nambisan (2013), Pollitt et al. (2006), OECD (2011)).

It is interesting to point out that in this process of OGD-driven co-creation, the service producer and consumer are asking the same motivational questions as, in co-creation, the service producer and consumer are not clearly delineated roles and one stakeholder will often play the role of both producer and consumer. Based off this mapping between agile development and co-creation, Fig. 3 was drafted and represents a new agile development-based co-creation public service framework. In this framework, any stakeholder is able to take the lead and initiate, design, implement, and evaluate a new public service. This represents a large shift from the traditional top-down approaches of public service delivery. Furthermore, it should also be noted that Fig. 3 denotes an iterative cycle; OGD plays a catalytic role and enables co-initiation, but once the service has been co-initiated the co-creators rapidly iterate through the co-design, co-implement, and co-evaluation stages until the co-created OGD-driven public service is finished. In the model shown in Fig. 3, any actor is able to provide feedback at any stage of the cycle and during any iteration (be it the first or the last).

The final two propositions of the presented framework relate to Fig. 3:

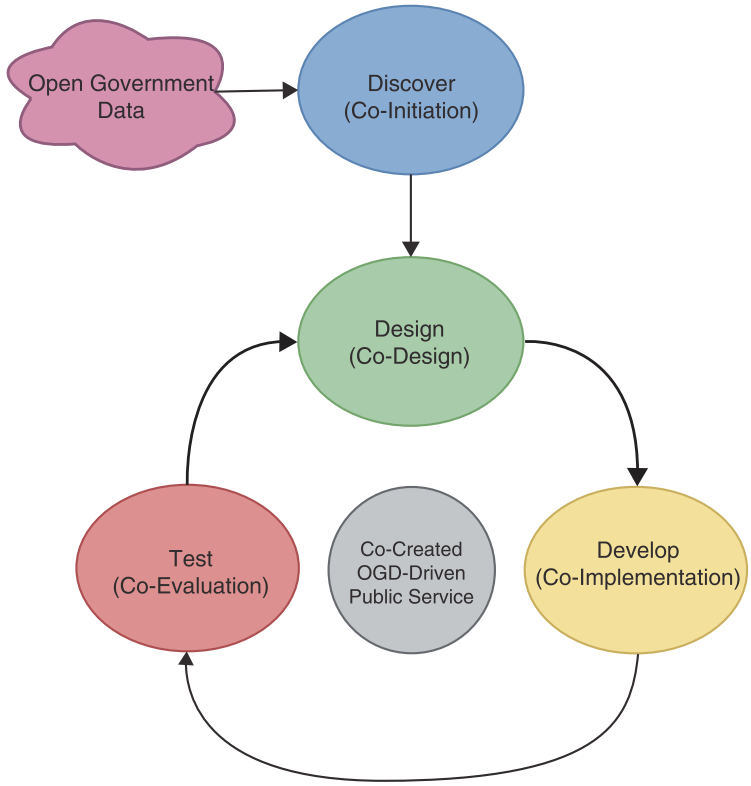

Fig. 3 Co-created OGD-driven public service cycle. (Source: authors)

Proposition 5 – Input of the service consumer should be sought and given consideration at all stages of public service development.

Proposition 6 – The public service should be able to change and/or respond in a fast and efficient manner based on received feedback from the service consumer.

In order to understand the different actions that may take place during each "co-" stage, Table 2 has been prepared; this table lists the potential actions and contributions that fit into each stage, but it does not claim to be an exhaustive list.

The framework presented in this section represents a dramatic reimagining of how public services are conceptualized, built, and implemented. By following the framework, governments should be able to create public value from their open government datasets. Furthermore, an agile development approach that puts a heavy emphasis on citizen involvement in the co-creation of services should lead toward a transition of citizen as customer to citizen as collaborator (see Vigoda 2002); this is one of the biggest potential benefits of this framework. Ultimately, the framework has the following goals:

Table 2 Co-creation stages and actions

Co-creation stage	Co-creator contribution
Co-initiation	Problem and needs identification Idea generation User story generation Target group identification
Co-design	Service user interface mockups Service process design Participation in design workshops
Co-implementation	Contributing code online through a medium such as GitHub Helping to gather or clean data Engaging other stakeholders in the co-creation process
Co-evaluation	Providing feedback on the service Raising issues to service developers Reporting on data quality

Source: authors

- Transition toward "new public services" (Denhardt and Denhardt 2000) that place public value and citizens at the center of public services.
- Conceptualize the idea of a co-created OGD-driven public service.
- Redesign the process associated with public service provision.
- Provide an easy-to-follow process to turn OGD into public services.
- Empower communities by allowing them to become public service producers.
- Encourage active civic involvement by all stakeholders due to decreasing the barriers for participating in service co-creation.
- Allow governments to harness the power of citizen participation and collaboration.

