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Open Government Data Co-Created Public Services

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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.

Keegan McBride

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List of Publications

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

I **McBride, K.** (2019). Sailing towards digitalization when it doesn't make cents? Analysing the Faroe Islands' new digital governance trajectory. *Island Studies Journal*, 14(2), 193–214. **(ETIS 1.1)**

II **McBride, K.,** Aavik, G., Toots, M., Kalvet, T. & Krimmer, R. (2019). How does open government data driven co-creation occur? Six factors and a 'perfect storm'; insights from Chicago's food inspection forecasting model. *Government Information Quarterly*, 36(1), 88–97. **(ETIS 1.1)**

III **McBride, K.,** Toots, M., Kalvet, T. & Krimmer, R. (2018). Leader in e-government, laggard in open data: Exploring the case of Estonia. *Revue francaise d'administration publique*, (3), 613–625. **(ETIS 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: Parycek, P., Edelmann, N. (Eds.), *Conference for E-Democracy and Open Government (CeDEM)* (pp. 102–112). IEEE. **(ETIS 3.1)**

V **McBride, K.,** Toots, M., Kalvet, T. & Krimmer, R. (2018). Open Government Data Driven Co-creation: Moving Towards Citizen-Government Collaboration. In: Parycek, P., Glassey, O., Janssen, M., Scholl, H.J., Tambouris, E., Kalampokis, E., Virkar, S. (Eds.), *International Conference on Electronic Government* (pp. 184–195). Springer, Cham. **(ETIS 3.1)**

VI **McBride K**., Toots M., Kalvet T., Krimmer R. (2019) Turning Open Government Data into Public Value: Testing the COPS Framework for the Co-creation of OGD-Driven Public Services. In: Rodríguez Bolívar M., Bwalya K., Reddick C. (Eds.), *Governance Models for Creating Public Value in Open Data Initiatives. Public Administration and Information Technology*, vol 31. (pp. 3–31). Springer, Cham **(ETIS 3.1)**

VII 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: Janssen, M, Axelsson, K., Glassey, O., Klievink, B., Krimmer, R., Lindgren, I., Parycek, P., Scholl, H.J., Trutnev, D. (Eds.), *International Conference on Electronic Government* (pp. 264–275). Springer, Cham. **(ETIS 3.1)**

Author's Contribution to the Publications

Contribution to the papers in this thesis are:

II The author of this thesis is the lead author, corresponding author, and responsible for a majority of the content of this paper, including research design, conducting of interviews, and writing the paper.

III The author of this thesis is the lead author, corresponding author, and responsible for a majority of the content of this journal article.

IV The author of this thesis played a significant role in writing the background literature section on open data and co-creation, as well as helping in the analysis of the drivers and barriers.

V The author of this thesis is the lead author, corresponding author, and responsible for a majority of the content of this paper, including research design, conducting of interviews, and writing the paper.

VI The author of this thesis is the lead author, corresponding author, and responsible for a majority of the content in the book chapter. Additionally, the author was the first author of the deliverable from the H2020 funded OpenGovIntelligence project that this chapter was based on.

VII The author of this thesis helped to draft the deliverable that this publication was based on and played a significant role in helping to draft the theoretical background and the framework itself.

1 Introduction

Technology does not a government make. However, in the current field of e-Government, this distinction is not always clear. The importance of specific technologies is sometimes being put on a pedestal without attempting to gather a detailed understanding about how it influences, or influenced is by, the government itself. Instead of understanding *why* or *when* a technology could/should be used, *how* it could/should be used, or *what* factors influence its usage and adoption, disruptive technologies are often viewed in a normative fashion as inherently 'good'. Technologies are said to be able to transform, disrupt, or dramatically change the form and function of government (Norris & Lloyd, 2006; West, 2004). This is especially true, now, as more and more 'disruptive' technologies (i.e. blockchain, artificial intelligence, big data, etc…) continue to emerge, with academics who study e-Government devoting a large amount of attention to understanding better these technologies. In fact, there are specific tracks at many of the major e-Government related conferences and special issues of journals dedicated to these technologies. This thesis argues against this practice, taking a broader approach to the study of a specific e-government phenomenon-cum-technology, that of open government data (OGD)-driven co-created public services. Before continuing further, and due to the newness of this concept, it is important to offer already some initial foundational definitions to the core concepts that this thesis relies upon; these are presented in the Table 1 below.

Table 1. Core definitions

Open Government Data	… is data that is created and provided by a government, offered with a reusable license, is human readable, machine understandable, and released without discrimination or cost to the public.
Co-Creation	… is the involvement of outside, non-typical, stakeholders in the initiation, design, implementation, and evaluation of a new public service **(VII).**
Public Services	… "are services offered to the general public and/or in the public interest with the main purpose of developing public value" (European Commission, 2013, p.2).
Open Government Data Driven Co-Created Public Services	… are services producing public value that rely on OGD and have been developed by stakeholders from different groups coming together in a co-creative process **(II)**.

As previously mentioned, this thesis bases itself within the discipline known broadly as e-Government and it is this discipline where the primary contribution of the research is expected to take place; though the research is itself interdisciplinary in nature. To-date, there has been limited research within the field of e-Government on OGD-driven co-created public services, with a large majority of current research and empirical examples in the academic literature being contained within the research articles that make up this thesis. Thus, one of the primary contributions of this research is the identification, conceptualization, and investigation of these services. Additionally, the research: 1) provides an overview of the drivers and barriers associated with the co-creation of new OGD-driven public services; 2) provides initial insights into how different contexts may

influence and effect the development, growth, and usage of OGD ecosystems; and 3) provides new knowledge into how OGD ecosystems allow for the development of new and innovative public services through a co-creative process. While this thesis does primarily contribute to the field of e-Government, it draws on insights and experiences from the parent disciplines of e-Government, public administration and information systems research, and the contributions of this research are relevant to scholars in these fields as well (for example **I** contributes to public administration of small states, **III** contributes to public administration, **II** contributes to an e-government and information systems).

When talking about e-Government, there is still not-yet a widely agreed upon definition. At its initial stages, e-Government was often associated with the use of internet for delivering public services or for other externally-focused operations (Schedler, Summermatter & Schmidt, 2004). However, as technology has changed, so has the definition and understanding of e-Government. There has been a slow shift from using specific technologies to define e-Government (such as the internet) to a focus on the processes and interactions as it is clear that that "certain technologies do not fundamentally define what e-Government is and what will be" (Yildiz, 2007, p.655). Interestingly, while many normative assumptions have been ascribed to e-Government, authors have pointed out that these assumptions are often just simply myths (Bekkers & Homburg, 2007). In order to try to avoid any normative assumptions and to try to stray away from specific technologies being included in the definition of e-Government, this thesis views e-Government as the use of digital means to facilitate the interaction and flow of information between government and another party (i.e. non-governmental organizations (NGOs), citizens, businesses, or other governmental agencies). Thus, in order to understand better the nature of e-Government, it becomes important to understand the different relationships, interactions, dynamics, and systems that are created and facilitated by some sort of digital means.

One such digital innovation that has recently come to the attention of the academic community, and society more broadly, is that of OGD. OGD is not purely technological, it is a philosophy (OECD, 2018), and systemic in nature; so, when introduced, it leads to the creation of new systems, interactions, and dynamics (Dawes et al., 2016; Harrison et al., 2012; Styrin, Luna-Reyes & Harrison, 2017). As mentioned previously in this section, scholars are now beginning to investigate whether and how OGD can lead to the development of new (or enhancement of) co-creation systems (Jarke, 2019; Khayyat & Bannister, 2017; Mergel, et al., 2018) and, therefore, new understanding about how OGD influences these systems would be of relevance for the domain.

The research in this thesis started with an investigation into understanding how new technological innovations could affect a term that had been seeing increasing popularity in the field of public administration, that of co-creation. As co-creation involves the involvement of stakeholders from different groups coming together to create new public services, it followed that any technology that may allow for stakeholders to come together to create in an easier manner may well help drive these co-creative processes. Interestingly, this is exactly what previous research on OGD suggested it could do: it was believed that OGD has the potential to create new public services, increase transparency and accountability, reduce barriers to government information, as well as bring higher levels of public value, innovation, and economic benefits (European Data Portal, 2018; Janssen et al., 2012; Zuiderwijk, et al., 2015). Thus, OGD should influence or lead to higher levels of co-created public services. This line of thought is also discussed in **IV** where it was noted 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 public value" (p. 102). However, upon initial investigation, it was found that little to no research had yet been done on this topic **(III, VII)**. Additionally, it appeared to be the case that there was a high level of normative/positive bias in the research on co-creation (Dudau, Glennon & Verschuere, 2019) and similarly, with OGD, many authors took the position that more OGD would automatically mean higher levels of value (e.g. Pereira, G.V., et al., 2017). This thesis argues against this idea: simply making 'more' data available does not necessitate an automatic increase in public value, in fact, larger amounts of data being released can have the opposite effect, reducing public value, by making relevant datasets harder to find and diluting the value of available information. It is from here that the idea for this thesis was born, and the exploration of OGD-driven co-created public services, why they may or may not be important, and how they may lead to higher levels of public value began.

This research is interdisciplinary in nature and based within the field of e-Government. E-Government research happens primarily in three fields: firstly, Public Administration (PA); secondly, Information Systems; thirdly, e-Government. While the research across domains deals largely with the same topics, the research still remains largely siloed with little to no overlap or crossover of ideas, methodological approaches, or theoretical development (Gil-Garcia, Dawes & Pardo, 2017). This issue has been brought up on both sides, with PA scholars claiming that the original explosion of e-Government research was "developed in a vacuum…. [becoming] the scientific equivalent of wishful thinking" (Norris, 2010 p. s181) or that the approach adopted by the field of e-Government is too techno-centric and ignores many of the important contextual factors (Castelnovo & Sorrentino, 2018). In contrast, e-Government and Information Systems scholars often point to their real-world impact and the applied and interdisciplinary nature of the field to highlight that perhaps the technological-driven approach is actually meaningful (Scholl, 2006, 2007). Additionally, it has also been argued that while the field of e-Government does seem to lack research philosophy (Heeks & Bailur, 2007), there is often a high level of technological understanding that is missing from other research disciplines investigating e-Government (Scholl, 2006).

Though digital government has had an effect on how citizens and governments interact (Chatfield & Brajawidagda, 2013; Dillon, Deakins & Chen, 2006; Meijer, 2012; Norris, 2004), for the most part, we have yet to see any large, radical, transformational shifts in how governments work. This is especially the case when it comes to OGD, with some scholars noting that OGD has not yet had the wide or powerful impact that it was initially expected to have (Mergel, Kleibrink & Sörvik, 2018; Zuiderwijk, Shinde & Janssen, 2019).

In order to understand why this is the case, many scholars have focused on understanding the specific drivers and barriers associated with the usage of OGD, such as in the work by Janssen et al., 2012 or Young & Yan, 2017. However, most of these studies are only single case studies, not allowing for cross-context comparison. Although many drivers and barriers are similar across contexts, there are also those that are context specific (for example, when it comes to OGD-driven co-creation, see the work in McBride, et al., 2019). So, in order to understand better these drivers and barriers, what is needed is more empirical studies that look at the usage of OGD in a wide variety of contexts. It is here too, that this thesis aims to make a contribution, by providing empirical results on the drivers and barriers from different contexts be it the Faroe Islands as a sub-national island jurisdiction **(I)**, Chicago as a municipality **(II)**, or European states (Belgium, Estonia, Greece, Ireland, Lithuania, United Kingdom) **(IV-VI)**.

2 Focus and Aim

Whilst previous research has explored the success or failure of OGD initiatives (e.g. Sayogo, Pardo & Cook, 2014; Susha, et al., 2015; Tygel et al., 2016), the drivers and barriers associated with OGD (e.g. Barry & Bannister, 2014; Beno, et al., 2017; Conradie & Choenni, 2014; Janssen et al., 2012; Young & Yan, 2017), innovation with OGD (e.g. Juell-Skielse, et al., 2014), co-creation (e.g. Osborne, Radnor & Strokosch, 2016), and ICT-mediated co-creation (e.g. Cordella & Paletti, 2017; Lember, Brandsen & Tõnurist, 2019), attention has not yet largely been paid to how the concepts of OGD and co-creation can be linked together **(VII)**. In fact, outside of the work in this thesis, the only major publication dealing directly / specifically with this topic is the 2017 paper by Khayyat and Bannister titled "Towards a model for facilitating and enabling co-creation using open government data" that explores the role of OGD in a co-creation ecosystem in Ireland. However, this work is limited to that of a single case study. This raises the situation where there is large amounts of research on OGD and co-creation more broadly and individually, but limited research that bridges these two topics and perspectives together, exploring further how their combination could lead to the creation of new public services and the attainment of higher levels of public value. Starting from this research gap, and in order to address the contributions outlined in the previous introductory section of this work, this thesis asks the following research questions (RQs):

1. How can OGD be used to enable the co-creation of new public services?
2. What are the main drivers and barriers associated with the practice of OGD-driven co-creation?
3. How does the availability of OGD influence public service co-creation ecosystems?
    a. How does the introduction of OGD to co-creation ecosystems allow for public value to be created?

To achieve the aims of this thesis, and to answer the research questions, this thesis utilizes a total of seven articles. The first publication, "Sailing Towards Digitalization When It Doesn't Make Cents? Analyzing the Faroe Islands' New Digital Governance Trajectory" (I), presents the story of Talgildu Føroyar which is the organization responsible for the Faroe Islands' digitalization efforts. The second publication, "Leader in e-Government, Laggard in Open Data. Exploring the Case of Estonia" (II) examines the apparent disconnect between Estonia's position as a perceived leader in e-Government with its underperformance in OGD. The third publication, "How does Open Government Data Driven Co-Creation Occur? Six Factors and a 'Perfect Storm'; insights from Chicago's Food Inspection Forecasting Model" (III) looks at the development of how an innovative OGD-driven co-created public service was made possible by a unique combination of environmental, technological, legal, and human factors. The other four articles, "Open Data as Enabler of Public Service Co-Creation: Exploring the Drivers and Barriers" (IV), "Open Government Data Driven Co-Creation, Moving Towards Citizen-Government Collaboration" (V), "Turning Open Government Data into Public Value: Testing the COPS Framework for the Co-Creation of OGD-driven Public Services" (VI), and "A Framework for Data-Driven Public Service Co-Production" (VII) provide further insights into the different factors that influence the usage of OGD for the co-creation of new and innovative (public) services.

To build up an initial understanding of OGD-driven co-created public services, papers **II** – **VII** all deal explicitly with gaining a better understanding of the different parts of an OGD-driven system or public service co-creation and the behaviour of such a system. While **I** does not focus explicitly on OGD as the object of study, it does look at the role of OGD in a wider digitalization initiative. The research papers explore OGD in a number of different ecosystems. **I** is focused on the Faroe Islands, **II**, is focused on the City of Chicago, **III** and **V** are focused on Estonia, **IV** and **VI** take a broader approach and explore OGD-driven co-creation in six different countries, and, finally, **VII** takes an a-contextual approach focusing rather on a potential process for using OGD rather than exploring an empirical example of its usage. Furthermore, all seven research papers included in this thesis address different drivers and barriers associated with the usage of OGD. This work started primarily in **IV** and **VII**, which served to create an initial understanding of the drivers and barriers associated with OGD. After this, further empirical explorations in **I, II, III, V,** and **VI** were conducted to understand better the systematic and contextual influences on these initially discovered factors.

RQ1 asks "How can OGD be used to drive the co-creation of new public services?". In order to answer this question, the thesis utilizes the published research articles to: develop an understanding of the concept of a "co-created OGD-driven public service", proposes a model for understanding the process of co-creating an OGD-driven public service, and then studies real-world empirical examples of OGD-driven public services in different contexts. Papers **IV**, **VI,** and **VII** come together to form the necessary background information for further investigating the nature of co-created OGD-driven public services. Papers **II** and **V** provide two different examples of co-created OGD-driven public services, whereas **VI** provides examples of different services in different contexts.

For RQ2, all papers, with the exception of **I**, pay special and specific attention to the drivers and barriers that are encountered in different contexts in relation to co-created OGD-driven public services.

The third question, RQ3, asks "How does the availability of OGD influence public service co-creation ecosystems?". In all seven of the papers included with this thesis insights into this question are provided. For RQ3a, the thesis draws on insights provided by the research conducted in papers **II, V, VI** as they all explicitly provide information about empirical examples of how the introduction of OGD to the public service co-creation process allowed for public value to be created. In order to do this, different OGD-driven co-created public services have been studied and the public value they aimed to create is present, as well as whether or not this value emerged.

The rest of this thesis is devoted to answering the primary and supplementary research questions in a more in-depth manner, and, through this process, making clear how the aforementioned contributions have emerged as a result of this research, and, ultimately, are encapsulated within this thesis. In the following section, the methodology and research philosophy that guided this research are presented and discussed in detail. Following the methodological overview, important and necessary background information on the topics of OGD and co-creation are provided to make clear how the ideas presented in this thesis have emerged, and also, to clearly demonstrate the areas that this research is able to make a contribution to. After this background has been provided, an overview of the articles is presented; during this process, the research questions will be reflected upon and the current answers provided. Finally, the main conclusions and key contributions of the thesis are put forth, as well as implications for future research.

3 Methodology

The research conducted for this thesis draws primarily on its philosophical basis from interpretivism. Interpretivism is a research philosophy that views "our knowledge of reality [as] a social construction" (Walsham, 1995, p.376) and that this knowledge is "incapable of being understood independently of the social actors" (Orlikowski & Baroudi, 1991, p.14). In practice, this means that interpretation is one of the key ways to gain new understanding about complex social phenomena, such as politics, public administration, or e-Government. When it comes to ontology, interpretivism relies heavily on constructivism (Hay, 2011; Walsham, 1995) viewing reality as a social construction that is influenced by the views, beliefs, traditions, and ideas of people. Epistemologically, interpretivism is concerned with interpretation and understanding, it is only by understanding how and why certain beliefs, traditions, and values are held that we can generate new knowledge (Bevir & Rhodes, 2005; Chen & Hirschheim, 2004).

With this in mind, certain research methodologies are likely to be more in line with interpretivism than others. The methodology must allow for interpretation and understanding, and it must also allow for the study to take place in vivo, or within the whole. Thus, specific qualitative methodologies such as case studies or field studies are likely to be featured more predominantly in interpretive research (Merriam & Grenier, 2019; Orlikowski & Baroudi, 1991; Walsham, 1995). However, it is also important to point out that these case studies should be conducted in an inductive rather than a deductive manner, where the focus is on generating knowledge and understanding rather than testing hypotheses and theoretical concepts. In terms of evidence and data collection, methods (almost always qualitative) that allow the research to understand the subjects' beliefs and values should be relied upon this includes, in a non-exhaustive manner: interviews, field work, participation, ethnography, or document reviews (such as narratives or stories).

In this research, the primary used methodology was case study research with articles **II, III, V,** and **VI** being exploratory case studies and article **I** being a descriptive/narrative case study. Exploratory case studies allow for some contemporary phenomenon to be explored within its natural context and setting and has an explicit goal of generating initial insights, knowledge, and understanding (Yazan, 2015; Yin, 1989). A narrative case study, aims to tell a narrative or story about how and why a certain phenomenon has emerged and focuses heavily on historical processes and developments (Merriam, 1998; Merriam & Grenier, 2019). In each case-study based article, the case study was a single case with a single unit of analysis (except **VI**, where five different countries were studied).

This thesis argues that e-Government phenomenon, in the context of this thesis OGD-driven co-created public services, could be studied by following a case-study based approach, paying special attention to the unique systems at play, the contextual factors, and the different environments for each OGD initiative that was being studied. As each case takes place in a different context, this approach allows for a better understanding of the different aspects of the OGD ecosystems, the different beliefs and values associated with OGD ecosystems, and allowed for a strong and more in-depth understanding of their drivers and barriers. In every case study, the research was conducted in an inductive manner, with initial research being conducted to understand the context and environment of the case. After this initial desk research had been conducted, interviews and field research followed, this allowed the researcher to interact

with those involved in the case and thus allowed for a more complete and in-depth understanding to be gained.