It can thus be assumed that if the proposed process is followed, and appropriate attention is given to the factors identified in the context section, governments should see increased levels of public value creation. This occurs due to the design and creation of new public services that come into existence because of the availability of OGD. Furthermore, if public service providers acknowledge that other stakeholders are able to take the lead in public service creation, there should be an increase in new and innovative approaches for solving citizens' problems and issues.

3 Research Design

In order to understand to what extent the underlying assumptions of this conceptual framework hold true in practice, we conducted an exploratory multiple case study of five pilot initiatives that had been undertaken within the Horizon2020-funded OpenGovIntelligence project to demonstrate how OGD could be used to create public value. A case study strategy was chosen because of our goal of investigating the phenomenon in its real-life context (Yin 2013). Due to the novelty of the concept of

co-created OGD-driven public services, not much information about such initiatives is yet available in literature; hence, the OpenGovIntelligence pilots provided a valuable opportunity to access detailed information about the content, context and process of such initiatives, while enabling to study OGD-driven public service co-creation in different circumstances. The selection of the pilot locations for the project was based on the following criteria:

1. The pilots needed to address a relevant and current societal issue or problem.
2. The pilots were required to use OGD to address the selected issue with the end goal of increasing public value, i.e., every location that wanted to be selected as a pilot location had to be able to demonstrate a problem that could be fixed through the exploitation of OGD.
3. The pilot cases were also chosen based on their variety in terms of country context, representation of different levels of government (national, regional, local), and different policy domains.

This resulted in the selection of six pilot cases covering six European countries – Belgium, Estonia, Greece, Ireland, Lithuania, and the United Kingdom. In addition to these countries' differences in terms of the overall political and public administration system, they also differed in their level of OGD maturity, involving early adopters (e.g., the United Kingdom) as well as laggards (e.g., Estonia, Lithuania). The chosen pilots also represented different levels of government and involved different policy/service domains. Although the OpenGovIntelligence project involved six pilots, one pilot (Greece) was omitted from our study due to its focus on using data to improve public sector internal decision-making rather than co-creating a public service. We therefore ended up investigating five pilots in more detail.

The aim of our study was to empirically validate our understanding of the elements and processes that make up the OGD-driven public service system. More precisely, we asked the following specific questions about each pilot in order to map them against the key propositions of the framework (Table 3):

The following data sources were used to collect information about the cases:

- Written documents and official reports of the OpenGovIntelligence project produced from 2016 to early 2018, most notably project Deliverable 1.1 "Challenges and Needs," Deliverable 4.2 "Evaluation results – First round," and Deliverable 4.4 "Evaluation results – Second round."
- Oral communication with pilot coordinators during project meetings (2016–2018).
- E-mail survey among the pilot coordinators (March–April 2017).
- Because of the involvement of the authors in the development of the Estonian pilot, participant observation was used as an additional data source for this pilot.

The research approach has some clear limitations, which should be kept in mind when interpreting the results of the study. First, the involvement of the authors in the Estonian pilot may raise the question of possible bias in interpreting the results. In order to minimize the risk of bias, we paid careful attention to triangulation between multiple sources of data (Yin 2013), being open to contrary findings (Yin 2013) and

Table 3 Questions asked during pilot analysis

Aspect of framework	Related propositions	Questions
Content	Proposition 1	Did the use of OGD enable to address the indicated societal need or issue?
		Did the use of OGD allow for a public service to be co-created?
		What kind of public value was (or will likely be) provided by the pilots?
Context	Proposition 2	What drivers enabled or supported the process?
		What barriers hindered or constrained the process?
		Did the application of the framework enable stakeholders to overcome some of the previously existing barriers?
Process	Proposition 3 Proposition 4 Proposition 5 Proposition 6	How was the service creation process implemented? What steps did it involve?
		What stakeholders were involved in the process? Did the service creation take place by way of co-creation between different stakeholders, including those not typically involved in public service provision?
		What method was used for service development? Did the use of agile development enable to speed up the development process? Did it support co-creation?
		Did the pilots produce an MVP? Did the provision of an MVP allow for a quicker collection and integration of feedback from service users and stakeholders?

Source: authors

comparing evidence from the Estonian pilot with the other pilots where the authors had no role. Second, due to the small and unrepresentative sample, the results of our study are not statistically generalizable to other cases. However, findings from a multiple case study do allow for analytical generalizations to be made about theoretical propositions (Yin 2013). Third, due to the limitations of the research design, the case study only allowed us to develop a basic understanding of the ability of the framework to describe and guide the co-creation of OGD-driven public services while not allowing conclusions to be drawn about the effect of particular contextual variables (e.g., government level) on the results of the pilots. Last but not least, as the pilots are still ongoing at the time of writing this chapter, our conclusions are based on the results of the first phases of the pilots and are thus preliminary, whereas the long-term results of the pilots still remain to be studied.

4 Pilots

The pilots conducted within the scope of the OpenGovIntelligence project aimed to demonstrate how OGD could lead to the generation of public value by following an innovative public service co-creation process. What is unique about these pilots is

that they provided researchers direct access to validate and test the proposed framework across a wide variety of scenarios:

- Pilots were conducted at different levels of government (regional, municipal, and national).
- Pilots had different goals (such as increased transparency and improved decision-making).
- Pilots aimed to create services that could be used by different user groups (internal to the implementing organization, external to the implementing organization, or both internally and externally focused).
- Pilots took place within a wide variety of contextual domains varying from unemployment and social policy to maritime search and rescue.

As every pilot has its own specific use case and context, each pilot will be described in more detail with special attention being paid to the specific problem it aims to address, the solution to address the problem, and the OGD that is utilized by the solution to address the problem.

Pilot Country One – Belgium The Belgian pilot has been initiated and driven by the Flemish Department of Environment, Nature, and Energy. This organization aims to ensure a healthy and sustainable environment. One part of this goal is to ensure that there was a clear understanding of industrial pollutant emissions. To achieve this understanding, the Flemish government has required companies operating within Flanders that wish to emit polluting substance to apply for a permit and then to report yearly on their pollutant emissions. This data has been collected since 2004, and the government is now working on opening up the data so that it may be used and analyzed by companies, the general public, and by public sector organizations. The opening up of this data was done in response to complaints from companies who believed that if there were such stringent reporting requirements, the data that was collected should be opened so that some value could be generated from the reporting. This pilot believes that by making the pollutant information public, new analytical dashboards can be built that allow for easy and efficient monitoring of emission trends. Furthermore, stakeholders with an interest in ensuring adherence to environmental regulations are able to monitor companies and check for any irregularities or violations that may occur. This pilot acts as a proof-of-concept for the Flemish government, demonstrating how opening up data may allow for the creation of new and innovative public services that increase cooperation and communication between society, government, and private sectors. The initial service takes the form of an online dashboard that allows individuals to view pollution on a map, compare across regions, timescales, and conduct other forms of statistical analysis on the data.

Pilot Country Two – Estonia The Estonian pilot is being implemented by two different organizations, Tallinn University of Technology and The Estonian Ministry of Economic Affairs and communications. The Estonian pilot aims to fight information asymmetry in the Tallinn real estate market by providing users an easy way to

access data relating to real estate. In Estonia, much of the information relating to real estate is either closed or not easy to find/access. This means that when an individual navigated to an online real estate portal, they may be able to find out the size of the apartment, its condition, and the price, but nothing else in relation to the environment, safety, or other environmental factors. The pilot aims to remedy this by aiding in the opening up of new datasets and by bringing together relevant datasets into a single-point-of-access portal. The Tallinn real estate portal allows anyone to search for an address and find all data that may be relevant for a given address. For example, the user is able to find information about crime in the area, car crashes nearby, school locations, public transport, and information about the building. The initial version of the pilot proposed to use and bring together 11 different data sources. The initial target group for this pilot is foreigners who are moving to Tallinn, Estonia and may be trying to find out more information about where they are moving to so that they can make an informed decision about where to live in Tallinn. The pilot has been built in a completely open-source manner, utilizing open-source technology, and has encouraged and sought out outside input throughout the entire design and implementation of the pilot. The Estonian pilot was co-initiated by foreigners living in Tallinn, the University, and the Ministry of Economic Affairs. Though the pilot's initial focus is foreigners moving to Tallinn, it has the potential to provide value to government officials, real estate agents, investors, and other stakeholders who may be interested in real estate data. The benefits of this pilot include increased timesaving for those trying to find real estate information, a decreased administrative burden, and increased transparency in the real estate sector leading to fairer prices.