While it is true that case studies may limit the external validity of the conducted research, the purpose of these studies was more to focus on understanding the how and why certain e-Government related phenomena have emerged within a specific context. In regard to internal validity of the studies, each article used multiple sources of evidence that could be used to support and triangulate the interpretations. To make clear the different methodological approaches and data sources used for the articles of this thesis, Table 2 (below) has been drafted.

Table 2. Methodology and Data Collection Summary. Source: Author.

Paper	Methodology	Document	Interviews	News	Survey	Workshop	Observation	Ethnographic Evidence	Literature Review
I	Case Study	X	X	X			X	X	X
II	Case Study	X	X	X					X
III	Case Study	X	X	X	X	X	X	X	X
IV	Survey				X				X
V	Case Study	X	X	X	X	X	X	X	X
VI	Case Study	X	X		X		X	X	X
VI	Theoretical Model Building				X		X		X

In addition to the theoretical and academic research conducted for this thesis, there is also a heavy pragmatic component as well. In the case of **I**, the researcher went to the Faroe Islands and provided key insights as both a visiting researcher and consultant to the digitalization program on the Faroe Islands, Talgildu Føroyar. More specifically, the researcher worked directly with the project manager in charge of the "Basic Data" program to help develop an understanding about the role of OGD for a Faroese digital society. In relation to **III**, **IV**, and **V**, the researcher has been heavily involved in Estonia's OGD ecosystem. Starting in 2016, the researcher began to collect and utilize OGD to create a new OGD-based public service as part of the H2020 funded OpenGovIntelligence project. In addition to this work, starting in 2018, the researcher became the chief technical consultant for the Estonian OGD Portal, and in this time, has improved from rank 27 to rank 14 in the European OGD Index (European Data Portal, 2019). More recently, the researcher has been actively involved with the Estonian government's response to Coronavirus by developing a new portal based around OGD that shows the spread of the virus in Estonia. The application receives, on average, 50,000 unique users a day and the data behind the application has quadrupled traffic to the Estonian OGD portal within a matter of days (Tuul, 2020). While this experience is not dealt with directly in the research papers, it provides an example of how the availability of OGD can be used by volunteers to co-create public services that create public value. It was, in many respects, a validation of why this thesis is important; by opening up data that is relevant to the public it allows for problems to be solved or addressed based around new and innovative approaches. People want to help, and if the data is available, they can. The practical components associated with this research have all been heavily informed by the theoretical and interpretivist research that has been conducted within the context of this doctoral thesis.

For this research, eight different sources of evidence have been used throughout all of the articles. For document analysis, **I, II, III, V,** and **VI** all included analysis of official government statutes, policy documents, white papers, laws, executive orders, government opinions, etc. Semi-Structured interviews were conducted in a majority of the case study papers (**I, II, III, V**). Semi-Structured interviews are preferred in qualitative case study research as they allow for more informal conversations to take place, which allows for the interviewee to provide more insight into their beliefs and opinions thus allowing for more information to be gained and assisting the researcher with later interpretations. For the most part, interviewees were selected following a snowballing based approach, with initial experts being interviewed and other interviewees being identified and suggested by the earlier interviewees. In total, 35 interviews were conducted. In **I**, twenty-three interviews were conducted with members of civil society, government officials, government employees, and private sector stakeholders being included in the analysis. In **II**, six interviews were conducted with all key stakeholders in the project being studied, these stakeholders represented civil society, private sector, and the city government. In **III** and **V**, the same six interviews were used for both papers (originally gathered in **V**), having been conducted with key players in Estonia's OGD-ecosystem. For all interviews conducted in person, the interviews were recorded, transcribed, and then analyzed for key and common themes, topics, beliefs, and ideas (Birks & Mills, 2015).

II was unique in that there was a high amount of news and media coverage for the topic and thus different newspaper articles and videos were also included in the analysis, whereas **I, III,** and **V**, used primarily newspaper articles, rather than videos (as in the case of **II**). The survey used for **III - VII** included 63 responses from six European Union countries about OGD and co-creation and included both closed and open ended questions. The 63 responses included 34 public administrators and 29 non-governmental stakeholders. The responses were distributed as follows: Greece – 16; Belgium, Ireland, and UK – 10; Estonia – 9; and Lithuania – 8. There were 11 questions in the survey and respondents had to describe their previous experience with OGD, co-creation, OGD-driven co-creation, and also asked about their beliefs about key drivers and barriers associated with the aforementioned topics.

For **V**, a workshop was also conducted with stakeholders from Estonian private and public sectors taking part. The workshop included 7 different public sector agencies and 2 Estonian private sector companies and was based around nominal group technique (Delbecq, de Ven & Gustafson, 1975). The workshop had four primary goals: 1. To get end user feedback 2. To improve the initial offering of the public service 3. Involve stakeholders with the design of the service and 4. Raise awareness of the Estonian Real Estate Pilot Program. As a result of this workshop further elucidation of context-specific drivers and barriers for Estonia were gathered, as well as a list of key datasets that could be opened and included in the proposed pilot project.

In **I, III, V**, and **VI** the researcher was directly involved and thus was able to gather direct observations and ethnographic evidence during the research, and, additionally, due to participating at some stages was also able to gather evidence in this manner as well. Finally, all five articles utilized evidence obtained from conducted literature reviews as well.

4 Background Information

The aim of this section is to provide an overview of the core concepts of this research, open government data and co-creation. It aims to provide a definition of each concept, as well as the current understanding of each concept within the scholarly literature. The overview of these concepts in the introduction provides a firm grounding for further reading of the academic articles that make up this thesis.

4.1 Open Government Data

The idea, or concept, of Open Government Data (OGD), is a semi-new phenomenon that has been seeing a rapid increase in grow and interest since its initial emergence. OGD can trace its origins and popularity, primarily, back to President Barack Obama's 2009 Open Government Directive (Obama, 2009), and his 2013 memorandum on Open Data Policy (Obama, 2013). The idea, then, was that the government has a responsibility to be accountable, open, and transparent towards its citizens; the Open Government Directive declared that "the three principles of transparency, participation, and collaboration form the cornerstone of an open government" (Obama, 2009). This idea of openness, accountability, transparency, and collaboration are all values that are encompassed within OGD and the wider global OGD movement. Indeed, it can be said that OGD has spread rapidly across the globe, permeating throughout our societies, creating new expanding ecosystems with their own emergent behaviour in a wide variety of sectors. Government agencies at every level have invested heavily into OGD initiatives, hoping to achieve higher levels of transparency, accountability, and economic development. NGOs, such as Open Knowledge Foundation, have sprung up and devoted large amounts of resources to encourage the development of OGD ecosystems, and, furthermore, to create tools that encourage and drive the growth and usage of OGD (Open Knowledge Foundation, 2019). Private sector companies are taking advantage of freely available and reusable data to create new jobs, services, and create economic growth. Citizens as well have also taken notice about the increasing availability of OGD, and are beginning to play the role of active citizens, analyzing data for transparency and accountability purposes, or using data to create new applications and services that are able to lead to higher levels of public value.

While there are many potential benefits to OGD, there are, naturally, barriers that inhibit its usage, and, additionally, some examples of how *not* to do OGD. Two of the most well-known examples of 'failures' with OGD are as follows. Firstly, New York City released taxi receipts as OGD, however, it was discovered that by looking at the timestamps of paparazzi photos and comparing them to the receipts on taxi's, it was possible to identify how often certain celebrities took taxis, and, additionally, which celebrities were the best and worst tippers, which is, of course, a violation of personal privacy (Hern, 2014). A second example had to deal with open health care data when a student from MIT was able to identify the governor of Massachusetts' (William Weld) data from what was supposed to be anonymized data (Barth-Jones, 2012). These two examples highlight well one potential risk associated with OGD, that of personal privacy. Other barriers associated with OGD have been highlighted in (e.g., Beno et al., 2017; Young & Yan, 2017; Zuiderwijk, et al., 2012), but often include lack of technological capability, lack of interest, missing technical infrastructure, and /or cost. In **VII**, it is highlighted that there are differences in the primary sources of barriers for government and for OGD users. In the case of the former, it is often organizational or ideological

issues, OGD is not given political priority or is not viewed as important, whereas in the case of the latter, it is more often technological issues (lack of technical expertise). However, in the case where the user is knowledgeable about OGD, then the barriers are most often caused by the data itself, such as poor quality of data.

Naturally, it is important to understand these barriers, and how to overcome them, if one would want to create some sort of value from OGD. However, it is not enough to simply approach each barrier one by one. This is due to the systemic nature of OGD; OGD is more like a co-evolutionary system where human actors use, interact, influence (and are influenced by), OGD. While this idea of taking a systemic perspective on OGD is not necessarily new, it is one area of research that still remains underdeveloped. One of the most well-known activists associated with OGD, Rufus Pollock, noted that OGD must be viewed as an ecosystem, and this ecosystem would "thrive on collaboration, componentization, and open data" (Pollock, 2011).

In essence, OGD relies on collaboration and innovation to turn OGD into something that creates value. In the academic field, one of the most well-known systems-based approaches to OGD is that of (Dawes et al., 2016). Their model provides a way to understand better how different contextual, systemic, internal, and external characteristics all play a role in influencing the beliefs, values, and actions of OGD providers, OGD users, and OGD beneficiaries. The main contribution, here, is it provides a way for analyzing who is using OGD, why are they doing so, what are they doing with it, and what values or benefits can be associated with the system.

What this "value" is, depends on who is asked (Gonzalez-Zapata & Heeks, 2015). This is one of the most important questions currently being studied on the topic of OGD, what is the actual tangible or intangible benefits associated with the release and usage of OGD. Unsurprisingly, some of the most commonly cited benefits and values associated with OGD come from the name itself, open, or, rather, values associated with openness: transparency, accountability, responsiveness, adaptability, etc…(dos Santos Brito, da Silva Costa & de Lemos Meira, 2015; Janssen et al., 2012; Kassen, 2013; Reggi & Dawes, 2016) Outside of the more normative and value-based benefits, there also appears to be other clear benefits. For example, OGD ecosystems are able to deliver value by driving the creation of new public services (Chan, 2013; Janssen et al., 2012; Krimmer, et al., 2016), creating new areas of economic activity (European Data Portal, 2018), improving government efficiency (European Data Portal, 2018), or increasing citizen-government interaction (Lonn & Uppstrom, 2016; Schrock & Shaffer, 2017). It must be acknowledged that the "values" associated with OGD are highly dependent on the beliefs, values, and motivations of the involved actors, and that these have all been, at least to some extent, influenced by their own unique context. Gonzalez-Zapata & Heeks, 2015 argue this point exactly, OGD has multiple meanings, and these meanings and perspectives change depending on which stakeholder is being studied.

4.2 Co-Creation

An additional concept that needs to be addressed within this theoretical background section of the doctoral thesis is that of co-creation (this thesis does not focus on co-creation amongst a specific stakeholder group such as citizens or government, but takes a more holistic approach allowing for different configurations of stakeholder groups to co-create). However, in order to understand co-creation, it is important to first understand how exactly it differs from a term that is sometimes used colloquially as a synonym, co-production. Co-production is a term that originated in the late 1970s from

the work of Elinor Ostrom (Ostrom, 1972). In this work, Ostrom concluded that the value received from a given public service was highly affected by the participation, inclusion, and interaction between service user and service provider. Thus, it was posited that by focusing on the relationship between service user and provider, specifically at the point of service delivery, it may be possible to both understand and improve the effective value of a public service. To give a more exact definition to the term co-production, Bovaird, 2007 argues that co-production can be thought of as:

> "the provision of services through regular, long-term relationships between professionalized service providers (in any sector) and service users or other members of the community, where all parties make substantial resource contributions" (Bovaird, 2007, p.847).

Another definition is offered by Osborne, Radnor & Strokosch, 2016 who write that co-production is the "voluntary or involuntary involvement of public service users in any of the design, management, delivery, and/or evaluation of public services" (p. 640). Furthermore, in previous research, two of the authors of the definition argue that:

> "Co-production is thus not an add-on to the delivery of a public service but is rather a core element of the effective management of public services on a day-to-day, operational, basis – and a key determinant of both their quality and performance." (Osborne & Strokosch, 2013, p. s38)

In agreement with the first definition offered, but in opposition to the second, Alford (2014) argues that it is not just the citizen that can be a co-producer, but many stakeholders can, in fact, "co-produce" and further notes in Alford, 2016 notes that co-production is a part of every public service, but that it exists on a "continuum, from optional to essential" (p. 677).

Before moving on to co-creation and understanding how co-production and co-creation differ, it is important also to introduce the concept of public services. The idea of public services has become an increasingly debated topic in the current academic literature. In line with the rise of popularity of openness, transparency, and participation in the global sphere, a new perception of public services has begun to emerge; this perspective is often framed with the concept of New Public Governance (NPG), which was coined initially by Stephen Osborne, focuses heavily on public value, service outcomes, networks, systems, and co-production (Osborne, 2006, 2010). Within this new NPG paradigm, public services are viewed as value delivery systems, where every actor is able to take part and play a role in the service and value creation process. One definition that encapsulates these concepts quite well, is advocated for by the European Commission's Public Services unit in DG Connect, where it is stated that "public services are services offered to the general public and/or in the public interest with the main purpose of developing public value. Public value is the total societal value… [that] is shared by all actors in society" (European Commission, 2013, p.2). Furthermore, it is argued that in today's increasingly networked and connected world citizens must be empowered (European Commission, 2013). More succinctly, they are arguing three things: public services are anything that creates public value, public value is dependent on the beliefs and values of society, all stakeholders can play a role in the delivery and creation of public services.

In the definition offered of public services by the European Commission, it is the third point that is concerned directly with co-creation. When talking about co-creation, numerous definitions have been offered, but one of the more recent ones views co-creation as the "joint effort of citizens and public sector professionals in the initiation, planning, design, and implementation of public services" (Brandsen, Steen & Verschuere, 2018). This denotes a deliberate action to involve non-traditionally involved stakeholders in the process of creating a new public service. However, it falls short in that it excludes other stakeholders that could be involved in the co-creative process, such as NGOs or businesses. This is one of the biggest potential benefits of co-creation, and in line with the definition of public services offered above, any stakeholder can be empowered to play a role in the creation of new public services. So, taking this into account, this thesis rather views co-creation as the involvement of outside, non-typical, stakeholders in the initiation, design, implementation, and evaluation of a new public service (**VII**). It is important to point out as well that co-creation on its own is not a tool. Co-creation is an ongoing process, dependent on the relationships and interactions taking place in order to provide or produce value.

Now, reflecting back on the difference between co-production and co-creation, what can be said? Firstly, co-production is an inherent part of ***all*** public services, whereas co-creation is not; expressed logically, it could be said that all co-creation is co-production, but not all co-production is co-creation (McBride, 2017). Stephen Osborne writes that co-production is a linear process with value being created as a result of a service being produced, whereas co-creation is rather non-linear, delivering value throughout the process at the point of interaction (Osborne, 2017. p. 225). So, while co-production is an inherent part of all public services, and produced at the time of service delivery, co-creation is an interactive process that can be driven by any stakeholder group, where value is created throughout ongoing deliberation and interactions, thus leading to even higher levels of value being produced if and when a service is made used and/or offered.

Why, though, has co-creation only recently emerged as a topic of interest; especially as co-production, where co-creation can find much of its theoretical initiation, has been around since the 1970s? In fact, there has been a long development of this topic, Table 3, shows how the terms co-production and co-creation have evolved over time.

Table 3. Evolution of Co-creation / Co-production in literature. Source: Author, modified from McBride (2017)

Authors	Types of "coproduction/co-creation"
Whitaker (1980)	Citizens requesting assistance from public agents; Citizens providing assistance to public agents; Citizens and agents interacting to adjust each other's service expectations and actions
Pollitt, Bouckaert & Löffler (2006)	Co-Planning; Co-Design; Co-Delivery; Co-Evaluation
Linders (2012)	Citizen sourcing (citizen to government); Government as a platform (government to citizen); Do it yourself government (citizen to citizen)
Bracci, Fugini & Sicilia (2016) Verschuere, Brandsen & Pestoff (2012)	Individual acts of coproduction; Collective acts of coproduction; A mix of individual and collective acts of coproduction
Osborne & Strokosch (2013)	Consumer coproduction; Participative coproduction; Enhanced coproduction
Voorberg, Bekkers & Tummers (2015)	Citizen as a co-implementer; citizen as a co-designer; citizen as an initiator
Osborne et al., (2016)	Coproduction; Co-Design; Co-Construction; Co-Innovation
Paletti, (2016)	Coproduction through ICT: Applications to report problems Applications to crowdsource data Applications to involve citizens in the public service delivery
Lember, 2018; Lember et al., (2019)	ICT augments coproduction; ICT transforms or diversifies coproduction; ICT substitutes for coproduction; ICT bypasses need for coproduction

As new tools and technologies have become available, it has affected how we interact with our environment. We now exist in a world where data is abundant, interactions are instant, and information is reachable within just a few clicks or taps. This has led, as previously mentioned, to new world views and ideas where government information must be open, available, and accessible. Government should be transparent and accountable (Open Government Partnership, 2011). In essence, due to a changing environment, it has changed the values that some societies view as important, thus creating a new environment where concepts such as co-creation are sought after and viewed as not only important, but necessary for the future of public administration.

Not all co-creation must involve technology, but the role that technology may or may not play in influencing the co-creation process is seeing increased attention in the academic literature. Starting in 2012, Linders proposes a typology for technologically mediated co-production where he proclaims that due to the advent of new technologies, we should expect to see co-production vigorously re-emerging in new and innovative forms (Linders, 2012). More recently, Lember et al., 2019 argues that there are four main potential ways that ICTs are influencing this co-creative process, three positively and one negatively (Lember et al., 2019). Additionally, Lember et al., 2019, highlight that co-creation with technology is not a positive thing by default, there could be external negative externalities, thus it is important to study and understand better how this co-creation via ICT mediation occurs, and what the potential impacts are. Taking all of this into account, it is possible to say that co-creation can be seen as a process that is dependent on new interactions emerging between government and non-government actors, technologies that encourage or discourage these interactions will have some effect on co-creation and, as such, it is important to understand better exactly how this change will happen.

5 Open Government Data Driven Co-Creation

Both OGD and co-creation have been given increased prominence in today's world where openness, transparency, accountability, and inclusiveness continue to grow in popularity as part of the open government movement and as seen in today's NPG paradigm. While co-creation was traditionally not analyzed within the context of ICT-enabled co-creation, this is something that is changing, with increasing amounts of scholars and governments paying attention to how technological advances could drive new and innovative ways for co-creation of public services. In a similar vein, OGD has also seen a shift in how it is analyzed, from something of a static asset (OGD for the sake of OGD), it has shown increasing promise as both a system creator and a system changer. That is to say, OGD can both lead to the creation of new ecosystems based around OGD and change existing ecosystems, for example it could integrate into already existing co-creation networks to transform how this system works (Lember et al., 2019). Thus, the aim of this section is to firstly build the bridge between the concepts of OGD and co-creation, and then further provide an overview of the contributions of the articles by demonstrating how OGD can be used to drive the co-creation of new public services, exploring how OGD-driven co-created public services create public value, and showing why the availability of OGD is able to both create and influence co-creation ecosystems.

OGD-driven co-creation is a concept that has not yet received much attention in the current academic literature (**II, V**). While there are similar topics that relate to the usage of OGD for the creation of new and innovative services (Foulonneau, et al., 2014; Maccani, Donnellan & Helfert, 2015; Mergel, 2015) or how co-creation is influenced by digital technologies (Lember et al., 2019; Linders, 2012; Mergel et al., 2018), there is, to date, limited literature on real, empirical examples that looks at the process of co-creating with OGD as the unit of analysis. In this situation, the starting stage of the research was to, firstly, define what exactly co-creating an OGD-driven public service entails.