Pilot Country Three – Ireland In Ireland, the pilot is being led by the Irish Marine Institute, which is a state agency with a mandate to research and innovate within the marine sector. The Marine Institute maintains a large amount of data that is available in an open and linked format, but there were some issues when it came to accessing and creating value from this data. The Marine Institute found that three areas could use OGD to generate new and innovative public services: search and rescue, renewable wave energy, and maritime tourism. The primary focus of the pilot was to collect and make data available in real time. In regard to the first scenario, search and rescue, the availability of quality and easily accessible real-time data could aid rescuers by providing them information about the current size of waves, wind speed, or other conditions where a rescue needed to take place. In the second use case, open data related to the waves would allow researchers to plan and optimize the locations to test new solutions for creating energy from the movement of waves. The final use case aimed to provide value to those who wish to engage in leisure activities on the water such as boating or swimming. With real-time data available, stakeholders would be able to make informed decisions about the safety of their activity at a certain time or be able to be better prepared for a situation they may encounter such as a storm. The Maritime Institute collects data from multiple sources such as weather stations, buoys on the water, and other statistical reports and then makes its available and open in real time. This data can be both queried

statistically using a language such as SPARQL, but it is also possible to view in real time data related to specific areas of the Irish coastline on a map. Overall, the pilot aims to provide value across multiple sectors in the form of safer and more effective search and rescue operations, allow for increases in informed decision-making, decrease administrative burden, and also allow for new and innovative services to be built on top of the data.

Pilot Country Four – Lithuania In Lithuania, a pilot project is being coordinated by Enterprise Lithuania that aims to increase business and entrepreneurship within the city of Vilnius. At the start, there was no information in regard to the opportunities that were available to businesses in the city of Vilnius, so, in order to remedy this, a portal has been created that allows for easy visualization of data to allow businesses to make more informed decisions. The portal was initially conceptualized by Enterprise Lithuania (a state agency), but the user experience and the design have been generated and created in cooperation between Enterprise Lithuania and local business owners and entrepreneurs. In order to build and implement this portal, data was opened and made available to the public; this data largely dealt with potential markets, active businesses, demands, and current distribution of businesses across different sectors. The portal foresaw potential entrepreneurs and businesses thinking about entering the Lithuanian market as the initial target group, but it is also likely that citizens with an interest in accountability and fair businesses practices will engage with and analyze the data made available on the portal.

Pilot Country Five – the United Kingdom The pilot that is taking place within the United Kingdom is being run and organized by Trafford Council, which is a government organization responsible for the area of Trafford in the area of Greater Manchester. In the United Kingdom, there is a problem when it comes to the distribution and usage of Job Centre Plus locations; there are over 800 locations maintained by the Department of Work and Pensions. These locations provide a place for citizens to claim their work benefits, gain assistance with interviewing, receive job training, receive help in applying for jobs, and generally are supposed to aid those who are having difficulty with any aspect of obtaining employment. The location of these centers is being reviewed, as it is believed the current system is not as efficient as it may be. The pilot being organized by the Trafford Council aims to understand the location of these centers within their area and also look at how they are being utilized, by who, when, and for what reasons. Using OGD sets relating to Job Centre Plus locations, worklessness, poverty, and other related datasets, a pilot program has been constructed that will allow for policy-makers to gain a better understanding of the usage of each center and also see which areas are currently over- or underserved. The pilot has actively sought and engaged input from outside stakeholders and met with other government decision-makers, private sector companies, and managers of Job Centre Plus locations to discuss what data is needed and how it should be presented. Overall, this pilot creates a new dashboard that allows government officials to make decisions that are more informed due to increased availability of data and easy to understand visualizations. Thus, citizens and users of Job

Table 4 Pilot country summary

Pilot	Level	Domain	Type of users	Goal
Belgium	Regional	Environment	Internal and external	Increased transparency
Estonia	Municipal	Real estate	External	Increased transparency
Ireland	National	Marine	Internal and external	Improved decision-making and services
Lithuania	Municipal	Business	External	Improved decision-making
UK	Regional	Unemployment	Internal	Improved decision-making and services

Source: authors

Centre services are also to benefit as locations and services provided will be optimized based on information from this pilot.

To provide a summary of the different pilots and their domains, Table 4 shows the level of government where the pilot was initiated at (either municipal, regional, or national), the problem domain of the service, the type of end user for the service (internal to the public sector, external, or both), and the overall motivational goal of the pilot. There was a mix of pilots across government levels (2 from regional, 2 from municipal, and 1 from national) which operated in five different domains.

5 Results and Findings

The proposed framework latches onto the idea that digital technologies, such as OGD, have the potential to transform public services. The framework aims to provide a new way of understanding, designing, and implementing these services. It is stated that the availability of OGD has the potential to act as a catalyst for co-creation, and that a public service creation process that embraces co-creation, agile development, and lean development may drive the creation of new and innovative services that provide public value. Therefore, the ultimate test of the value of this framework is to what extent the application of the proposed process allows to create public value from OGD and successfully engage different stakeholders in this co-creation process.

The framework put forth six propositions with regard to the phenomenon of co-created OGD-driven public services (some of these propositions have been previously published in Toots et al. 2017a). Next, the findings of the empirical study will be presented as regards each proposition, with the goal of understanding whether the application of the framework allowed for public value to be successfully co-created from OGD in each pilot.

Proposition 1 – OGD can be turned into public value through the co-creation of OGD-driven public services.

Due to the focus of the OpenGovIntelligence project on the exploitation of OGD to create public value, the core component elements of a co-created OGD-driven public service were present in all pilots. All exploited OGD to address some societal

need, and all applied a co-creation process to create concrete services whereby the value of data could be released. The findings from the first rounds of pilot evaluation conducted within the project showed that all of them had a public value-oriented goal: the Belgian pilot aimed to increase transparency in the domain of environmental pollution; the Estonian pilot aimed to increase transparency and reduce information asymmetry in the real estate field; the Irish pilot aimed to improve maritime search and rescue services; the Lithuanian pilot aimed to help businesses make better decisions on where to locate their activities; and the UK pilot aimed to improve public decision-making and public services targeted to tackling worklessness. In order to achieve the goal, all pilots engaged different organizations and stakeholder groups in a process of co-creating the respective services.

Proposition 2 – The results of the co-creation system are influenced by the contextual environment.

All pilots demonstrated the importance of context as a source of drivers and barriers for the co-creation process. For example, for the pilots in Estonia, and Lithuania, data availability and quality turned out to be major challenges due to a low level of OGD maturity. However, in the other pilot countries where a higher level of OGD maturity existed, these challenges did not present themselves to the same extent. In some pilot countries, the organizational beliefs also posed a major challenge to the co-creation of new OGD-driven public services. In the case of Estonia, there was minimal government support due to the belief that only a government should provide services, whereas in the United Kingdom, organizations are actively pushing for more user involvement and co-creation. Though all of the pilot countries strove to involve outside stakeholders, getting individuals to participate in the co-creation of the service was difficult. This appears to be linked to the fact that four pilots were co-initiated at a government level and, therefore, perhaps there was not much interest from citizens, private sector, or non-profits.

The pilots' experience also suggests that the application of an agile and collaborative service development process effectively helped bypass some of the main barriers to the use of OGD for public value creation. For example, the Estonian case demonstrated that if government organizations lack the interest and capacity to initiate OGD-driven services, such services can well be initiated and created by non-governmental stakeholders such as a group of university students and researchers.

Proposition 3 – Any stakeholder (even individual citizens) is able to take the lead in the public service creation process.

A large majority of the pilots were initiated by stakeholders in the governmental sector, the exception being Estonia. In the Estonian pilot, a foreign researcher living in Estonia noticed that there was a serious need for more information to be provided on the real estate market, that this data existed, and that the data was not easily accessible. This, then, led to an Estonian university taking the lead role in initiating the co-creation of an OGD-driven web application to address this need. The role of the public sector partners in this case was limited to providing data for the

application and participating in a co-design workshop where user stories were created and the functionalities of the application were defined.

Proposition 4 – There should be an initial release of a public service at the earliest possible stage as an MVP so that the process of validated learning and development may be started as quickly as possible.