While the components are self-explanatory from the name, to be more concise, it is possible to clarify three critical components for any OGD-driven co-created public service: 1) OGD is necessary for the service to function, 2) stakeholders from different groups must be involved in a co-creation process, and 3) the service must produce public or societal value (**II**). It should, also, be seen from the definition that this is not a simple objectively existing thing, it is systemic in nature and highly dependent on the internal components, their interactions, and effected by the external environment (**II, V, VI, VII**)**.**

There are different examples of what these services can look like. For example, they can be initiated by any stakeholder, be it from the government, citizen, or private sector. In the context of this thesis, the example of **II** comes was a service initiated on the governmental level drawing on expertise from the private sector and including citizens throughout the delivery process. On the other hand, the service presented in **V** represents a service led by a University but supplemented with support and input from the public sector, private sector, and citizens more broadly. In **VI**, all services were initiated and led by a governmental agency, but at different levels, municipal, national, and regional, and, similarly, addressing a large variety of domains from unemployment to the environment to business.

In every case presented, the availability of OGD, or the knowledge of OGD, was a precondition for the creation of the service. This is interesting as it represents something that was, even 15 years ago, not possible. Whereas before the emphasis was on the

government to provide services and release only data they thought was relevant, the mental model has now switched, it is possible to release data in an open format, and encourage anyone to use it and create new services from it. Thus OGD-driven co-created public services do not only represent a new technological concept, but it also represents a paradigm shift in the way of doing government **(IV)**.

In regard to the sorts of ways in which OGD can be used in the co-creation of new public services, there appears to be a few different ways in which this manifests. Firstly, the services can be either externally or internally focused **(VI);** the case of **(II)** was internally focused, whereas **(IV)** was externally focused. In this context, externally focused services imply that the service user is the government, and that by using this service they are able to do their job better and thus provide higher levels of public value (for example, in **(I)**, if food inspectors are able to catch critical food safety violations earlier, it means less people will get sick, thus providing value for society in the form of healthier citizens). Externally focused OGD-driven co-created public services are focused on external service users, for example **(IV)** discusses the creation of a new real estate portal that helps to fight information asymmetry in the real estate market thus providing those who wish to know more about said market. While there are likely to be numerous ways in which OGD-driven co-created public services could manifest themselves, initial research seems to highlight three main service types: web applications, machine learning models, and mobile applications. It is also important to highlight that co-creation happens on a continuum of activity, from fairly passive (e.g. monitoring a website or filing in a form) to active (e.g. taking pictures with your phone, coding, or using sensors to gather data)

Reflecting back onto how this process of turning OGD into an OGD-driven co-created public service occurs, it is important to highlight again the systemic nature of OGD-driven public service co-creation. To this end, **VI** elucidates this process further, but it is also expanded upon in greater detail in (McBride et al., 2017). At a minimum, an OGD-driven co-created public service system consists of ICT tools, a group of stakeholders, OGD, and a co-creation process (McBride et al., 2017). There are environmental attributes as well that influence how this system functions, such as a given historical context, government system, legal environments, data infrastructures, stakeholder beliefs, funding, organizational factors, policies, administrative factors, and previous experience with co-creation or OGD (**VI,** McBride et al., 2017). This system would behave, in its simplest form, in the following manner: A group of stakeholders come together to utilize ICT tools to exploit OGD, through a co-creative process, in the hope of creating higher levels of public value from OGD and delivering this public value in a tangible form of a co-created OGD-driven public service. In (McBride et al., 2017), a diagram was made to illustrate the OGD-driven public service co-creation system, which is shown in Figure 1, below.

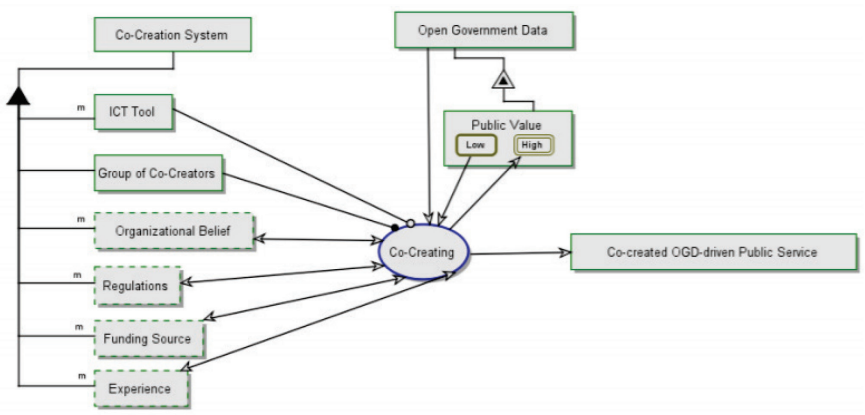

Figure 1: OGD-Driven Co-Created Public Service Ecosystem. Source: McBride et al., (2017)

The figure is diagrammed using object-process-methodology (OPM) (Dori, 2015) and demonstrates how a co-creating process transforms the public value of OGD from low to high by taking OGD, passing it to a co-creation system, and creating a co-created public service. While this systemic process, the input, and output should be quite clear, what is a bit more abstract, is the idea of a "co-creative" process. As previously shown in Table 3, there are quite many different approaches to co-creation, and different understandings of what does and does not count as co-creation. As the aim of this process is ultimately the creation of a public service thereby creating public value, it was possible to draw on some insights provided by NPG and the current literature that views service delivery as a networked and systemic process. Following this, it is also known that one characteristic of systems that encourages growth, sustainability, and higher levels of performance is the presence and existence of feedback loops (Forrester, 1991; Meadows, 2008), more specifically, positive reinforcement loops. One of the best ways to develop these loops is to design mechanisms that allow fast and accurate movement of information between actors within a system, in the case of co-creation, this would be between the service user and service creator. It is also known from the current scholarly literature that one of the best ways to encourage this sort of feedback development is through the usage of agile (Figure 2) and lean development (Highsmith, 2002; Janssen & van der Voort, 2016; Parcell & Holden, 2013; Ries, 2011; Upender, 2005) so, it followed that these design approaches may appear in a co-creation process.

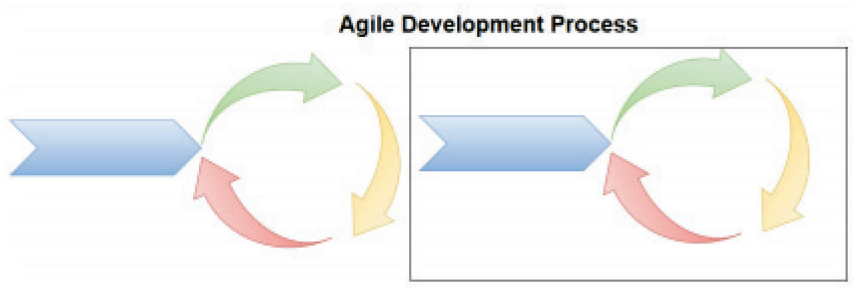

Figure 2: Agile Development Process. Source: Krimmer et al. (2016)

The final concept to grasp, is that of co-creation itself. As co-creation is, an ongoing process, it is hard to define it as a single or linear manner, rather, it is more likely that it occurs dynamically with many different possible stages that all, in their own way, form part of the co-creative process. While there are many different ways of understanding these stages, the research articles drew on inspiration from (Osborne et al., 2016; Pollitt et al., 2006) to define the four potential stages of co-creation as co-initiation, co-design, co-implementation, and co-evaluation (**II, V, VI, VIII**). Putting all of this together, it became possible to create a mental model of what the process behind OGD-driven co-created public services would look like. One would expect that this process is started or reliant on OGD, that numerous actors are engaged, that it is iterative and agile, that it may exhibit dynamic and not-linear behaviour, and that this process is highly dependent on the environment that is taking place within. While this process has been visualized and is shown below in Figure 3, it cannot be emphasized enough that this is merely supposed to represent visually the concept and process of OGD-driven co-created public services (here, the common phrase 'all models are wrong, but some are useful' comes to mind). It is a tool that helps to frame and understand this process, but due to its systemic nature it will look differently in different contexts and environments. It is the role of the researcher to look further and understand how different environments and contexts influence this process and mental model.

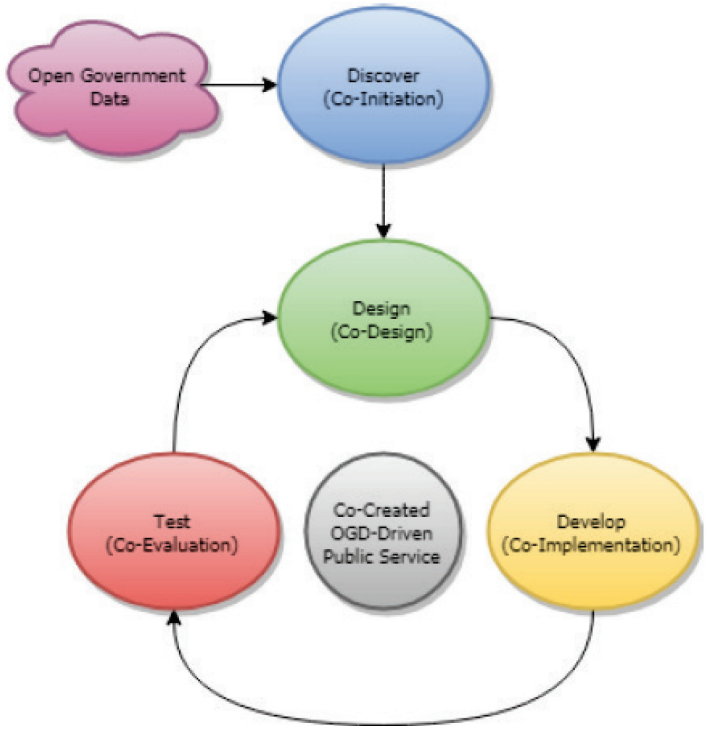

Figure 3: OGD-Driven Public Service Co-Creation Process. Source: VI, amended and improved in VII

As part of this model, and in addition to the visual representation, four findings and insights were offered in **(VII),** highlighting the ways in which OGD influences and / or creates this public service co-creation process. Firstly, OGD driven co-creation of public services requires a change in how stakeholder involvement is perceived in the public

service creation process; secondly, governments are indirectly playing a role in the co-creation of new public services anytime OGD is used; thirdly, OGD serves as a platform and foundation for new innovative public services to be built upon; fourthly, availability of OGD does enable and encourage public service co-creation (**VII,** p. 187-188).

In order to help understand what this process looks like in practice, a simple generic architecture was developed in (McBride et al., 2017) and is shown below in Figures 4 and 5 (this demonstrates well P3 from above).

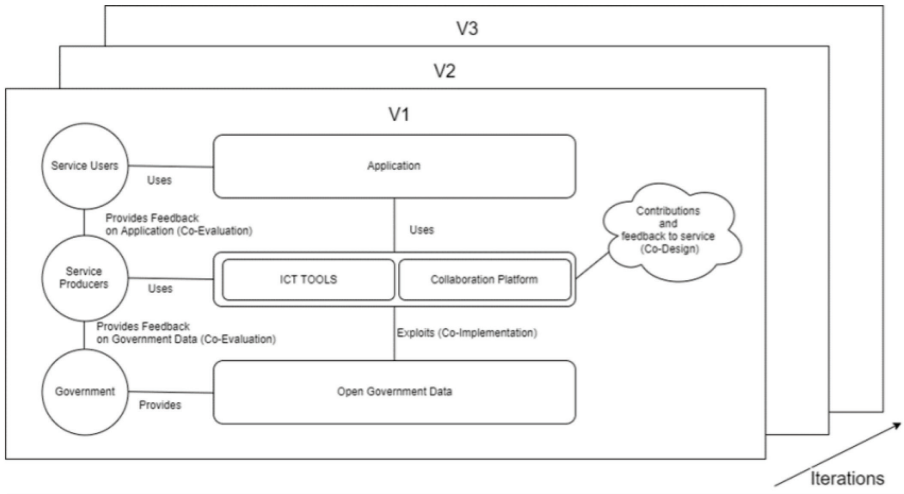

Figure 4: OGD-Driven Co-Created Public Service Architecture. Source: McBride et al. (2017)

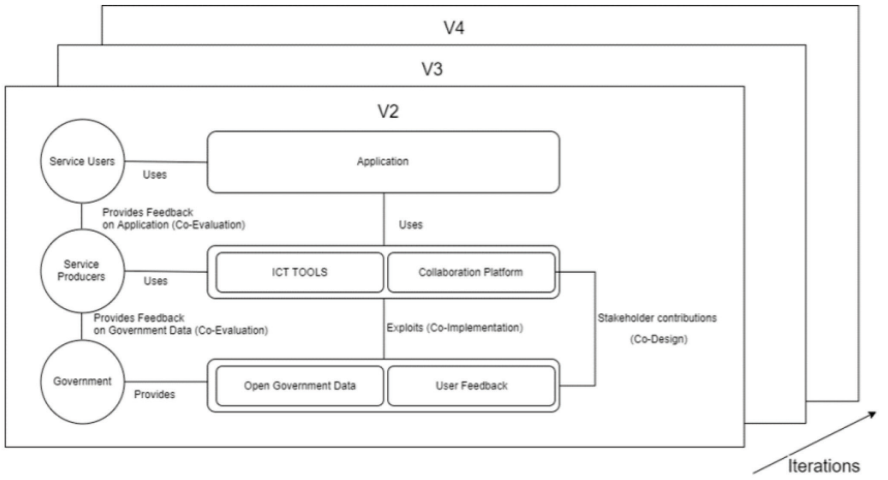

Figure 5: OGD-Driven Co-Created Public Service Architecture. Source: McBride et al. (2017)

What can be seen here is that in Figures 4 and 5 there is different stakeholder groups, government, service producers, and service users. The government provides OGD, which is then exploited by service producers who use ICT Tools and some sort of collaboration platform (such as GitHub) to develop an application. It is at this level where co-implementation and co-design happens. All three parties (service users, service providers, and government) are able to provide feedback to each other (co-evaluation), representing co-evaluation, reporting either on service usefulness, data quality, or in any

other form of requested (or not) feedback. It can also be seen that there are numerous versions, highlighting that numerous iterations are usual in this process, ideally becoming more in line with user needs and expectations with each iteration.

Moving on from the OGD-driven co-created public services and the process in which they are created, it is important to explore and understand better the different drivers and barriers that are also associated with these concepts. Additionally, it is important to understand exactly how different contexts may or may not play an influencing role in the co-creative process. This is where and how the initial results from the performed survey were used: they were harmonized (a-contextually and grouped together) in paper **IV**, but the results from different countries' respondents were used also in further research to elucidate drivers and barriers in their specific contexts, such as in **III, V,** and **VI**. This was possible as the survey, in addition to knowing the participants' demographic information, asked respondents how they understand the importance of the country context for the drivers and barriers. In addition to asking what the drivers and barriers were, the survey specifically required respondents to provide insight into why they thought these drivers and barriers existed. This allowed for information to be gathered not only on the country-specific context, but also to understand better the beliefs associated with each of the drivers and barriers. The initial results from this survey were harmonized in a table in **IV** and are displayed below in Table 4.

Table 4. Overview of Drivers and Barriers from Survey Source: IV

Barriers (B)	Drivers (D)
Data and technology (DT)	
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) (S)	
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 (O)	
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 (LP)	
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

The identified drivers and barriers were able to be divided among different parts of the OGD-driven co-creation system: data and technological, stakeholders, organizational, legislation and policies. Within these main categories, further drivers and barriers were identified, many of which can be directly associated with contextual factors and/or beliefs or values. Interestingly, many of these drivers and barriers could be viewed as both driver and barrier, it depended simply on the belief behind the actor. This is the case, for example, when it comes to awareness about OGD, organizational processes, or societal beliefs. In order to overcome the different barriers, **IV** offered 10 different policy suggestions for government, and four different steps that non-governmental stakeholders could do to help increase the availability of OGD and, furthermore, to encourage OGD-driven co-creation. These included, for example, Making OGD a clear political priority, analyzing and publishing key datasets as OGD, review data licensing and copyright regulations, make OGD the legal default, expressing clear demand for OGD (from the non-governmental side), and/or creating an application from some limited amount of available OGD to demonstrate the usefulness and potential of OGD (**IV,** pp.109-110). This last point seems to be of the utmost importance as many of the studies in this thesis have suggested that previous experience with OGD-driven co-creation highly influences future OGD-driven public service co-creation (**II, IV,** McBride et al., 2017). While these policy recommendations were done so theoretically, but, based on the initial qualitative examination of the survey results in **IV,** many turned out to be validated empirically. This empirical validation happened as part of the OpenGovIntelligence project where it was required to identify key success factors associated with the pilots that were involved with OGD-driven public service co-creation, in this study, the four main factors were identified: previous availability of OGD, history with co-creation, existence and knowledge of laws relating to OGD, the use of a minimum viable product (MVP) and an iterative design process (McBride et al., 2017), thus policies that encourage these factors are likely to have a positive effect on any OGD co-creation ecosystem.

Exploring this further, one of the countries studied in this initial survey was Estonia, based on the initial results, further studies on OGD and OGD-driven co-creation were conducted within Estonia and the results are presented in **III** and **V**. In **III**, the unique image of Estonia as a global leader in e-Government is contrasted to its poor performance on all international indices and metrics in regard to OGD. This was even more interesting as, on paper, Estonia should be a leader when it comes to the availability and usage of OGD. It has an innovative government, it has the proper legal frameworks in place, data is open by default, and a large majority of Estonian citizens interact with the government via digital means (**III**). In the Estonian context, many of the barriers encountered were similar to those that have been previously discussed in the academic literature, such as lack of interest, high cost, lack of knowledge, or lack of political interest (**III**). However, there are two somewhat unique issues at play in Estonia. The first, is the existence of the X-Road, which serves to facilitate the movement of data between different government agencies. This is important, as, in other contexts, the availability of OGD actually stems from a desire for increased levels of interoperability, but it seems that if interoperability exists before the OGD movement, then this interoperability acts as a barrier. This can also be seen in the previous CIO of Estonia's view on OGD, where he argued that "Open Data… [is] just so last century" (MeriTalk, 2016). There was a true belief that OGD simply was not useful anymore. A second major unique barrier to the Estonian context is that it is a small state. There is a small population, and, therefore,

there is a perceived lack of demand for OGD (**III**) this was a similar finding in **I**. Since the availability of OGD in Estonia is currently lacking, it also follows that the concept of OGD-driven co-creation is also not something commonly seen.

There are only few examples of co-creation in Estonia, and even fewer still of OGD-driven co-creation (**V**). Interestingly, one of the biggest barriers here is not the lack of availability of OGD, but, rather, the lack of political and citizen willingness to engage in co-creation. Estonia does, de-facto, have high level of data availability via the X-Road and due to the laws in place requires for data to be made available if requested **(III)**. However, even though data could be made available, it is not often requested, and there is little co-creation of OGD-driven public services happening. **V** concludes by noting that co-creating a public service with OGD is possible, however, in addition to the availability of OGD, there needs to be a clear desire from stakeholder groups to give up some control and engage in the co-creative process. Without the right mind-set or beliefs from key stakeholders, co-creation is not possible, regardless of how much OGD is or is not available. However, what the availability of OGD does appear to do is decrease the barriers to co-creation, thus driving more actors to be willing to engage in the process (**V, VI**). Estonia also raises an interesting point, and reinforces the importance of the systemic approach to OGD-driven co-creation, in that this is a country where the laws support the availability of OGD, that the citizens know how to use technology and OGD, that some (though limited) OGD exists, and yet, even still, there is a lack of OGD-driven co-creation. This, then, implies that OGD-driven co-creation is less about the parts that make up the system, but more about how they interact.

In contrast to Estonia, paper **II**, provides an example of a co-created OGD-driven public service in the City of Chicago. This case discusses how staff at the City of Chicago's Department of Innovation and Technology came together with the Chicago Department of Public Health, the Civic Consulting Alliance (a local non-profit oriented towards help create new public value for the city of Chicago), Allstate insurance, and citizens to work together in a co-creative manner to create a new public service that relied on OGD to create new and high levels of public value**.** In contrast to Estonia, Chicago's OGD portal was highly developed, with government agencies having real time data streams integrated into the portal. This meant that the data on the portal was, for the most part, the same data that government agencies used themselves in the decision-making process. It also demonstrates an example of when and how OGD can be used to create and drive interoperability, instead of building a government to government interoperability network (as was the case in Estonia). As there was already high quality OGD available in Chicago, no interviews pointed to OGD as a potential barrier in their co-creative process, in fact, it was widely viewed as a key reason as to why this initiative was successful, all the data they needed was available, clean, and easy to understand (**II**).