The use of agile and lean development principles varied widely across the pilots. In Estonia and the United Kingdom, an MVP service was developed, released, and then improved over multiple iterations. In these two cases, the development was all done in an open-source manner, an initial service was released, and the end users of the service were consulted and their feedbacks integrated into each successive cycle of development, thus leading to more personalized services.

In the other cases (Belgium, Lithuania, and Ireland), user input was also sought, but development was not conducted in an agile manner and the code was not open. Though a new service has been created in all pilot cases, the two pilots in Estonia and the United Kingdom are the easiest to evaluate and monitor as all improvements, issues, and comments have been raised and are visible online; whereas in the closed development cycles these issues are not transparent.

Proposition 5 – Input of the service consumer should be sought and given consideration at all stages of public service development.

All pilots involved a sort of a co-creation element (co-initiation, co-design, co-implementation, or co-evaluation), but this manifested itself in different ways in the different contexts. In order to discuss each of these "co-" steps in detail, definitions are provided for each step:

- Co-initiation occurs when service users play a critical role in getting service producers to create a new service or response.
- Co-design occurs when users and producers of a service interact with each other and both are able to influence the design and direction of the service.
- Co-implementation may be understood as the process in which input from service users is required for the service to function or where the service user plays a critical role in building or implementing the service.
- Co-evaluation occurs when users of a service provide feedback and this feedback is available and used by other service users or service providers.

In an ideal world, all four steps would be followed to have a truly "co-created" public service. However, what was made clear by studying the pilots is that it is difficult for all four of these elements to take place and quite often only two or three steps are actually put into practice by the service producer. In the case of the pilots, all had elements of co-design, only three pilots had strong elements of co-implementation (Estonia, the United Kingdom, and Ireland), and all pilots had elements of co-evaluation. Thus, it does appear that of the four proposed stages, co-implementation is the hardest to implement in practice. It is unclear why co-implementation occurred easier in some pilot countries compared to others as where it did occur and where it did not occur contained an equal mix of contextual background, and it is not possible to identify what caused this.

When looking at how each "co-" stage manifested across the pilots, there were many different approaches. For example, all pilots conducted user workshops at the co-design stage where stakeholders from different groups were brought together to discuss the use case, service design, and direction/focus of the new service. However, at the co-implementation stage, two separate approaches were used. In the Irish pilot, users were able to upload their own data, refine and improve available data, and will soon be able to use sensors to help provide and gather data for the service producer. On the other hand, the United Kingdom and Estonian pilots aimed to involve outside stakeholders in the implementation of the service by making the code open source and encouraging active participation from service users in the actual coding of the pilot. Additionally, the Estonian pilot worked with civic hackers to help improve some internal functions of the pilot. Interestingly, the pilots that engaged in co-implementation also had the strongest levels of user engagement and interaction. This is interesting as it does seem to suggest that in terms of the four "co-" stages, it may be the most important when it comes to the co-creation of public value and facilitating active co-creation of a new service.

Proposition 6 – The public service should be able to change and/or respond in a fast and efficient manner based on received feedback from the service consumer.

In regard to the last proposition, services that went through more iterations (the United Kingdom and Estonia) tended to be more open and more responsive and have a higher usage rate than the services that did not follow an iterative development cycle. There are a few potential reasons for this. Firstly, it seems to be the case that when users are involved throughout the co-creation process, they are more attached and engaged with the service and thus feel a sense of ownership and will continue to engage with the service over time. Secondly, services that start with an initial MVP launch and improve over time simply provide more opportunities for engagement with other co-creators, and more opportunities for engagement with lower barriers would understandably lead to higher levels of interaction between service user and service provider. Thirdly, services developed in this manner are able to transition the direction of the service quickly, so if initial users of the MVP point out issues they can be dealt with immediately rather than later on in the process where changes may not be possible. Thus, services that are co-created in an iterative manner are more responsive and in tune with the users' needs, which helps drive efficiency of the service, provides higher levels of public value, and also appears to drive higher levels of user engagement and empowerment.