When discussing why this OGD-driven co-created public service was able to be implemented successfully in the City of Chicago, interviewees pointed out how their system was like a "perfect storm" of motivated stakeholders, innovative leaders, proper communication, existence of an OGD portal, external funding, and agile development (**II**). It is interesting to point out here, that the interviewees themselves pointed out the systemic nature of this process. Many of these factors are directly related to beliefs, communications, values, actions, and decisions made; it is less about the existence of OGD, but, rather the willingness, innovativeness, and ideals behind the citizens and government officials who engaged in the process.

In paper **I**, OGD and co-creation are not the focus per say, but it does provide interesting insight into the role that OGD may play in the development of a society's digitalization efforts. OGD was viewed as so important by the Faroe Islands, that it has been made a core component of their digital initiative, along with interoperability, a digital ID, and a citizen service portal (**I**). What is, here, interesting is that the Faroe Islands are not fully independent, and, as a result of this, many datasets that are freely available in other areas of the world, are actually created and maintained by the Kingdom of Denmark. This created a situation where the Faroe Islands needed to pay large amounts of money in order to access this data, and, subsequently, make it available to the public (**I**). Additionally, even though they have databases in use on the island that may contain useful or interesting data that could be made available as OGD, due to the small size, often times these databases are inaccurate and out of date (**I**). For example, the population register has been said to be notoriously out-of-date and the cadastral register faced similar issues; in the Faroe Islands, everyone knows everyone and where they live, there is no need, necessarily, to keep these things up to date. However, by making an effort to digitalize, and by making OGD a core component of this initiative, it creates a new top-down pressure to ensure high levels of accurate and up-to-date data, even if it is not cost effective (**I**).

These cases bring up a number of interesting points for discussion. Firstly, there are different governmental pressures in engaging with OGD. This can be quite easily seen when comparing Chicago and Estonia. In the case of the former, the OGD that is on the portal extracted direct from the databases of the government agency releasing the data, thus, the data on the OGD portal is more or less the same data that the agency itself uses **II**, thus stifling any need for direct agency to agency interoperability. On the other hand, Estonia's X-Road enabled interoperability between government agencies, but also necessitates, at least to some extent, some form of common data quality and control standards. Thus, Estonia has only recently begun to engage in releasing OGD due to societal and international pressure with OGD being a core component of international e-Government rankings. In this case, the motivations for releasing data is different. Whilst OGD is normally associated with citizen-focused benefits, in the case of Chicago it has the added dimensions of benefiting the public sector agency itself, whereas in Estonia, this benefit is not likely to occur (though, perhaps, in a minor form by allowing users to perform some sort of data control checks if they try to use the data and find issues). This example can also be further highlighted by bringing in the example of the Faroe Islands. In this instance, OGD is being used as a core part of building up the digital infrastructure of the country. As any e-Government needs the data behind it to be accurate, by making OGD a political priority, it helps to create new datasets and provide access to data that was not previously available, thus strengthening their e-Government initiative in the long run.

In regards to how OGD-driven co-created public services create public value, it is first important to understand that public value is not something static, it is something created at the societal level (different values in different societies) and it is the result of some service or activity **(II**, p.89**)**. However, there are often similar goals or values found in the services. In **II, IV,** and **VI** four primary goals or aims were identified for the service creation (or some combination of the three): increased transparency, increased decision-making capabilities, efficiency, or improved service quality. However, it is important to point out that the initial goal of the service does not necessarily translate to the actual public value it creates. As an example, in **II**, the food service monitoring

algorithm was created firstly to make life easier for the Chicago Department of Public Health and improve their ability to do food inspections. The side effect of this is that eating in the City of Chicago becomes safer, thus, the value of this service for the government is improved decision making and efficiency, whereas for the public at large, they benefit as well from having safer food. In a similar fashion, in **IV**, the main goal was to increase transparency in the real estate market. However, the service itself had little impact and public value, but the process of creating this service led to a large increase in the knowledge, awareness, and availability of OGD in Estonia, thus providing another un-intended value. Thus, it appears to be the case that OGD-driven co-created public services create value in both intended and unintended ways, highlighting the systemic nature of the process, and meaning that there are likely to be a large range of different public values that could be associated in future research with this concept. This sentiment was highlighted more succinctly in McBride et al. (2017), where it was noted that "OGD-driven public services are possible in a wide variety of possible contexts, with different goals, and with different users in mind" (p. 47).

6 Conclusion

This research contributes to the field of e-Government by providing new insight to an area of study that has seen increased interest recently, that of OGD-driven public service co-creation. The thesis put forth three primary research questions and one sub-research question to be answered:

1. How can OGD be used to drive the co-creation of new public services?
2. What are the main drivers and barriers associated with the practice of OGD-driven co-creation?
3. How does the availability of OGD influence public service co-creation ecosystems?
    a. How does the introduction of OGD to co-creation ecosystems allow for public value to be created?

In order to address these questions, this doctoral thesis relied on research contributions from seven original scholarly publications published between the years 2017 and 2019. The published research includes some of the first and only empirical examples and studies of OGD-driven co-creation of public services and includes work that is comprehensive in nature at addressing the drivers and barriers of OGD-driven co-creation, and the systemic nature of this co-creative process. The research frames OGD-driven co-creation as a systemic process and papers **VI** and **VII** lay out an approach for understanding and thinking about the systematic process of OGD-driven co-creation of public services. Additionally, in papers **I, II, III,** and **V**, a systematic approach is used to study the focus of the case. By adopting a systematic perspective on the study, it is easier for researchers to understand better how different contextual factors are influencing the performance of the OGD-driven co-creation ecosystem. For example, why in Estonia (**III**, **V**) the OGD ecosystem is not functioning well, whereas it appears to be in Chicago (**II**), or how OGD ecosystems can influence larger digitalization initiatives such as in (**I**). One of the main findings in **VI** was also that the "the results of the co-creation system are influenced by the contextual environment". Indeed, as different configurations, relationships, and interactions within a system would lead a system to behave differently. Thus, by framing OGD-driven co-creation as a systemic process it allows for a better understanding of how different relationships do or do not influence the behaviour of the ecosystem.

To answer the research question, "How can OGD be used to drive the co-creation of new public services?", the research provided numerous different examples of real-world empirical examples of public services that have been co-created via the use and exploitation of OGD (**II**, **V, VI**). In all of these papers, it is found and argued that OGD does indeed have the potential to both facilitate and drive the co-creation of new public services. This happens in a few ways. Firstly, the government, in effect, plays an indirect role in co-creation just by releasing and maintaining OGD for citizens to interact with (**II**). Secondly, the presence and usage of OGD appears to make the so called "buy-in" for engaging in a co-creation process lower for contributors, thus increasing the likelihood for co-creation to occur (**II, V, VI**). Thirdly, OGD-driven co-created public services appear to be more likely to succeed if they are of higher relevance to the engaged stakeholders, or initiated by a non-governmental stakeholder (**V, VI**). Finally, OGD allows non-traditional stakeholders, such as citizens, to play the initiating or leading role in the implementation and design of new co-created public services (**II, V, VI**).

In regard to RQ2, "What are the main drivers and barriers associated with the usage of OGD driven co-creation?", all papers except for **I**, explicitly address this issue. It was argued that the main barriers can be divided into four primary categories: Data and technological, stakeholder, organizational, and legislation and policies (**IV**). However, it has also been argued, that drivers and barriers cannot be applied broadly or be taken to exist in some sort of objectively real way. For example, both Estonia and Chicago had functioning OGD portals, yet, in Estonia, there was little to no engagement with OGD, whereas in Chicago, there was (**II, III, V**). This highlights the importance of how systemic factors also influence the drivers and barriers. It is also interesting to point out that the most influential drivers and barriers tend to be often attributable to non-tangible objects. For example, in **II**, it was pointed out that it was the fact that key stakeholders felt innovative, motivated, and were willing to experiment were far more important than the actual OGD existing. This was also mirrored in the other cases, such as in **I**, where there was a value statement made on OGD, they said this is important, and, though there is currently little demand, the government has decided to force through and provide access to OGD, even though it is not cost effective. Thus, it can be said that context plays a large role in influencing the drivers and barriers associated with OGD-driven co-creation.

In regard to RQ3, "How does the availability of OGD influence public service co-creation ecosystems?" it can be summed up quite simply, it makes things easier. OGD is, in some ways, a nutrient, it can provide sustenance and grow existing systems, but it can also draw in new stakeholders to form systems in a self-organized manner. If OGD is available, those who are interested in interacting with it naturally begin to gather together. This can be seen in Chicago's "ChiHackNight", where civic activists gather together to use OGD to create new public services on a weekly basis or, additionally, now in Estonia, which has seen the number of applications using OGD on its OGD portal grow from 4 to more than 20, due primarily to the slow development of a ground-up OGD-based community. In terms of how OGD influences previously existing co-creation ecosystems, it can help to make them more efficient, reduce the barriers for participation, and increase the number of involved stakeholders. Additionally, as OGD covers a wide variety of potential areas, it broadly expands the potential ways that co-creation can occur, that is to say, new co-created public services could begin to be created in a wide variety of domains, whereas traditional co-creation ecosystems may be focused primarily within one domain (such as education or anti-corruption).

Finally, in regards to RQ3a, "How does the introduction of OGD to co-creation ecosystems allow for public value to be created?", the research and this introduction discuss the different ways in which a co-creation process is used to turn OGD's public value from low to high. Through co-creating a OGD-driven public service, it is possible to create this value from OGD, as it is only through some sort of transformative process that OGD has any value. This happens in a few different ways. There are the direct effects of the service, such as increased transparency in **IV** or better decision making and efficiency in **II**, but there are also the other positive externalities that can be associated with this, such as broader environmental effects be it in new investments into OGD (such as what has happened in Estonia), safer restaurants (as in **II**), new awareness of OGD more broadly, or through increased transparency and accountability, such as highlighted in **V.** What is important to highlight here is that public value is very contextualized, that is to say something valued by the public in Chicago, may not be valued in the Faroe Islands or Estonia. It could, then, be said that there are three primary ways in which OGD-driven

co-created public services create public value: at the initiation stage, via increased awareness and spreading of ideas; at the point of delivery, when a service user uses the service for some goal (perhaps to interact with the government or provide information via sensor to an agency or other citizens); and in an emergent manner, after or during the process of co-creation, due to the systemic nature of OGD, sometimes a small change in the system could lead to a larger, unintended, effect.

Based on the findings from the publications within this thesis, it is possible to make some policy recommendations for a governmental organization wishing to either drive or encourage OGD-driven co-creation of public services. For example, **II** argues that you should 1) contextualize the problem and make it relatable to the stakeholder; 2) start simple and develop as little as possible to meet the initial need; 3) communicate and develop a shared understanding of definitions and processes. Create and disseminate documentation to stakeholders that includes pre-agreed upon words, phrases, and processes and their definitions and criteria; 4) Be open and accessible to other stakeholders, engage with questions, issues, and feedback made in open environments. GitHub is a good option for hosting open source code and interacting with stakeholders. **VI** (similarly discussed in **V**) noted that one of the largest barriers for OGD-driven co-creation of public services was resistance in the public sector about a new conceptualization of public services or how co-creation could be applied. However, it was shown in **VI**, that this resistance could be overcome by strong involvement from non-governmental stakeholders leading the way forward. Additionally in **VI** it was shown that pilots that had higher levels of co-creation and user-participation were more effective and in-line with user needs; in-line with this, the pilot projects that had a faster iteration rate (had more releases of their service than other pilots), had higher levels of service usage. Thus the following recommendations could be made: created a shared understanding of 'public service' within the organization, additionally, encourage motivated and active stakeholder groups to take the lead in new service design and initiation. Secondly, don't be afraid of co-creation, by involving stakeholders in the public service delivery process and iterating quickly, services are created that are more in line with user needs and see higher levels of usage and effectiveness. While the aforementioned recommendations are primarily directed at governmental organizations, it also possible to make recommendations for civil society at large, especially as co-creation implies any stakeholder may take the lead in the service delivery process. This was done in **IV**, where it was argued that in order to help drive OGD-driven co-creation of public services non-governmental stakeholders could: raise awareness of the value of OGD in a self-organized manner, hosting workshops and hackathons, creating new applications from what OGD is currently available (if it is), be vocal in the desire and need for OGD, and offer training and capacity building programs to any interested stakeholders to help develop the skills and abilities to work with OGD.

Overall, this thesis contributes to the domain in four major ways. Firstly, it provides new insights into and further conceptualizes the concept of OGD-driven co-created public services and provides empirical examples of these services as well, which is an area of research that is currently still under-studied in the e-Government academic literature. Secondly, it explores the different drivers and barriers (both contextually and a-contextually) influence the co-creation of OGD-driven public services. Thirdly, it provides some initial insights into how different contexts may affect and influence the development and growth of OGD ecosystems. Fourthly, it provides new knowledge about

how OGD-driven co-creation may lead to the development of new and innovative public services.

Future research could explore other e-Government phenomena in a similar manner. Additionally, this research primarily looks at co-creation that is ongoing within the western world where societal values tend to be similar. It could be, then, interesting to study OGD and OGD-driven co-creation in non-western societies and administrative environments to see what effect this has on OGD-driven co-creation, if any. Furthermore, many of the studied examples in this paper were initiated by government agencies and the applications were created as web applications. When the application development is led by the government, they appear to be more sustainable, however, citizen-led initiatives may run into sustainability issues due to loss of interest or resources. Thus, future research should pay attention to the issue of sustainability, investigating how to maintain OGD-driven co-created public services over time. Future research could also address OGD-driven co-created public services that were initiated from a different stakeholder group to see how this effects the process of development or the usage of the service. Additionally, other types of OGD-driven co-created public services such as mobile applications or offline applications could be explored as well. This may well help the field of e-Government develop and advance forwards as a scholarly discipline, encourage increased levels of understanding, and allow for the development of new and rich theoretical concepts about the ontological nature of e-Government and e-Government associated issues.

To conclude, I offer the following closing sentiment from **VI:**

> "One of the most 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." (p. 26)

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References

Alford, J. (2014). The Multiple Facets of Co-Production: Building on the work of Elinor Ostrom. *Public Management Review*, *16*(3), 299–316. https://doi.org/10.1080/14719037.2013.806578

Alford, J. (2016). Co-Production, Interdependence and Publicness: Extending public service-dominant logic. *Public Management Review*, *18*(5), 673–691. https://doi.org/10.1080/14719037.2015.1111659

Barry, E. & Bannister, F. (2014). Barriers to open data release: A view from the top. *Information Polity*, *19*(1/2), 129–152. https://doi.org/10.3233/IP-140327

Barth-Jones, D. (2012). The 'Re-Identification' of Governor William Weld's Medical Information: A Critical Re-Examination of Health Data Identification Risks and Privacy Protections, *Then and Now (July 2012)*. Available at SSRN: https://ssrn.com/abstract=2076397

Bekkers, V. & Homburg, V. (2007). The Myths of E-Government: Looking Beyond the Assumptions of a New and Better Government. *The Information Society*, *23*(5), 373–382. https://doi.org/10.1080/01972240701572913

Beno, M., Figl, K., Umbrich, J. & Polleres, A. (2017). Open Data Hopes and Fears Determining the barriers of Open Data. In: Parycek, P., Edelmann, N. (Eds.), *Conference for E-Democracy and Open Government (CeDEM)*, 69–81. https://doi.org/10.1109/CeDEM.2017.22

Bevir, M. & Rhodes, R. A. W. (2005). Interpretation and its others. *Australian Journal of Political Science*, *40*(2), 169–187. https://doi.org/10.1080/10361140500129974

Birks, M. & Mills, J. (2015). Grounded Theory: a Practical Guide. London: SAGE Publications Ltd. ISBN: 1473917077

Bovaird, T. (2007). Beyond Engagement and Participation: User and Community Coproduction of Public Services. *Public Administration Review*, *67*(5), 846–860. https://doi.org/10.1111/j.1540-6210.2007.00773.x

Bracci, E., Fugini, M. & Sicilia, M. (2016). Co-production of public services: meaning and motivations. In Fugini, E., Bracci, E., Sicilia, M. (Eds.), Co-production in the Public Sector (pp. 1-11). Springer, Cham. https://doi.org/10.1007/978-3-319-30558-5_1

Brandsen, T., Verschuere, B. & Steen, T. (Eds.). (2018). Co-production and co-creation: Engaging citizens in public services. Routledge.

Castelnovo, W. & Sorrentino, M. (2018). The digital government imperative: a context-aware perspective. *Public Management Review*, *20*(5), 709–725. https://doi.org/10.1080/14719037.2017.1305693

Chan, C. M. L. (2013). From Open Data to Open Innovation Strategies: Creating E-Services Using Open Government Data. In *Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46)* (pp. 1890–1899). Wailea, HI, USA: IEEE Computer Society.

Chatfield, A. T. & Brajawidagda, U. (2013). Twitter Early Tsunami Warning System: A Case Study in Indonesia's Natural Disaster Management. In *Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46)* (pp. 2050–2060). Wailea, Maui, Hawaii. IEEE Computer Society.

Chen, W. & Hirschheim, R. (2004). A paradigmatic and methodological examination of information systems research from 1991 to 2001. *Information Systems Journal*, *14*(3), 197–235. https://doi.org/10.1111/j.1365-2575.2004.00173.x

Conradie, P. & Choenni, S. (2014). On the barriers for local government releasing open data. *Government Information Quarterly*, *31*(S1), S10–S17. https://doi.org/10.1016/j.giq.2014.01.003

Cordella, A. & Paletti, A. (2017.) Value creation, ICT, and co-production in public sector: bureaucracy, opensourcing and crowdsourcing. In Hinnant, C. & Ojo, A. (Eds.), *Proceedings of the 18th Annual International Conference on Digital Government Research (dg.o '17)*. Association for Computing Machinery, New York, NY, USA, 185–194. DOI:https://doi.org/10.1145/3085228.3085305

Dawes, S. S., Vidiasova, L. & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, *33*(1), 15–27. https://doi.org/10.1016/j.giq.2016.01.003

Delbecq, A. L., de Ven, A. H. & Gustafson, D. H. (1975). *Group techniques for program planning: A guide to nominal group and Delphi processes*. Scott, Foresman Glenview, IL.

Dillon, S., Deakins, E. & Chen, W. J. (2006). e-Local Government in New Zealand: the Shifting Policymaker View. *Electronic Journal of E-Government*, *4*(1), 9–18.

Dori, D. (2015). Automation systems and integration — Object-Process Methodology, ISO/PAS 19450:2015(en).

dos Santos Brito, K., da Silva Costa, M. A., Garcia, V. C. & de Lemos Meira, S. R. (2015). Assessing the Benefits of Open Government Data: The Case of Meu Congresso Nacional in Brazilian Elections 2014. In Zhang, J. & Kim, Y. (Eds.), *Proceedings of the 16th Annual International Conference on Digital Government Research (dg.o 2015)* (pp. 89–96). Phoenix, AZ, USA: ACM. https://doi.org/10.1145/2757401.2757422

Dudau, A., Glennon, R. & Verschuere, B. (2019). Following the yellow brick road? (Dis)enchantment with co-design, co-production and value co-creation in public services. *Public Management Review*, *21*(11), 1577–1594. https://doi.org/10.1080/14719037.2019.1653604

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.5465/amr.1989.4308385

European Commission (2013). *A vision for public services (Draft)*. Brussels. Retrieved from http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3179

European Data Portal. (2018). Benefits of Open Data. Retrieved September 26, 2018, from https://www.europeandataportal.eu/en/using-data/benefits-of-open-data

European Data Portal. (2019). *Open Data Maturity 2019 - Estonia*. Retrieved from https://www.europeandataportal.eu/sites/default/files/country-factsheet_estonia_2019.pdf

Forrester, J. W. (1991). System Dynamics and the Lessons of 35 Years. In Kenyon B. De Greene (Eds.), *The Systemic Basis of Policy Making in the 1990s*. Springer. doi: https://doi.org/10.1007/978-1-4615-3226-2.

Foulonneau, M., Turki, S., Vidou, G. & Martin, S. (2014). Open data in service design. *Electronic Journal of E-Government*, *12*(2), 99–107.

Gil-Garcia, J. R., Dawes, S.S. & Pardo, T.A. (2018) Digital government and public management research: finding the crossroads, *Public Management Review*, 20(5), 633-646, DOI: https://10.1080/14719037.2017.1327181

Gonzalez-Zapata, F. & Heeks, R. (2015). The multiple meanings of open government data: Understanding different stakeholders and their perspectives. *Government Information Quarterly*, *32*(4), 441–452. https://doi.org/10.1016/j.giq.2015.09.001

Harrison, T. M., Pardo, T. A. & Cook, M. (2012). Creating Open Government Ecosystems: A Research and Development Agenda. *Future Internet*, *4*(4), 900–928. https://doi.org/10.3390/fi4040900

Hay, C. (2011). Interpreting Interptretivism Interpreting Interpretations: The New Hermeneutics of Public Administration. *Public Administration*, *89*(1), 167–182. https://doi.org/10.1111/j.1467-9299.2011.01907.x

Hern, A. (2014). New York taxi details can be extracted from anonymised data, researchers say. *The Guardian*. Retrieved March 30, 2020, from https://www.theguardian.com/technology/2014/jun/27/new-york-taxi-details-anonymised-data-researchers-warn

Heeks, R. & Bailur, S. (2007). Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government Information Quarterly*, *24*(2), 243-265.

Highsmith, J. (2002). What Is Agile Software Development? *The Journal of Defense Software Engineering*, *15*(10), 4–9. https://doi.org/10.1109/2.947100

Janssen, M., Charalabidis, Y. & Zuiderwijk, A. (2012). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*, *29*(4), 258–268. https://doi.org/10.1080/10580530.2012.716740

Janssen, M. & van der Voort, H. (2016). Adaptive governance: Towards a stable, accountable and responsive government. *Government Information Quarterly*, *33*(1), 1–5. https://doi.org/10.1016/j.giq.2016.02.003

Jarke, J. (2019). Open government for all? Co-creating digital public services for older adults through data walks. *Online Information Review*, *43*(6), 1003–1020. https://doi.org/10.1108/OIR-02-2018-0059

Juell-Skielse, G., Hjalmarsson, A., Johannesson, P. & Rudmark, D. (2014). Is the Public Motivated to Engage in Open Data Innovation? In M. Janssen, H. J. Scholl, M. A. Wimmer & F. Bannister (Eds.), *Electronic Government: Proceedings of the 13th IFIP WG 8.5 International Conference, EGOV 2014* (Vol. 8653, pp. 277–288). Dublin, Ireland. Retrieved from http://link.springer.com/chapter/10.1007/978-3-662-44426-9_23

Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly*, *30*(4), 508–513. https://doi.org/10.1016/j.giq.2013.05.012

Khayyat, M. & Bannister, F. (2017). Towards a model for facilitating and enabling co-creation using open government data. *Information Polity*, *22*(4), 211–231. https://doi.org/10.3233/IP-170406

Krimmer, R., Kalvet, T., Toots, M. & McBride, K. (2016). *Deliverable 2.1 OpenGovIntelligence framework--first release*. Available at: http://www.opengovintelligence.eu/downloads/deliverables/OGI_D2.1%20OpenGovIntelligence%20framework%201st%20release_v0.1.pdf

Lember, V. (2018). The increasing role of new technologies in co-production. In T. Brandsen, T. Steen & B. Verschuere (Eds.), *Co-production and co-creation: engaging citizens in public service delivery.* Routledge. https://doi.org/10.13140/RG.2.2.10934.80966

Lember, V., Brandsen, T. & Tõnurist, P. (2019). The potential impacts of digital technologies on co-production and co-creation. *Public Management Review*, *21*(11), 1665–1686. https://doi.org/10.1080/14719037.2019.1619807

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*, *29*(4), 446–454.

Lonn, C.-M. & Uppstrom, E. (2016). Understanding Public Sector Collaboration Through Boundary Object Theory: A Case Study of an E-Government Initiative in Sweden. In *49th Hawaii International Conference on System Sciences (HICSS 2016)* (pp. 2687–2696). Kauai, HI, USA: IEEE. https://doi.org/10.1109/HICSS.2016.337

Maccani, G., Donnellan, B. & Helfert, M. (2015). Open Data Diffusion for Service Innovation: An Inductive Case Study on Cultural Open Data Services. In *Proceedings of the 19th Pacific-Asian Conference on Information Systems (PACIS 2015)* (pp. 1–17). Singapore.

McBride, K. (2017). *Government as a Platform: Exploiting Open Government Data to Drive Public Service Co-Creation*. Tallinn University of Technology. Available at: http://www.egov.ee/media/1376/keegan-mcbride.pdf

McBride, K., Toots, M., Kalvet, T. & Krimmer, R. (2019). Turning Open Government Data into Public Value: Testing the COPS Framework for the Co-creation of OGD-Driven Public Services. In: Rodríguez Bolívar M., Bwalya K., Reddick C. (Eds.), *Public Administration and Information Technology* (Vol. 31, pp. 3–31). Springer. https://doi.org/10.1007/978-3-030-14446-3_1

McBride, K., Toots, M., Kalvet, T., Krimmer, R., Kalampokis, E., Tambouris, E. & Tarabanis, K. (2017). *Deliverable 2.2 OpenGovIntelligence Framework*. Available at: http://www.opengovintelligence.eu/downloads/deliverables/OGI_D2.2_OpenGovIntelligence%20Framework_v1.0.pdf

Meadows, D. H. (2008). *Thinking in systems : a primer*. (Diana Wright, Ed.). Chelsea Green Publishing.

Meijer, A. (2012). Co-production in an Information Age: Individual and Community Engagement Supported by New Media. *Voluntas*, *23*(4), 1156–1172. https://doi.org/10.1007/s11266-012-9311-z

Mergel, I., Kattel, R., Lember, V. & McBride, K. (2018, May). Citizen-oriented digital transformation in the public sector. In Zuiderwijk A. & Hinnant, C., (Eds.), *Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age* (pp. 1-3).

Mergel, I. (2015). Open collaboration in the public sector: The case of social coding on GitHub. *Government Information Quarterly*, *32*(4), 464–472. https://doi.org/10.1016/j.giq.2015.09.004

Mergel, I, Kleibrink, A. & Sörvik, J. (2018). Open data outcomes: U.S. cities between product and process innovation. *Government Information Quarterly*. https://doi.org/10.1016/J.GIQ.2018.09.004

MeriTalk. (2016). Estonia CIO Calls U.S. Open Data 'So Last Century.' Retrieved April 30, 2019, from https://www.meritalk.com/articles/estonia-cio-calls-u-s-open-data-so-last-century/

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass Publishers.

Merriam, S. B. & Grenier, R. S. (2019). *Qualitative Research in Practice Examples for Discussion and Analysis.* John Wiley & Sons, Incorporated.

Norris, D. F. (2004). e-Government Impacts at the American Grassroots: An Initial Assessment. In R. Traunmüller (Ed.), *Electronic Government: Proceedings of the 3rd [IFIP WG 8.5] International Conference, EGOV 2004* (Vol. 3183, pp. 371–376). Zaragoza, Spain.

Norris, D. F. (2010). E-Government 2020: Plus ça change, plus c'est la meme chose. *Public Administration Review*, *70*, s180–s181. https://doi.org/10.1111/j.1540-6210.2010.02269.x

Norris, D. F. & Lloyd, B. A. (2006). The Scholarly Literature on E-Government. *International Journal of Electronic Government Research*, *2*(4), 40–56. https://doi.org/10.4018/jegr.2006100103

Obama, B. Making Open and Machine Readable the New Default for Government Information, Executive Order § (2013). Retrieved from https://obamawhitehouse.archives.gov/the-press-office/2013/05/09/executive-order-making-open-and-machine-readable-new-default-government-

Obama, B., (2009). Transparency and Open Government | The White House. *Whitehouse.Gov*. Retrieved from: https://obamawhitehouse.archives.gov/the-press-office/transparency-and-open-government

OECD. (2018). *Open Government Data Report*. Paris: OECD. https://doi.org/https://doi.org/10.1787/9789264305847-en

Open Government Partnership. (2011). Open Government Declaration. Retrieved April 30, 2019, from https://www.opengovpartnership.org/open-government-declaration

Open Knowledge Foundation. (2019). Open Knowledge Foundation - About. Retrieved November 23, 2019, from https://okfn.org/about/

Orlikowski, W. J. & Baroudi, J. J. (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research*, *2*(1), 1–28. https://doi.org/10.1287/isre.2.1.1

Osborne, S. P. (2006). The New Public Governance? *Public Management Review*, *8*(3), 377–387. https://doi.org/10.1080/14719030600853022

Osborne, S. P. (2010). Introduction The (New) Public Governance: a suitable case for treatment?. In Osborne, S.P. (Ed.), *The new public governance?* (pp. 17-32). Routledge.

Osborne, S. P. (2017). From public service-dominant logic to public service logic: are public service organizations capable of co-production and value co-creation? *Public Management Review*, *00*(00), 1–7. https://doi.org/10.1080/14719037.2017.1350461

Osborne, S. P., Radnor, Z. & Strokosch, K. (2016). Co-Production and the Co-Creation of Value in Public Services: A suitable case for treatment? *Public Management Review*, *18*(5), 639–653. https://doi.org/10.1080/14719037.2015.1111927

Osborne, S. P. & Strokosch, K. (2013). It takes two to tango? Understanding the co-production of public services by integrating the services management and public administration perspectives. *British Journal of Management*, *24*(S3). https://doi.org/10.1111/1467-8551.12010

Ostrom, E. (1972). Metropolitan reform: Propositions derived from two traditions. *Social Science Quarterly*, 474–493.

Paletti, A. (2016). Co-production through ICT in the public sector: When citizens reframe the production of public services. In Caporarello, L., Cesaroni, F., Giesecke, R. & Missikoff, M. (Eds.), *Lecture Notes in Information Systems and Organisation* (Vol. 18, pp. 141–152). Springer Heidelberg. https://doi.org/10.1007/978-3-319-40265-9_10

Parcell, J. & Holden, S. H. (2013). Agile Policy Development for Digital Government: An Exploratory Case Study. In Luna-Reyes, L. & Zhang, J (Eds.) *Proceedings of the 14th Annual International Conference on Digital Government Research* (pp. 11–17). New York, NY, USA: ACM. Retrieved from http://doi.acm.org/10.1145/2479724.2479731

Pereira, G. V., Macadar, M. A., Luciano, E. M. & Testa, M. G. (2017). Delivering public value through open government data initiatives in a Smart City context. *Information Systems Frontiers*, 19(2), 213-229.

Pollitt, C., Bouckaert, G. & Löffler, E. (2006). Making Quality Sustainable : Co-Produce and Co-Evaluate the Quality Journey To 4Qc. *4QC Conference*.

Pollock, R. (2011). Building the (Open) Data Ecosystem. Retrieved April 30, 2019, from https://blog.okfn.org/2011/03/31/building-the-open-data-ecosystem/

Reggi, L. & Dawes, S. (2016). Open Government Data Ecosystems: Linking Transparency for Innovation with Transparency for Participation and Accountability. In Scholl, H.J., Glassey, O., Janssen, M., Klievink, B., Lindgren, I., Parycek, P., Tambouris, E., Wimmer, M., Janowski, T., Sá Soares, D. (Eds.), *Electronic Government: Proceedings of the 15th IFIP WG 8.5 International Conference, EGOV 2016*. Guimarães, Portugal: Springer International Publishing.

Ries, E. (2011). *The lean startup : how today's entrepreneurs use continuous innovation to create radically successful businesses*.

Sayogo, D. S., Pardo, T. A. & Cook, M. (2014). A Framework for Benchmarking Open Government Data Efforts. In *Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS-47)* (p. 10). Waikoloa Village, Hawaii.

Schedler, K., Summermatter, L. & Schmidt, B. (2004). *Managing the electronic government : from vision to practice*. Greenwich, Conn.: Information Age Publishing.

Scholl, H. J. (2006). Is E-Government Research a Flash in the Pan or Here for the Long Shot? In Wimmer, M. A., Scholl, H.J., Grönlund, A., Andersen, K.V. (Eds.), *Electronic Government: Proceedings of the 5th [IFIP WG 8.5] International Conference, EGOV 2006* (Vol. 4084, pp. 13–24). Krakow, Poland.

Scholl, H. J. (2007). Central research questions in e-government, or which trajectory should the study domain take? *Transforming Government: People, Process and Policy*, *1*(1), 67–88.

Schrock, A. & Shaffer, G. (2017). Data ideologies of an interested public: A study of grassroots open government data intermediaries. *Big Data & Society*, *4*(1), 205395171769075. https://doi.org/10.1177/2053951717690750

Styrin, E., Luna-Reyes, L. F. & Harrison, T. M. (2017). Open data ecosystems: an international comparison. *Transforming Government: People, Process and Policy*, *11*(1), 132–156. https://doi.org/10.1108/TG-01-2017-0006

Susha, I., Zuiderwijk, A., Charalabidis, Y., Parycek, P. & Janssen, M. (2015). Critical Factors for Open Data Publication and Use: A Comparison of City-level, Regional, and Transnational Cases. JeDEM - EJournal of EDemocracy and Open Government, 7(2), 94–115.

Tuul, H. (2020, April 7). Koroonakaardi eestvedaja: riik saaks palju rohkem abi, kui lõpetaks varjamise ja avaks andmed. Retrieved from https://digi.geenius.ee/rubriik/uudis/koroonakaardi-eestvedaja-keegan-mcbride-riik-saaks-abi-kui-lopetaks-varjamise-ja-avaks-andmed/

Tygel, A. F., Attard, J., Orlandi, F., Campos, M. L. M. & Auer, S. (2016). “How Much?” is Not Enough: An Analysis of Open Budget Initiatives. In Bertot, J., Estevez, E. & Mellouli, S. (Eds.), 9th International Conference on Theory and Practice of Electronic Governance (ICEGOV ’15-16) (pp. 276–286). ACM. https://doi.org/10.1145/2910019.2910054

Upender, B. (2005). Staying agile in government software projects. Proceedin*gs - AGILE Confernce 2005*, *2005*, 153–159. https://doi.org/10.1109/ADC.2005.41

Verschuere, B., Brandsen, T. & Pestoff, V. (2012). Co-production: The State of the Art in Research and the Future Agenda. *Voluntas*, *23*(4), 1083–1101. https://doi.org/10.1007/s11266-012-9307-8

Voorberg, W. H., Bekkers, V. J. J. M. & Tummers, L. G. (2015). A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey. *Public Management Review*, *17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505

Walsham, G. (1995). The Emergence of Interpretivism in IS Research. *Information Systems Research*. INFORMS. https://doi.org/10.2307/23010981

West, D. M. (2004). E-Government and the Transformation of Service Delivery and Citizen Attitudes. *Public Administration Review*, *64*(1), 15–27.

Whitaker, G. P. (1980). Coproduction : Delivery in Service Participation Citizen. *Public Administration Review*, *40*(3), 240–246.

Yazan, B. (2015). *The Qualitative Report Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake*. *The Qualitative Report* (Vol. 20).

Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. *Government Information Quarterly*, *24*(3), 646–665. https://doi.org/10.1016/J.GIQ.2007.01.002

Yin, R. K. (1989). *Case study research : design and methods*. *Applied social research methods series ; v. 5* (Rev.). Newbury Park, Calif.: Sage Publications.

Young, M. & Yan, A. (2017). Civic Hackers’ User Experiences and Expectations of Seattle’s Open Municipal Data Program. *Proceedings of the 50th Hawaii International Conference on System Science (HICSS-50)*, 2681–2690. https://doi.org/http://hdl.handle.net/10125/41480

Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R. & Alibaks, R. S. (2012). Socio-technical Impediments of Open Data. *Electronic Journal of Electronic Government*, *10*(2), 156–172. https://doi.org/10.1641/b570402?ref=search-gateway:885882d1830675b0f27af0760faeaef8

Zuiderwijk, A., Janssen, M., Poulis, K. & van de Kaa, G. (2015). Open Data for Competitive Advantage: Insights from Open Data Use by Companies. In Zhang, J. & Kim, Y. (Eds.), *Proceedings of the 16th Annual International Conference on Digital Government Research (dg.o 2015)* (pp. 79–88). Phoenix, AZ, USA: ACM. https://doi.org/10.1145/2757401.2757411

Zuiderwijk, A., Shinde, R. & Janssen, M. (2019). Investigating the attainment of open government data objectives: is there a mismatch between objectives and results? *International Review of Administrative Sciences*, *85*(4), 645–672. https://doi.org/10.1177/0020852317739115

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Abstract

Open Government Data Co-Created Public Services

This thesis contributes to the field of e-Government by presenting research on how open government data can be used for the co-creation of new public services. Whilst there is large amounts of research on open government data and co-creation individually, there is a lack of academic research that aims to combine these two topics. As open government data appears to be able to help lower barriers to co-creation and encourage stakeholders to engage in co-creation of public services, there was a need to study exactly how this process happens, and what materializes as a result of this process. The research within this thesis aims to fill this gap.

This doctoral work consists of seven academic articles that, together, help to: conceptualize and define open government data-driven co-created public services, discuss the process of using open government data to engage in public service co-creation, discuss the drivers and barriers that affect and influence the open government data-driven public service co-creation process, and provides new knowledge about exactly how open government data can lead to the development of new and innovative public services.

In order obtain these goals and contributions, the thesis raises three primary research questions, and one sub-research question:

1. How can OGD be used to drive the co-creation of new public services?
2. What are the main drivers and barriers associated with the practice of OGD-driven co-creation?
3. How does the availability of OGD influence public service co-creation ecosystems?
    a. How does the introduction of OGD to co-creation ecosystems allow for public value to be created?

The thesis approaches these research questions from an interpretivist epistemology with a constructivist ontology. As open government data-driven co-creation of public services is highly dependent on the stakeholders involved in the process, and the environment that this process takes place in, interpretivism provides a lens that helps to focus and understand the different beliefs and values that influence this process. As the research is highly qualitative and interpretivist in nature, case studies were the primary methodological choice for the research articles, with five of the seven papers being case studies. The remaining two papers can be classified methodologically as a survey paper and theoretical model building. The case study approach is ideal in this situation as it allows for open government data-driven co-creation of public services to be studied within different contexts, allowing for a better understanding how different aspects of this process may or may not be affected by the environment.

As a result of this research, the following findings have emerged. Firstly, OGD has the potential to facilitate and enable the co-creation of new public services. In many ways, OGD is similar to a nutrient, when added to already existing co-creation ecosystems, it can encourage their rapid growth, expansion, and health. Similarly, simply adding OGD can lead stakeholders to flock together and self-organize new co-creation ecosystems. This primarily occurs due to OGD bringing together like-minded stakeholders around a unifying theme, openness, but also it lowers the buy-in effect for engaging in co-creation, making it easier for anyone to contribute. This has a combined effect of potentially influencing the governing process, in that co-creation with government involvement

means, fundamentally, that there has been a change in mindset, where non-governmental stakeholders are able to take a leading role in public service design and delivery.

A second finding relates to the drivers and barriers. Primarily, the drivers and barriers can be divided into one of four categories: data and technological, stakeholder, organizational, and legislation and policies. However, while there are many similar drivers and barriers across contexts, it has been found that the presence or absence of single drivers or barriers in a given location can predict the result. The thesis presents an example of Estonia and Chicago and discusses how though the parts in their OGD system were largely similar, small changes in how they interacted led to a vastly different emergent outcome. Thus, the thesis argues that it is important to take a systemic approach to the study of OGD, paying particular attention to how the different parts interact within said system.

Finally, the thesis demonstrates how OGD creates public value when it is utilized to create new public services. Value can be created either directly through the effect of the new service, such as through improved decision making or higher levels of transparency. Additionally, value can be created indirectly, with unintended emergent effects bringing value to society, such as increased awareness of OGD among citizens leading to a rapid growth and expansion of OGD usage in other ways and locations.