6 Conclusion

The growing availability of open government data is widely held to open up new ways of creating public and commercial value. However, not much is yet known about how exactly public value can be extracted from OGD. This chapter argued that one of the prominent ways of turning data into value for citizens and society is

the co-creation of public services. Such services are "public" not in the traditional sense of being provided or funded by public administrations but in the sense of contributing to public value and common good. If OGD is made available at a broad scale, any stakeholder that has the interest, ideas and skills can take the lead in building OGD-driven services that address some sort of societal need or add value to citizens' lives in different ways. This chapter proposed a framework that explains the concept of co-created OGD-driven public services (COPS) and put forward a collaborative process for the creation of such services, while taking into account the effect of various drivers and barriers in the broader context. The core ideas of the COPS framework were formulated as six key propositions:

- Proposition 1 – OGD can be turned into public value through the co-creation of OGD-driven public services.
- Proposition 2 – The results of the co-creation system are influenced by the contextual environment.
- Proposition 3 – Any stakeholder (even individual citizens) is able to take the lead in the public service creation process.
- Proposition 4 – There should be an initial release of a public service at the earliest possible stage as an MVP so that the process of validated learning and development may be started as quickly as possible.
- Proposition 5 – Input of the service consumer should be sought and given consideration at all stages of public service development.
- Proposition 6 – The public service should be able to change and/or respond in a fast and efficient manner based on received feedback from the service consumer.

In order to explore the ability of the conceptual framework to describe and guide the co-creation of OGD-driven services in practice, we conducted a multiple case study of five pilots that were implemented in five different countries and five different domains in the framework of a European project. The analysis of the pilots supported most propositions of the framework:

- All pilots used OGD to co-create public value through the creation or improvement of public services.
- The pilots also point to the effects of context – for example, the lack of OGD availability turned out to be the main barrier for pilots that were implemented in countries with a low level of OGD maturity.
- Some pilots met challenges related to engaging public sector stakeholders, but due to a new conceptualization of "public service" and the application of a co-creation approach, the lack of participation of public sector organizations could be overcome by non-governmental stakeholders taking the lead in developing the service.
- As regards the fourth proposition, the use of agile and lean development principles varied widely across the pilots, but following the agile and lean development cycle seemed to yield better results in terms of speeding up the cycle of service creation.

- All pilots also involved elements of co-creation, mostly in the form of co-design and co-evaluation. Since user input was sought and utilized in all pilots, it is difficult to evaluate to what extent the application of a co-creation approach may lead to more effective services compared to cases where co-creation is not used. Nevertheless, it is possible to say that the pilots that had higher levels of user participation and feedback tended to be viewed as more effective, thus giving some credence to the idea that increased user engagement throughout the "co-" cycle leads to services that are more in tune with the service users' needs. Interestingly, the three pilots that had strong elements of co-implementation with service users and other stakeholders had stronger levels of user engagement and interaction compared to other pilots.
- Finally, as regards the last proposition, the services that went through more iterations (the United Kingdom and Estonia) tended to be more open and more responsive and have a higher usage rate than the services that did not follow a development cycle that was able to respond fast to user needs.

Based on these cases, it appears that following the proposed framework can lead to the co-creation of OGD-driven public services and that the framework is applicable across a wide range of domains, problems, and environments. In regard to co-creation, it is interesting to see that despite the many barriers associated with this concept in literature, co-creation did occur in every pilot. One reason for this may be due to the breaking up of the co-creation process into four stages. This four-stage development approach provides more opportunities for stakeholders to contribute to the co-creation and lowered barriers to participate compared to other traditional approaches. Interestingly, the co-implementation stage seems to be the most important stage of the cycle. Thus, it follows that those who wish to benefit from OGD-driven co-creation should consider putting a large emphasis on this stage.

The analysis of the pilots allows us to conclude that the core concepts of the framework are useful and applicable in many different contexts. At the same time, several elements of the framework, in particular the process, still require further empirical exploration in order to understand how the process may be refined to achieve the best results in terms of creating public value from data. More research is also needed on the positive and negative effects of different contextual factors on the co-creation of OGD-driven public services. While context was only superficially touched upon in this chapter, we see broader environmental drivers and barriers such as political interest, attitudes to co-creation and availability of OGD as important elements of the OGD-driven public service ecosystem. Lastly, future research might also examine how people's familiarity with the data and proximity to the issues that are being solved with the help of data affect citizen engagement in the co-creation of OGD-driven services. For example, although the methodological limitations of our study did not allow us to explore this hypothesis, previous research (e.g., Mcbride et al. 2018; Schrock and Shaffer 2017) seems to hint that OGD at the local and municipal level may induce more active citizen engagement than OGD at the national level, thus possibly making the local government the most important arena where public value can be co-created.

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