Lühikokkuvõte

Avaliku sektori avaandmete põhjal koosloodud avalikud teenused

Käesolev doktoritöö annab panuse e-valitsemise uurimisvaldkonda, uurides, kuidas saab avaliku sektori avaandmeid kasutada uute avalike teenuste koosloomeks. Avaandmeid ja koosloomet on eraldiseisvana küll palju uuritud, ent seni on olnud puudu akadeemilistest uurimustest, mis käsitleks neid kaht teemat koos. Kuna avaandmetel on potentsiaal leevendada koosloome takistusi ning julgustada eri osapooli osalema avalike teenuste koosloomes, on tekkinud vajadus uurida, kuidas täpselt see protsess toimub ja mis on selle tulemused. Doktoritöö raames tehtud uurimistöö eesmärk oli seda tühimikku täita.

Doktoritöö koosneb seitsmest akadeemilisest artiklist, mis kontseptualiseerivad ja defineerivad avaandmete põhjal koosloodud avalike teenuste mõistet, lahkavad avaandmepõhiste avalike teenuste koosloome protsessi, uurivad avaandmepõhiste avalike teenuste koosloomet toetavaid ja takistavaid tegureid ning loovad uut teadmist selle kohta, kuidas täpselt avaandmed aitavad luua uusi ja innovaatilisi avalikke teenuseid.

Nende eesmärkide saavutamiseks tõstatab töö kolm peamist uurimisküsimust ja ühe alaküsimuse:

1. Kuidas on võimalik kasutada avaandmeid uute avalike teenuste koosloomeks?
2. Millised peamised tegurid soodustavad ja takistavad avaandmepõhist koosloomet?
3. Kuidas avaandmete kättesaadavus mõjutab avalike teenuste pakkumise koosloome ökosüsteemi?
    a. Kuidas loovad avaandmete-põhised koosloodud avalikud teenused ühiskondlikku väärtust?

Töö lähenemine neile uurimisküsimustele põhineb interpretivistlikul epistemoloogial ja konstruktivistlikul ontoloogial. Kuna avaandmetel põhinev avalike teenuste koosloome sõltub suuresti sellesse kaasatud osapooltest ja keskkonnast, milles see protsess toimub, pakub interpretivism vaatenurka, mis võimaldab mõista seda protsessi mõjutavaid erinevaid uskumusi ja väärtusi. Kuna läbi viidud uurimistöö on loomult kvalitatiivne ja interpretivistlik, kasutas uurimistöö peamise metoodilise valikuna juhtumianalüüse – viis seitsmest doktoritöö artiklist põhinevad juhtumianalüüsil. Ülejäänud artiklitest üks toetub ankeetküsitlusele ja teine pakub välja teoreetilise mudeli. Juhtumianalüüs on selles olukorras suurepärane meetod, kuna võimaldab uurida avaandmetel põhinevate avalike teenuste koosloomet erinevates kontekstides ning paremini mõista, kuidas keskkond võib mõjutada protsessi eri aspekte.

Uurimistöö põhijäreldused on järgmised. Esiteks on avaandmetel potentsiaal võimaldada ja toetada uute avalike teenuste koosloomet. Avaandmed on mitmes mõttes justkui toitaine, mis olemasolevatesse koosloome ökosüsteemidesse lisades soodustab nende kiiret kasvu, laienemist ja head tervist. Samuti võib avaandmete pakkumine viia eri osapoolte koondumise ja uute koosloome ökosüsteemide iseorganiseerumiseni. See juhtub peamiselt seetõttu, et avaandmed koondavad sarnaselt mõtlevaid osapooli avatuse kui ühise huvi ümber, ent ka seetõttu, et avaandmed madaldavad koosloomeprotsessides osalemise barjääri, võimaldades igaühe osalemist. Kombineeritult on neil nähtustel potentsiaalne mõju valitsemisprotsessile – avaliku sektori osalusel toimuv

koosloome tähendab sisuliselt, et on toimunud mentaliteedi muutus, mis võimaldab ka avaliku sektori välistel osapooltel haarata juhtrolli avalike teenuste kujundamisel ja pakkumisel.

Teine järeldus puudutab avaandmepõhist koosloomet soodustavaid ja takistavaid tegureid. Üldjoontes saab tegurid jagada nelja kategooriasse: andmed ja tehnoloogia, osapooltega seotud tegurid, organisatsioonilised faktorid ning õiguslik ja poliitikaraamistik. Kuigi paljud tegurid on sarnased kontekstist sõltumata, on leitud, et üksikute soodustavate või takistavate tegurite olemasolu konkreetses geograafilises kontekstis võimaldab ennustada avaandmetel põhineva koosloome tulemusi. Doktoritöö esitleb Eesti ja Chicago näidet ja arutleb, kuidas nende avaandmete süsteemide osalistest sarnasustest hoolimata viisid väikesed erinevused süsteemisisestes interaktsioonides väga erinevate tulemusteni. Seega väidab töö, et on väga oluline uurida avaandmeid süsteemikesksest vaatenurgast, pöörates erilist tähelepanu süsteemi eri osiste omavahelisele interaktsioonile.

Viimaks demonstreerib töö, kuidas avaandmed loovad ühiskondlikku väärtust, kui kasutada neid uute avalike teenuste loomiseks. Väärtus saab tekkida kas otseselt uue teenuse mõjude kaudu, näiteks võib teenus viia parema otsustusprotsessi või suurema läbipaistvuseni. Avaandmete kasutamine võib aga väärtust luua ka kaudselt – seda algselt planeerimata, aga ühiskonnale väärtust loovate kõrvalmõjude kaudu. Näiteks võib kodanike suurem teadlikkus avaandmetest viia avaandmete kasutamise kiire kasvu või laienemiseni teistes valdkondades või asukohtades.

Publications (Article I – VII)

Publication I

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Sailing towards digitalization when it doesn't make cents? Analysing the Faroe Islands' new digital governance trajectory

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Abstract: Talgildu Føroyar is a project-based temporary organization, funded from 2015 through 2020, tasked with spearheading the Faroe Islands' digital governance movement. As a small, subnational island jurisdiction (SNIJ), the government of the Faroe Islands with its population of 50,000 believes that digitalization will lead to decreased government costs, a reduction in bureaucracy, a more efficient government, and empowered citizens. The objective of this paper is twofold: firstly, to provide an accurate narrative of how the digitalization of the Faroe Islands has unfolded and, secondly, to explore the different beliefs and motivations held by stakeholders that have driven the digitalization of the Faroe Islands. The research is inductive in nature and was conducted following a descriptive case study-based methodology drawing primarily from 23 semi-structured interviews conducted over a three-week field visit to the Faroe Islands and supported by secondary evidence sources such as government policy documents and internal government reports. The paper outlines the primary barriers facing digitalization in the Faroe Islands, and finds that while digitalization is unlikely to be cost effective, it does have the potential to provide other tangible benefits such as a revitalized ICT sector.

Keywords: digitalization, Faroe Islands, governance, small states, subnational island jurisdictions (SNIJs), Small States, Faroe Islands

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Introduction

The Faroe Islands are a small, isolated, subnational island jurisdiction (SNIJ) that belongs to the Kingdom of Denmark. SNIJs "manifest diverse expressions of governance within typically asymmetric relationships with a much larger state," often leading to a unique power relationship and political discourse (Baldacchino & Milne, 2006). This unique relationship often manifests as a balancing act between an SNIJ's desire for increased levels of sovereignty and the benefits provided by the larger state, such as funding (the Faroe Islands receive an annual block grant of €86 million) (Government of the Faroe Islands, 2019) and national security. The Faroe Islands are no different, and this struggle is evident in the makeup of their political system where parties are classified along three dimensions rather than two (Hoff &

West, 2008): socially left/right, economically left/right, and independence for/against. Geographically, the Faroe Islands are isolated (Figure 1), rural in nature, spread out over 18 islands, and boasting a small, largely homogenous, population of around 51,000 people.

Figure 1: Geographical location of the Faroe Islands. *Source:* List, 2005. Retrieved from https://commons.wikimedia.org/wiki/File:Map_of_faroe_islands_in_europe_-_english_caption.png

Though part of the Kingdom of Denmark, the Faroes have had some degree of self-rule and autonomy since the passing of the Home Rule Act in 1948, which delegated most governance-related activities to Faroese institutions (Government of the Faroe Islands, 2019). Interestingly, though part of the Kingdom of Denmark, the Faroes are not a member of the EU or EEA. As it currently stands, the Faroese government is responsible for most areas of government, excluding national defence, policing and prisons, immigration, aviation, and financial regulation (Government of the Faroe Islands, 2019). As the Faroe Islands have been increasingly taking control over their own affairs, effort has been spent on increasing their institutional capacity and domestic governance mechanisms. Being a small state, there are some idiosyncrasies that are present that make a bureaucracy in the traditional Weberian sense impractical (Baker, 1992). Thus, methods are often sought to make governing more effective in a small state context. One of the newest approaches pursued in the Faroe Islands to potentially improve their governance capacity and effectiveness has been strategic investments in government digitalization. In order to better drive the digitalization process, a new project-based temporary organization was created within Gjaldstovan (the Faroe Government Institution for Accounting, Finance, and IT) and given the name Talgildu Føroyar ('Digital Faroe Islands'). The project was allocated funding from 2015 to 2020. Though the project was initially temporary in nature, there is an ongoing debate on whether to formalize Talgildu Føroyar as a department within Gjaldstovan to manage continued future digitalization efforts.

Though still ongoing, this project presents an interesting opportunity to study the digitalization efforts of a small state throughout the *process* rather than the *end result* of digitalization and to better understand the motivations of stakeholders and drivers behind the process, before any expected benefits or results have actualized. In order to better understand

this process, this paper adopts a descriptive and narrative case study-based approach to achieve two primary goals. Firstly, it aims to provide an accurate narrative of how the digitalization of the Faroe Islands has unfolded and, secondly, it aims to explore the different beliefs and motivations held by stakeholders that have driven digitalization.

In order to address these goals, the paper starts with a brief overview of the peculiarities associated with the governance of small states and territories, as well as the different understandings of digital governance in today's academic discourse. Following this, the narrative of the Faroe Islands' digital governance journey so far is relayed. The paper then proceeds into a discussion that critically compares and analyzes the competing motivations for pursuing digital governance in the Faroe Islands.

The research in this paper is likely to be of interest to both scholars of e-Government and for those within island studies. With regard to e-Government literature, this research is unique in that it presents an interpretive rather than positivist approach to the study of digitalization and, additionally, highlights the importance of context and narratives when conducting research on e-Government initiatives. For scholars within the domain of island studies, this research provides insights into the relationship between islandness, smallness, and digitalization. Thus, the main contribution of this paper is its description of digitalization within a small state and a greater in-depth understanding of how such a process unfolds.

Small territories, digitalization, making sense of the gap

The issue of size and defining 'smallness' is much debated within the current literature on small states and territories. A recent approach to the issue of 'size' has been to take a continuum-based (rather than an absolute) approach, in which the smaller the state, the more likely it is to exhibit governance and institutional traits associated with smallness (Bray, 1991, ctd. in Randma-Liiv & Sarapuu, 2019). As the Faroe Islands have a population of around 51,000, it may be considered a small state, but, more specifically, also a micro-state and, taking into account the continuum approach, is likely to exhibit and share traits with other small territories.

Over the years, it has become increasingly clear that small territories are not the same as larger territories, and the study of them needs to be approached in a different manner. Whereas larger territories can have a Weberian bureaucracy with professionalized, neutral, skilful, and specialized bureaucrats, this is for the most part impossible in small territories (Murray, 1981; Pirotta, Wettenhall, & Briguglio, 2001). There are many reasons this occurs, but most can be traced back to small population size, which places a natural limit on the size of the bureaucracy (Murray, 1981; Richards, 1982) and in turn requires policymakers and administrators to function more as generalists than specialists (Sarapuu, 2010). Another side effect of having a small population is that the cost of governing per person is higher than in larger territories due to economies of scale. Outside of these constraints directly associated with a small population, small territories are economically different than larger territories (Grydehøj, 2018), which may lead to difficulty when it comes to building administrative capacity (Murray, 1981) or procuring innovation due to small internal markets (Kattel, Randma-Liiv, & Kalvet, 2011). These contextual factors all potentially make the already-difficult process of governing even more so. Small territories may thus be especially interested in reforms, administrative procedures, or innovations that target or aim to improve effectiveness and efficiency.

Digital governance is one such innovation that has been proposed as a potential solution. For example, Awan (2013) notes that digital governance may be potentially assist Small Island Developing States (SIDS) in achieving higher levels of 'good governance'. Similarly, the United Nations e-Government Development Index pays special attention to SIDS and discusses the importance of digitalization for these countries (United Nations, 2018). It is proposed that digital governance has the potential to transform government, lead to more efficient practices, drive innovation, and facilitate interoperability and service development (Dunleavy et al., 2006; Torres, Pina, & Royo, 2005). While digital governance is still a heavily debated topic, it will be understood here as a concept that "focuses on steering mechanisms in a certain political unit, emphasizing the interaction of State (First), Business (Second), and Society (Third Sector) players" (Drechsler, 2004) through digital means, such as Information and Communication Technologies (ICTs).

It is important to note that, while many works on digital governance believe that digitalization will lead to organizational or administrative transformation, this may be something of a myth (Norris, 2010; Bekkers & Homburg, 2007). Digital governance is most often associated with external processes, that is to say, service delivery—often on the G2G (Government to Government), G2B (Government to Business), or G2C (Government to Citizen) level (Norris, 2010). The premise is that the introduction of ICTs allows for services to be delivered to citizens in a faster, more efficient (cheaper), and effective way, thereby improving quality of life for the service user. If services are delivered cheaper, bureaucracy may be able to shrink and save money. However, digital governance is expensive and labour intensive and brings with it many new challenges for government. Digital governance requires new digital infrastructure to be built and maintained, new services and tools to be developed, new bureaucrats with technical skills to be hired, and new cyber and digital security risks to be monitored and analysed.

Additionally, it is often the case that offline methods remain available during this period in case digital services become unavailable for technical reasons or due to the digital divide, with certain citizens unable to use or access new digital services (Helbig, Gil-Garcia, & Ferro, 2005). As there are high costs associated with the initial states of digital governance, these efforts for the most part require a high uptake and number of users in order to be cost effective. This is interesting, given that there have hitherto been limited studies explicitly focusing on how the size of a state influences digitalization. While studies do exist that explore digital governance in small territories (Cullen & Hassall, 2017; Kalvet, 2012; Li, Detenber, Lee, & Chia, 2004), state size is often not explicitly included as a variable in analyses of the implementation or performance of digital governance initiatives. So, there is a situation in which bureaucracy and public administration within small territories have been associated with certain limiting factors, and digitalization has been proposed as a potential solution to overcome these limitations, yet there appears to be a research gap regarding how this process unfolds and how the context of smallness influences the digitalization process.

Methodology

The research in this paper is interpretive in nature, regarding "our knowledge of reality [as] a social construction" and seeing this knowledge as "incapable of being understood independently of the social actors" (Orlikowski & Baroudi, 1991). The case study is among the most common

qualitative interpretivist research methods. This can be differentiated from other basic qualitative studies in its focus on a single unit of analysis rather than a broad topic (Merriam & Grenier, 2019). While there are many different case study approaches (see e.g. Eisenhardt, 1989; Yazan, 2015; Yin, 2013), the present research can be classified as a descriptive case study in which the goal is to create a "rich, thick description of the phenomenon under study" (Merriam, 1998; ctd. in Yazan, 2015). In this instance, the paper focuses on Talgildu Føroyar to provide a descriptive narrative of how the Faroe Islands has begun its digitalization journey.

This research relies heavily on semi-structured interviews but is also supported by participant observation, ethnographic evidence, and document review. During a three-week research field visit to the Faroe Islands in November 2018, 22 semi-structured interviews were conducted in-person with interviewees from academia, the public and private sectors, parliament, government agencies, and among other island citizens. The interviews started with key stakeholders, such as the project manager of Talgildu Føroyar, and additional interviewees were identified through snowballing and by reviewing internal Talgildu Føroyar documents that highlighted important stakeholders in the digitalization project. Additionally, one interview was carried out in February 2019 by e-mail with the Minister of Finance of the Faroe Islands. The questions asked during the semi-structured interviews focused on understanding: motivations for digitalization, feelings about the digitalization process so far, barriers faced during the digitalization process, and the legal and organizational environment that influenced the digitalization process (questions were altered to better fit each stakeholder's context). The interviews lasted between 30 and 60 minutes and were recorded in 80% of the cases (some participants did not wish to be recorded). Audio files were then transcribed and coded. The analysis and coding of the interviews followed conventional content analysis (Birks & Mills, 2015; Hsieh & Shannon, 2005), in which reoccurring themes and concepts are identified, and the developed findings are related back to initial codes and gathered evidence. Due to the small nature of the Faroe Islands and the close ties between partners, many interviewees wished to have certain comments fully anonymized and, as such, some quotes used in this research cannot be attributed. Overall, the interviews provided an overview of the different feelings, perceptions, and understandings of the digitalization process across many different interest groups.

During the three-week research field visit, the researcher was based in a government office and was allowed to observe and participate in meetings and discuss with government officials from a wide range of departments involved in digitalization, such as Talgildu Føroyar, Gjaldstovan, TAKS, and the Ministry of Finance. As a result of this direct access and participation, it was possible to gather additional ethnographic evidence in the form of participant observation. Documents analysed included slide shows and presentations from government organizations on the topic of digitalization, internal project documents focusing on implementation or planning of digitalization, official project reports, white papers, parliamentary rulings, newspaper reports, and web-based artefacts related to Faroese digitalization efforts. These documents were for the most part available in English. When the documents were only available in Faroese, they were translated or interpreted by native Faroese speakers.

As this research is epistemologically based on an interpretivist foundation, it is must be acknowledged that there could be alternative viewpoints or interpretations. Thus, it is important to ensure that it is clear how the interpretations that emerge from this research can be related back to the evidence and observations gathered. In order to ensure this higher level

of internal validity and to support the interpretations made, data and evidence were triangulated. The interviews allowed new concepts to emerge for the study, which could then be validated against findings from the document analysis and participant observation. The interviews also supported the analysis of observations and concepts that emerged from the document analysis and participant observation. Due to the nature of a case study in which the researcher also engages in fieldwork and observation, there is the possibility of bias and of findings being presented in a subjective manner. However, by ensuring a high level of internal validity of the research design and by striving to present the findings in a neutral and objective manner, it is possible to minimize these risks.

The case

Context

Though this paper focuses primarily on the most recent digitalization effort in the Faroe Islands, a historical and contextual overview is needed in order to truly understand the case.

The Faroe Islands are strongly dependent on the fishing industry, however, as is often the case, relying on a single industry risks economic disaster if this industry declines (Hamilton, Colocousis, & Johansen, 2004). This is exactly what happened in the early 1990s when the archipelago's human population rapidly declined from 48,000 in 1990 to 43,000 in 1996 due to a sharp drop in the fish population and a subsequent decline in the fishing sector: in the course of six years, the previous 20 years of population growth had been completely undone (Hamilton, Colocousis, & Johansen, 2004). The crisis worsened when Danish banks devalued the homes on the Faroe Islands, essentially bankrupting a large majority of Faroese citizens. This, combined with what is now known as the 'Great Bank Affair' (Adler-Nissen, 2014), created a large rift between Faroese society and Denmark and has played a major role in influencing how the Faroese chose to develop as a territory and emboldened calls for independence from Denmark. After the economic crisis, the Danish financial sector once again hurt the Faroe Islands' economy when a decision was made to move all IT capacity and infrastructure back to Denmark from the Faroe Islands. Almost overnight, this caused great damage to Faroe Islands' entire ICT sector (Randall & Berlina, 2019).

Politically, the Faroe Islands is a democratic SNIJ with a multi-party political system that identifies as Scandinavian and, as such, has similar democratic, cultural, and societal values as the Nordic countries. The Faroes, though small, have a vibrant and active democracy with an election turnout consistently over 90% (Hoff & West, 2008). With regard to citizenship and democratic participation, the Faroese have among the highest rates of participation in Scandinavia when it comes to contact with politicians and officials, but they are less likely to engage in more outwardly focused types of participation, such as writing news reports or participating in boycotts (Hoff & West, 2008). This is expected due to the small networked type of society that is present on the Faroe Islands. Elections for the Faroese parliament, Løgting, are intense, with seven parties competing for some 30,000 votes. The prime minister of the Løgting is able to appoint ministers to the seven Faroese ministries: Ministry of Finance; Ministry of Education, Research and Culture; Ministry of Fisheries; Ministry of Foreign Affairs and Trade; Ministry of Transport, Infrastructure and Labour; Ministry of Social Affairs; and Ministry of Health and the Interior. Each minister is assigned responsibilities by the Prime Minister and given control/put in charge of different public institutions.

While policy creation and management of public institutions primarily happens at the national level, a large number of responsibilities have been devolved to the 29 municipalities that make up the Faroe Islands. Municipalities in the Faroe Islands are, for the most part, sparsely populated, with 24 of the 29 municipalities having populations below 2,000 (the largest municipality, Tórshavn, has a population of just above 20,000) (Faroe Islands Government, 2019). These municipalities have the power to tax residents, and this is shared with the national government (TAKS, 2019; Jósup Henriksen, Interview 2018). Additionally, every municipality is responsible for service delivery, such as services related to elderly care, schools, public transport, and waste (Útledingastovan, 2017). As municipalities are responsible for service delivery and some aspects of taxation, it is with this level of government that citizens will interact in a majority of situations.

The beginning

The story of Faroese digitalization has its roots in TAKS, an organization within the Ministry of Finance that is responsible for the collection of taxes and revenues as well as administering any other taxation legislation put in place by the Faroese parliament. In 1984, TAKS launched its new taxation system, which all but eliminated the need for citizens to file taxes manually. Employers send employee wages directly to a central wage system, the taxes due are automatically calculated and withdrawn, and then the net wages are sent directly to the bank and made available to the employee. At the end of the fiscal year, TAKS sends out a letter to each person stating how much they paid in tax, how much they earned, and if the information is correct, they does not need to do anything more. For this tax system to become feasible, a unique identifier was needed for every Faroese citizen, so, in 1984, the Faroese 'P-Number' was created and maintained by TAKS. The creation of the P-Number required a legal act passed by parliament and met with much resistance as the number was associated with the "mark of the devil" (Nicolai Balle, Interview 2018; Helena Højgaard, Interview 2018). In order to help pacify the resistance to the identifier, it was made confidential and requires explicit authorization from the citizen to use except where required by law (Jósup Henriksen, Interview 2018). Since 2000, the letter-based system utilized by TAKS has been replaced with an online environment, which was renewed again in 2015 and is known in Faroese as Borgaragluggin. Faroese citizens are able to access the online portal using a Faroese ID solution known as MyKey, and from here they verify whether the tax information was gathered successfully. In the rare cases in which extra information is needed, the citizen is also able to provide it via the portal. Businesses also have access to an online environment where VAT, customs, end of year reporting, etc. can be done via electronic means. This has been available in some form since 2004 and has improved over the successive years.

Though TAKS is the primary example of digitalization, it is not the only one. For example, Føroya Tele, the Faroese telecoms provider, has managed to create one of the most connected societies in the world by providing a broadband penetration rate of 100% and 98% geographical coverage, thus creating a truly networked society on a "small collection of rocks in the Atlantic" (Jan Ziskasen, Interview 2018). At the national level, billing, invoices, accounting, and handling of national accounts is handled in a digital manner by the Ministry of Finance organization known as Gjaldstovan (Gjaldstovan, 2019). Additionally, since 2011, the Faroese national health system has been digitalized with the introduction of a e-Health record platform, which allows doctors around the Faroe Islands to access a patient's healthcare

records. Pharmacies are also connected, allowing for the usage of digital/electronic prescriptions (Jóanis Køtlum, Interview 2018). At the municipal level, only the two largest municipalities, Tórshavn and Klaksvik, have made progress when it comes to e-Services. However, these advancements are quite small in scope and are essentially limited to filling out forms online, and only in a few situations. For example, the Municipality of Tórshavn allows residents to sign up for kindergarten places online via an e-Form from its municipal webpage rather than in person. The Municipality of Klaksvik offers 22 different services/forms that can be filled out on its municipal service portal, located at: https://www.klaksvik.fo/sjalvgreidsla.

Talgildu Føroyar

Talgildu Føroyar is responsible for digitalization in the Faroe Islands. While the project is coordinated at the federal level, it relies heavily on involvement and investment from a wide variety of stakeholders, such as municipalities, banks, telecommunications companies, ICT development companies, other private sector stakeholders, and citizens. This is especially evident in how the project is funded. Talgildu Føroyar was given a budget of 150 million Danish kroner (DKK), with 60% coming from parliament, 17% coming from municipalities, and 23% coming from private external stakeholders (Balle, 2018). In addition to providing funding, there is also direct involvement of a wide variety of stakeholders in monitoring the progress of digitalization, with members of the IT industry, municipalities, and private sponsors serving as part of the program steering group (Balle, 2018; Talgildu Føroyar, 2015). Due to the wide variety of involved stakeholders and parties, it follows that digitalization can provide some sort of benefit for all. In order to accomplish this, Talgildu Føroyar aims to construct the new Faroese digital society based on four primary pillars shown in Figure 2: a citizen service portal, electronic identity (eID), interoperability, and basic data (Talgildu Føroyar, 2015; Kristina Háfoss, Interview 2019).

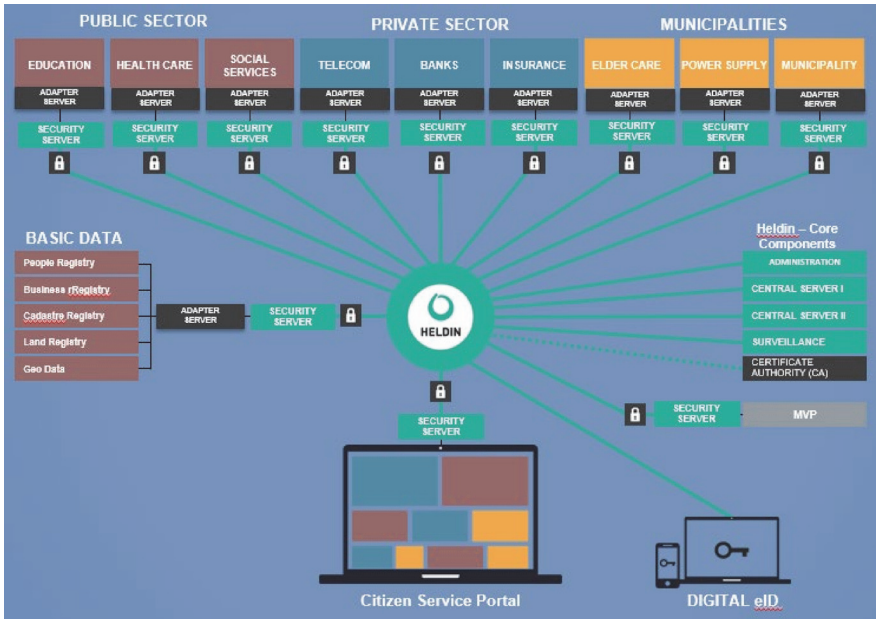

Figure 2: Faroe Islands digital governance. *Source:* Balle, 2018.

Citizen Service Portal

The citizen portal aims to provide citizens access to their information that is currently held in different government databases and, additionally, to provide a 'one-stop shop' for e-services. While the idea of a 'one-stop shop' for e-services is not new, Talgildu Føroyar mandated in its procurement that the portal must be built using a 'low-code' system. Low-code development platforms allow for applications to be developed through a graphical user interface and tend to allow for faster development (Dunn, 2018). That being said, there are trade-offs. Some of those involved with the implementation and development of the citizen portal disagreed with Talgildu Føroyar on the importance of the 'low-code' system and highlighted that they felt constrained or limited in what they were able to do, were faced with a lack of customization and choice, experienced issues with interoperability, and were inhibited their ability to pivot and adapt to changes in the future. Talgildu Føroyar have also aimed to make the user interface and user experience a priority from the beginning and have hired an expert as part of the core team. Though the portal is in development, there are not yet many e-services available, and, as such, the initial usage of the portal is likely to be limited to simply viewing one's information (Ásla Rasmussen, Interview 2018). Currently, the first data to be made available on the portal is information that exists in the population registry, a citizen's religious affiliation, and genealogy (Ásla Rasmussen, Interview 2018).

Electronic Identity (eID)

Arguably, one of the most important parts of any digitalization effort is the existence and usage of a digital identity (European Commission, 2019; European Union, 2017). The digital identity allows for a service provider to use unique identification information to know that the service user is who they say they are. In the Faroe Islands, this identifier is known as the P-number and is a confidential number only to be used by government agencies and those who have received explicit consent from the citizen. Due to the limitations associated with P-number usage, other alternatives have been used for identification in the Faroes for different use cases. For example, a solution known as MyKey was developed and used for authentication and identification with TAKS online solutions, but this is now outdated in terms of security (Meyerhoff Nielsen, 2016). A Danish solution, NemID, was used by Danish banks and had a wide uptake: at the beginning of the digitalization process, it was debated whether to create a new identity system or simply to adopt NemID from Denmark (Rolf Olsen, Interview 2018; Randall & Berlina, 2019). However, due to historical and political grievances associated with the Danish banks, the debate surrounding digital identity became tied to the debate surrounding Faroese independence. Thus, it was decided that any new digital identity solution used should be owned and built by Faroese companies to demonstrate the capacity of the Faroese IT sector.

The new Faroese digital identity solution is ambitious; unlike in many other territories, there is no ID card, and a mobile phone application is to be used instead. Talgildu Føroyar wanted to be future oriented and stated that it could either copy the "outdated Estonian ID card-based solution, or develop something on their own more adapted for their society" (Anonymous, Interview 2018). Due to the high level of mobile phone penetration and almost universal access to data and internet (1.2 cell phones per person and 92% of households with internet available (Randall & Berlina, 2019)), a mobile based solution is more feasible than in other territories (Talgildu Føroyar, 2016). However, it is also acknowledged that not every

person can be expected to use a mobile phone for identification purposes, and a crypto USB solution is also offered as an alternative. The new digital identity will be eIDAS compliant and allow citizens to access all online e-services. Even though the proposed solution is quite innovative, there are also some weaknesses that must be addressed. For example, this solution is only viable for online identification and cannot be used, for example, to identify oneself when picking up a prescription from the pharmacy or as a substitute for a driver's license. Legally speaking, there is currently an ongoing debate about how to use and adopt the digital identity and digital signatures into law. While there will be a requirement for all government service providers to use the new eID solution, and the eID will be used as the standard for digital signatures in the Faroe Islands, it is unclear whether it will be possible to mandate private sector companies to use the new eID. Though it is debated whether the private sector can be forced to use the new solutions, what is not debated is the fact that usage of the new eID in the private sector is key to the identity scheme's success; if citizens do not use the eID, then it will fail, and the digitalization effort will be dramatically hindered (Jan Ziskasen, Interview 2018; Ólavur Ellefsen, Interview 2018).

Interoperability

As the Faroe Islands becomes increasingly digitalized, there needs to be a way for data to move between organizations, agencies, and service providers in a fast and efficient manner. In the Faroe Islands, the Estonian interoperability platform X-Road has been adopted, implemented, and renamed in Faroese as Heldin. This solution allows data to move between service providers in a fast, secure, and efficient manner. Services in the Faroe Islands already communicate with each other, but this is often done in an unsecure or inefficient manner (Ann Damgaard, Interview 2018; Randall & Berlina, 2019). The older systems in place, such as those run by TAKS, communicate directly with each other via REST interfaces and other custom-built integrations. This leads to a situation in which data is not always up-to-date and also creates multiple potential points of failure. However, this will change as these services will be required to be brought onto and become compatible with Heldin. Bringing old systems onto Heldin will require a large investment, both financially and in terms of time, due to a high level of technical complexity.

To illustrate this, the example of the Faroese Person Registry, originally known as LFY, is provided and shown in Figure 3. This registry was originally built and maintained by TAKS, but a change in the law created a new person registry, FOLK, under the responsibility of the Ministry of Environment. However, as so many systems had been directly communicating and integrated into the original LFY registry, it was seen as too complex to move all the integrations to the FOLK registry. Both databases now exist in tandem, and TAKS simply copies data directly from the FOLK registry to its LFY registry every night in an attempt to stay up to date.

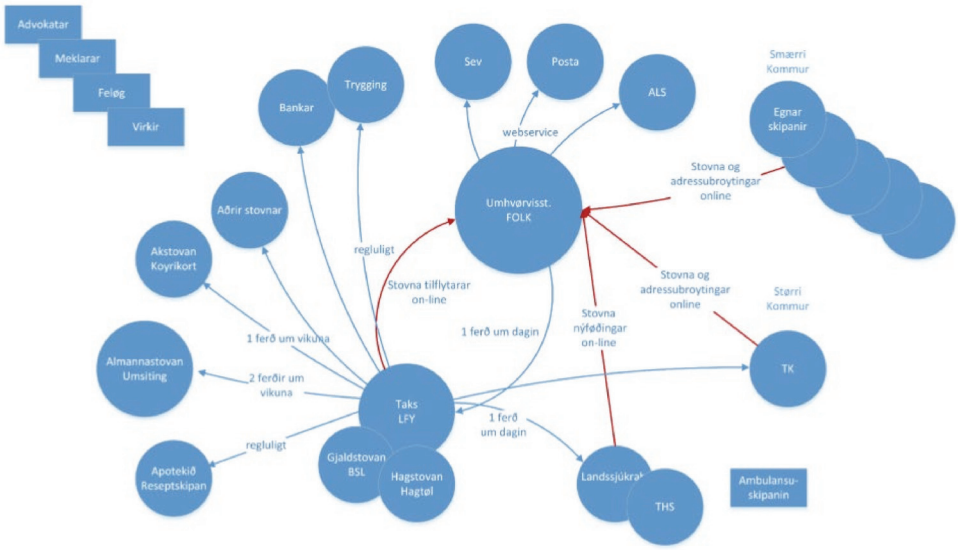

Figure 3: Faroe Islands current integrations. *Source:* Hanssen, 2017.

The interoperability solution helps combat these sorts of situations and allows for information to be held and accessed in one place. Heldin has a standard communication protocol, clear metadata, and clearly defined services (Hanssen, 2017). This ensures that data held by one organization can be easily accessed by another organization. Due to the strict metadata requirements and service descriptions, it should hypothetically facilitate an increase in data quality. However, in practice, some interviewees noted that the systems often do not work as described, and this has led to arguments between public and private service. An additional complaint that has arisen around Heldin is due to the fact that many of the systems currently in place have been developed and built by private sector Faroese IT companies over the past few decades, and they have a vested interest in keeping them in place. Thus, at least initially, there was pushback from Faroese IT companies, as this is one instance in which the digitalization project was more of a hindrance than a benefit, potentially limiting a primary area of business. However, the digitalization could also increase competitiveness by forcing competing IT companies to build services compliant and compatible with the same interoperability platform (Ulla Joensen, Interview 2018; Ann Damgaard, Interview 2018). As the uptake of the interoperability platform grows, it should allow for a new ecosystem to emerge that is conducive to the quick movement of data between service providers and service users, more secure movement of data, and more efficient implementation and design of services. At the time of writing, Heldin has been adopted by 34 institutions, 61 information systems, and 37 services (Talgildu Føroyar, 2019).

Basic data

The final component of the Faroese digital governance initiative is basic data. During the strategic study, Talgildu Føroyar identified five main sources of data that it viewed as critical for the implementation of any digital government effort. These data sources were: a population registry, business registry, cadastre registry, land registry, and geospatial data (Heini Hátún, Interview 2018). Though many of these sources of data already existed, some needed to be established. For example, there is no business registry within the Faroe Islands. The cadastre, land registry, and geospatial data all exist and are held by the Ministry of Environment. While most of the geospatial data is of high quality (Umhvørvisstovan, 2019; Petur Nielsen, Interview 2018) and now freely available, the land and cadastre registry may not be up to date, as, due to the small size of the Faroes, if something changes, everyone already knows about it,, and there is no need to update the electronic registry (Leif Abrahamsen, Interview 2018). This would cause issues in a truly digital society as there is an assumption that all information held within registries should be up-to-date and easily accessible. As a result, effort has been devoted to improving and updating these datasets. The one aspect of basic data that does not yet exist in the Faroe Islands is the business registry. As many of the datasets required for basic data already exist within the Ministry of Environment, the original idea was to base the business registry within the Ministry of Environment as well (Petur Nielsen, Interview 2018). However, the business registry has little to do with its day-to-day operations. A home for this dataset is now being sought, and debates about the ownership of this data continue.

Analysis

Though the digitalization process is still in its initial stages, and the architecture and infrastructures are still being and developed, the Faroe Islands does appear to be motivated in its mission of enabling digital governance. The Minister of Finance noted that "digitalization is happening whether we want it or not. The question is, whether we want to be in control of the development or not. We have chosen not to let the development be random" (Kristina Háfoss, Interview 2019). The Faroes are able to begin their digitalization efforts and try to drive the process and make sure it does not happen in a random manner; however, it is also important to acknowledge and embrace the context of being a small state and take into account and plan for the factors that may influence the digitalization process.

It is clear that the Faroe Islands have committed to developing its digital governance capacities, but as one interviewee noted, "If I build a house, I can see my house. If we dig a tunnel, we can see the tunnel. If I build a boat, I can see my boat. But with digitalization, what can I see? How can I know what it does?" (Jacob Vestegaard, Interview 2018). Thus, the questions remain: Why has the Faroe Islands made digital governance as a strategic priority? How can it be understood? And what exactly will the Faroe Islands get in return for its digital governance investments? Depending on who one talks to, the answers will vary. For example, the Minister of Finance, Kristina Háfoss, stated that digitalization will change how things are done and should lead to increased quality, more sustainable solutions, and better connections between nations and people (Kristina Háfoss, Interview 2019). Similarly, Talgildu Føroyar argues that this digitalization will lead to transformation. As a result of this transformation:

> There is no doubt that the effect of the Digital Strategy will be a more efficient and flexible public sector, which will be more cost-effective […] The purpose of digitalization must always be to ensure the easiest, safest, and most reasonable solution. This entails that administrative customs, guidelines, processes, and structures must be re-evaluated, and if necessary adjusted, when services are digitalized (Talgildu Føroyar, 2015).

In contrast, some interviewees from the private sector viewed these changes as primarily positive but were hesitant to believe any real change would follow. Some government officials also argued against this idea, noting that digitalization is something that is occurring due to external environmental pressure, rather than internal demand (Jacob Vestegaard, Interview 2018, Leif Abrahamsen, Interview 2018).

What is clear is that while everyone seems to agree digitalization is happening, the reasons for it and the expected benefits are still widely debated by stakeholders within the Faroe Islands. Thus, this discussion section aims to bring some clarity to this debate by drawing upon the results of the conducted case study and exploring the four most common themes that emerged relating to *why* the Faroe Islands should digitalize and *what* benefits stakeholders expected as a result of digitalization. These four primary themes were: cost effectiveness and efficiency, demographics, economics, and independence. To better understand each of the identified themes associated with digitalization, each one will be examined individually in the following subsections.

Cost effectiveness and efficiency

While in larger territories, digital governance may lead to cost savings and increased efficiency, in the Faroe Islands, this benefit may not occur. TAKS was the first citizen-facing organization to launch e-services with its citizen and business online tax portals. TAKS' experience seems to suggest that digitalization is not necessarily a quick fix. While it is true that less paper is now used, the tax returns go faster, and citizens and TAKS employees are generally happier, the workload has not disappeared; it has simply shifted, with more staff being routed to customer support (Diana Gilstón, Interview 2018; Helena Højgaard, Interview 2018). While e-services have enabled the removal of lower-tier work by putting the services online, there are now more opportunities for people to have problems with tax papers, which has led to increased phone calls and customer interaction (Diana Gilstón, Interview 2018). This was surprising as "this was too many calls, especially when looking at the energy and investment needed to uplift our self-service possibilities" (Diana Gilstón, Interview 2018). Interestingly, at the same time, TAKS closed the in-person customer support opportunities at all its offices except for the main office in Tórshavn. This was done to ensure that citizens and businesses received a consistent level of service and accurate information, which was only possible by consolidating the customer support offices. Thus, while digitalization is meant to transform the service delivery process and help reduce administrative burdens, what has happened instead is the reinforcement of an organization that can now be associated with one physical building, demonstrating that digitalization is less about doing something new than about doing the same thing in a different way; bureaucracy is far from disappearing (Drechsler, 2019).

Outside of TAKS, the idea that digital governance will save money was also classified as a myth by the current head of Gjaldstovan (Leif Abrahamsen), the organization responsible for Faroese IT and accounting. While discussing the idea of digital governance, Leif noted that many services are only used two or three times a year and that, from a cost-based standpoint, digitalization in the Faroes will never be cost effective. He noted that, with the current digital systems already in place, human resources are strained, with people holding responsibility for multiple systems, whereas in larger territories, one person would be responsible for only one system (Leif Abrahamsen, Interview 2018). Similarly, within TAKS, some of the departments, such as the one responsible for citizen taxation, have a majority of the staff approaching the age of retirement, with many staff members expressing discomfort working with the newest technologies (Johan Heinesen, Interview 2018). If digitalization is to progress to a level at which it is widely used across the Faroe Islands, it requires buy-in from stakeholders in both the public and private sectors. In order for this to happen, investments in the creation of new IT systems are needed, and there will be an increased need for IT experts who can successfully work with and manage these systems.

To date, a majority of the IT experts in the Faroe Islands are either self-trained or received education outside the Faroe Islands. In order to try to change this, the University of the Faroe Islands launched a bachelor's program in software engineering in 2010 (Fróðskaparsetur Føroya, 2019). However, this program only admits students every two years (meaning there have only been five intakes of students at the time of writing), and, according to some private sector actors, the quality of education is generally low, with the curriculum inadequately preparing students for working with current or future IT systems in the Faroe Islands (Anonymous, Interview 2018). In addition to these costs, the Faroe Islands must cope with having a local language spoken by only around 70,000 people. This creates an additional cost in that the Faroese must devote additional resources to bringing their language and culture into the digital sphere, which further increases expenditure.

Demographics

With only a small number of people living in the Faroe Islands, there is constant concern about how to maintain or increase the size of the population. The Faroese are connected digitally to the rest of the world but are geographically disconnected. This leads many Faroese youth to travel to Denmark (where there are more opportunities and close cultural connections) or to other countries to pursue opportunities not available at home (Meyerhoff Nielsen, 2016). The Faroe Islands hopes to use its digital governance program to address this group and create new opportunities at home to bring the diaspora back (Helena Højgaard, Interview 2018; Talgildu Føroyar, 2015). Those who do not remain in the Faroe Islands will still be able to remain connected with their government back home via the new eID and service portal. Wherever you are in the world, it is hoped that you can remain connected to the Faroe Islands. Additionally, it has been argued that those who leave the Faroe Islands, especially to Denmark (which constantly tops digital government indices as one of the top performers in the world (United Nations, 2018)), acquire a level of expectation when it comes to digital services: if these things are available somewhere else, they should also be available in the Faroe Islands (Leif Abrahamsen, Interview 2018; Nicolai Balle, Interview 2018). So, digitalization becomes less about being innovative and more about catching up and matching citizen expectations, which should hopefully allow the Faroe Islands to remain competitive and comfortable as a place for

people to stay and live. In addition to attracting Faroese abroad back home, it has been claimed that investment in digital governance should help drive immigration to the Faroe Islands and increase the flow of foreigners coming to stay and work (Talgildu Føroyar, 2015; Kristina Háfoss, Interview 2019). This attractiveness should come primarily from growth in the IT sector, with private sector companies looking abroad for the much-needed IT talent. Additionally, the City of Tórshavn's IT department manager also has ambitions to transform Tórshavn into the "startup capital of the North Atlantic" (Lars Black, Interview 2018), which would allow for a startup-friendly ecosystem and encourage foreign talent to come to the capital city.

It seems there is an effort to intertwine digital governance with the core Faroese identity, with Kristina Háfoss arguing that "the digital world and the digital reality is becoming an increasingly important part of the Faroe Islands society and identity" (Kristina Háfoss, Interview 2019). Others also noted the importance of digital technologies for the Faroese livelihood, as it is the best way to remain connected with the outside world. In fact, the Faroe Islands has shown its savvy when it comes to digital technologies and social media by organizing digital campaigns that went viral, such as the 'sheep view' campaign, which brought Google Maps to the Faroe Islands (Durita, 2016) and the crowd sourced 'Faroe Islands Translate' campaign (Visit Faroe Islands, 2017). These campaigns both show and help support the argument that the Faroe Islands has begun to embrace the 'digital' as part of its culture and identity. This is interesting as, if digitalization becomes part of the Faroese culture, people who emigrate overseas can still generate substantial benefit by playing the role of ambassadors even if they do not move back to the Faroe Islands simply by sharing or talking about their culture and digital governance efforts in their home state.

Economy

The Faroe Islands, as is the case with many small territories, are strongly dependent on a single industry, in this case, fishing. It is hoped that digital governance will help remove the Faroese reliance on this industry by fostering the development of the IT sector, which had previously been crippled by Danish banks removing their IT infrastructure (Meyerhoff Nielsen, 2016; Randall & Berlina, 2019). In an effort to ensure that investments into digital governance directly benefited the Faroese economy, procurement requirements stated that all solutions must be built by Faroese IT companies, and every effort should be made to outsource the development (this is only possible as the Faroe Islands are not bound by EU procurement requirements) (Randall & Berlina, 2019; Talgildu Føroyar, 2015). However, this comes with its own disadvantages, for although the IT capacity of the private sector is quite high and continues to improve, the bureaucracy's internal IT capacity suffers as there is no internal development related to the solutions. This is a strategic decision that elevates the importance of the private sector in the governance of the Faroe Islands as its competence will become a strategic requirement that may remain lacking in the bureaucracy.

The digitalization project represents the largest IT project in the history of the Faroe Islands and is driving the growth and creation of new jobs in this industry (Kristina Háfoss, Interview 2019). The importance of digitalization for this industry is also clear to the private sector, which has provided 23% of the total digital governance budget (DKK 34 million over the course of the project) (Balle, 2018). When it comes to the development of the different infrastructural components of the Faroese digital governance program, there are four main companies: Formula, Electron, Klintra, and Føroya Tele (Helena Højgaard, Interview 2018;

Ólavur Ellefsen, Interview 2018; Gert Joenson, Interview 2018). During interviews with representatives from these companies, the response was largely positive, with every interviewee hoping that the project succeeded. One interviewee discussed how the new project has allowed companies to talk together and cooperate in ways that had not happened before (Ulla Joensen, Interview 2018). The CEO of Føroya Tele noted that it hopes to play a key role in the digital governance process, is driven by a desire to be number one in the world, and that this project will help the company achieve this goal (Jan Ziskasen, Interview 2018). However, there were some complaints related to restrictive procurement and fear that this initiative, while providing funding for the companies, was stifling their innovative potential. Additionally, some companies that had helped build the currently in-place interoperability solutions felt that the newly required Heldin platform did not work well and, if given the choice, would prefer to stick with their self-built solutions.

Independence

The final theme that emerged during the research was the importance of the Faroe Islands' independence and geopolitical relations with Denmark as a driving factor for digitalization. There seems to be a direct relationship between the Faroe Islands' push for digitalization and the SNIJ's desire for independence. The historical context and recent controversies involving Denmark affected Talgildu Føroyar's technological procurement choices, with all solutions needing to be created in the Faroe Islands rather than adopted from Denmark. The same held for the political desire to digitalize: there was a feeling of, 'If Denmark can do it, so can we' (Anonymous, Interview 2018). It should also be noted that this drive for independence, especially when it comes to digitalization, may actually hamper Faroese development efforts. For example, as it stands, both Denmark and the Faroe Islands use the same e-health system, and the Faroe Islands are heavily reliant on Denmark for healthcare in more extreme cases and illnesses; however, these systems are not connected, which causes difficulty inn moving and accessing information about patients (Jóanis Køtlum, Interview 2018). This causes a situation in which the Faroe Islands is technically able to digitalize on its own, yet there is still a need to remain digitally connected and interoperable with Denmark. Thus, in the future, attention will need to be paid to the debate between digital autonomy and digital interoperability and the effect this has on independence and sovereignty.

When discussing the notion of independence and digitalization with the Minister of Finance, she noted that Faroese digital society must be "built on our values and on the foundation of the Faroese people and our society. This is our historic opportunity to create our own digital society and nation. Therefore, we have chosen not to be part of, or copy, the Danish digital solutions" (Kristina Háfoss, Interview 2019). But while this is currently the government position, it could change in the future if a pro-Denmark coalition were to gain power in the Faroe Islands. However, at this moment in time, and at the initiation of the digitalization project, it is clear that the process has at least in part been about further distancing the Faroe Islands from Denmark.

While there has historically been a tendency to adopt solutions that have already been trialled and demonstrated to be successful in Denmark, the current efforts' strong focus on outsourcing and looking to other digital governance leaders, such as Estonia, has led to the development of new relationships and networks. These networks help when it comes to building institutional and technological capacity through a knowledge-transfer process. They

also help frame the Faroe Islands in the international arena as a potential future leader in digitalization leader. Overall, the idea of rallying behind a digital governance program to create new 'digital institutions' and further separate the Faroe Islands from Denmark is interesting and could pave the way for many other areas in which independence is desired.

Conclusion

In the Faroe Islands, there is a desire to mimic the success and achieve the benefits that other countries and territories have experienced with digitalization. However, these desires are bound within the Faroe Islands' context as a small state and must overcome typical small state issues, such as lack of access to skilled experts, small population, high cost of governance, and lack of access to local innovative markets. In order to better understand the digitalization process of a small state and how it is affected by its context, this paper presented the initial results of an interpretive case study that aimed to provide a descriptive narrative of how the Faroe Islands have engaged in the digitalization process. The research focused primarily on one temporary, project-based organization known as Talgildu Føroyar and, by conducting fieldwork; engaging with stakeholders; conducting semi-structured interviews; and paying close attention to the different motivations, values, and beliefs, it became possible to better interpret and understand the digitalization process. Thus, the main contributions of this paper is a new description and understanding of the digitalization of the Faroe Islands as well as identification of key contextual factors that influence this process and key beliefs about digitalization that have affected the current digitalization trajectory.

With regard to the contextual issues affecting the digitalization process, it is argued that digitalization is generally more difficult, less cost effective, and less likely to alter the size of the bureaucracy in smaller territories than in larger territories.

Interestingly, many of the interviewees came out strongly against the idea that digitalization was easier in a small territory, noting that due to the Faroe Islands' small size, any sort of change was in fact *harder* than in larger territories (e.g. Leif Abrahamsen, Interview 2018; Jacob Vestegaard, Interview 2018). This was primarily due to the networked and informal relationships that are prevalent in small societies, which requires a long grassroots effort to convince the whole of society of the benefits of digital governance. It has also been found that, while digital governance may well make sense from a cost standpoint in larger territories (Asgarkhani, 2005; Yang & Rho, 2007), this is simply not the case in the Faroe Islands. The costs of digital governance in terms of new technologies, infrastructure, development, and maintenance cannot be spread across a large population and thus remain disproportionately high. Additionally, as digital governance requires up-to-date infrastructure to function properly, services that are rarely used and function effectively and efficiently in their current form must be redesigned and brought into the digital age. In addition to the high costs, it also appears to be a myth that digitalization leads to a decreased bureaucracy or decreased government-citizen interaction. This issue, while manageable within a single organization, does not scale well due to the Faroe Islands' small population and lack of access to the necessary skilled experts. In order to counter this, explicit steps should be taken to increase the availability of knowledgeable IT experts in the Faroese public sphere.

In addition to the contextual factors that influenced digitalization in the Faroe Islands, it was possible to identify four key motifs that affected stakeholder beliefs and perceptions

concerning digitalization: cost effectiveness and efficiency, demographics, economics, and independence. There was a common belief that digitalization would lead to a more effective, efficient, and cheaper bureaucracy, though as mentioned above, this is unlikely to occur. Concerning demographics, it was often said that digitalization of the Faroe Islands is not optional but is something that is a necessity to ensure the future of the Faroese people and attract people to come (back) to the Faroe Islands. However, as the digitalization project is not yet complete, it is not yet possible to measure the effect this will have on the demographics. With regard to economics, it is widely believed and hoped that digitalization and the requirement to use Faroese IT competencies will revitalize the IT sector. Based on interviews with private sector actors, these benefits already seem to be appearing. Finally, it was overwhelming stated that the digitalization of the Faroe Islands utilizing Faroese solutions helps advance the cause of independence from Denmark.

While this paper does provide an initial description and interpretations of digitalization in a small island territory, future research could be conducted to ascertain whether the same drivers and factors are also present in digitalization efforts in other small island territories. This research seeks to represent all stakeholder groups in the interviews, but it is highly biased towards the private and public sectors. Thus, future research should also focus on better understanding citizen perspectives on digitalization of the Faroe Islands and comparing whether these match the factors identified in this paper. Finally, as the digitalization process is still ongoing, future research should be conducted to identify and compare the actual effects of digitalization on the governance of the Faroe Islands.

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References

Adler-Nissen, R. (2014). The Faroe Islands: Independence dreams, globalist separatism and the Europeanization of postcolonial home rule. *Cooperation and Conflict*, *49*(1), 55-79. https://doi.org/10.1177/0010836713514150

Asgarkhani, M. (2005). Digital government and its effectiveness in public management reform. *Public Management Review*, 7(3), 465-487. https://doi.org/10.1080/14719030500181227

Awan, O. (2013). e-Governance in Small States. In A. Ming, O. Awan, & N. Somani (eds.). *e-Governance in small states* (pp. 25-41). London: Commonwealth Secretariat. https://doi.org/10.14217/9781848591585-6-en

Baker, R. (1992). Scale and administrative performance: The governance of small states and microstates. In B. Randall (ed.). *Public administration in small and island states* (pp. 5-26). West Hartford: Kumarian. https://doi.org/10.1002/pad.4230130215

Baldacchino, G., & Milne, D. (2006). Exploring sub-national island jurisdictions: An editorial introduction. *The Round Table*, *95*(386), 487-502. https://doi.org/10.1080/00358530600929735

Balle, N. (2018). *The Faroese journey towards a digital society and the role of Heldin*. Tórshavn: Talgildu Føroyar.

Bekkers, V., & Homburg, V. (2007). The myths of e-government: Looking beyond the assumptions of a new and better government. *The Information Society*, *23*(5), 373-382. https://doi.org/10.1080/01972240701572913

Birks, M., & Mills, J. (eds.). (2015). *Grounded theory: A practical guide*. (2nd ed.). New York: Sage.

Bray, M. (1991). Education in small states: Growth of interest and emergence of a theory. *Prospects*, *21*(4), 503-516.

Cullen, R., & Hassall, G. (eds.). (2017). *Achieving sustainable e-government in Pacific Island states*. New York: Springer.

Drechsler, W. (2018). Pathfinder: e-Estonia as the β-version. *JeDEM-eJournal of eDemocracy and Open Government*, *10*(2), 1-22. https://doi.org/10.29379/jedem.v10i2.513

Drechsler, W. (2004). Governance, good governance, and government: The case for Estonian administrative capacity. *TRAMES*, *8*(4), 388-396.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). New Public Management is dead: Long live digital-era governance. *Journal of Public Administration Research and Theory*, *16*(3), 467–494. https://doi.org/10.1093/jopart/mui057

Dunn, B. (2018). Low-code could change much more than just IT, according to Exec. *InformationAge*. Retrieved from https://www.information-age.com/low-code-it-123477572/

Durita (2016). *Sheepview 360*. Retrieved from https://visitfaroeislands.com/sheepview360/

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.5465/amr.1989.4308385

European Commission (2019). Trust services and electronic identification (eID). Retrieved from https://ec.europa.eu/digital-single-market/en/policies/trust-services-and-eidentification

European Union (2017). *Tallinn Declaration on eGovernment at the ministerial meeting during Estonian Presidency of the Council of the EU on 6 October 2017*. Tallinn. Retrieved from https://ec.europa.eu/digital-single-market/en/news/ministerial-declaration-egovernment-tallinn-declaration

Faroe Islands Government (2019). People of the Faroe Islands: Faroe Islands population. Retrieved from https://www.faroeislands.fo/people-society/people-of-the-faroe-islands/population/

Fróðskaparsetur Føroya (2019). B.Sc. í KT-verkfrøði. Retrieved from https://www.setur.fo/fo/utbugving/bachelor/kt-verkfrodi/

Gjaldstovan (2019). Gjaldstovan: About us. Retrieved from https://gjaldstovan.fo/Gjaldstovan/vit/

Government of the Faroe Islands. (2019). The Constitutional Status of the Faroe Islands. Retrieved from https://www.government.fo/en/foreign-relations/constitutional-status/

Grydehøj, A. (2018). Decolonising the economy in micropolities: rents, government spending and infrastructure development in Kalaallit Nunaat (Greenland). *Small States & Territories*, *1*(1), 69-94.

Hamilton, L. C., Colocousis, C. R., Johansen, S. T. F. (2004). Migration from resource depletion: The case of the Faroe Islands. *Society & Natural Resources*, *17*(5), 443-453. https://doi.org/10.1080/08941920490430232

Hanssen, L. (2017). Heldin. Retrieved from https://d3pnpprk515r42.cloudfront.net/media/1716/2017-06-07-heldin-framløg-á-verkstovu-um-ger-av-vevtænastur-lilly.pdf

Helbig, N., Gil-Garcia, J. R., & Ferro, E. (2005). Understanding the complexity of electronic government: Implications from the digital divide literature. *Government Information Quarterly*, *26*, 1-11. https://doi.org/10.1016/j.giq.2008.05.004

Hoff, J., & Fríða West, H. (2008). Citizenship in the Faroe Islands: Participant, parochial or colonial? *Scandinavian Political Studies*, *31*(3), 311-332. https://doi.org/10.1111/j.1467-9477.2008.00208.x

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*(9), 1277-1288. https://doi.org/10.1177/1049732305276687

Kalvet, T. (2012). Innovation: A factor explaining e-government success in Estonia. *Electronic Government*, *9*(2), 142-157. https://doi.org/10.1504/eg.2012.046266

Kattel, R., Randma-Liiv, T., & Kalvet, T. (2011). Small states, innovation and administrative capacity. In V. Bekkers, J. Edelenbos, & B. Steijn (eds.). *Innovation in the Public Sector* (pp. 61-81). London: Palgrave Macmillan. https://doi.org/10.1057/9780230307520_4

Li, H., Detenber, B., Lee, W. P., & Chia, S. (2004). E-Government in Singapore: Demographics, usage patterns, and perceptions. *Journal of E-Government*, *1*(3), 29–54.

Merriam, S. B., & Grenier, R. S. (2019). *Qualitative research in practice examples for discussion and analysis*. Hoboken: John Wiley & Sons.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Murray, D. J. (1981). Microstates: Public administration for the small and beautiful. *Public Administration and Development*, *1*(3), 245-256. https://doi.org/10.1002/pad.4230010306

Nielsen, M. M. (2016). Digitising a small island state. In *Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance, '15-16* (pp. 54-59). New York: ACM. https://doi.org/10.1145/2910019.2910042

Norris, D. F. (2010). E-Government 2020: Plus Ça Change, plus c'est La Meme Chose. *Public Administration Review*, *70*(December), 180–181. https://doi.org/10.1111/j.1540-6210.2010.02269.x

Orlikowski, W. J., & Baroudi, J. J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information Systems Research*, *2*(1), 1-28. https://doi.org/10.1287/isre.2.1.1

Pirotta, G. A., Wettenhall, R., & Briguglio, L. (2001). Governance of small jurisdictions: Guest editors' introduction. *Public Organization Review*, *1*(2), 149-165. https://doi.org/10.1023/A:1011596326871

Randall, L., & Berlina, A. (2019). *Governing the digital transition in Nordic regions: The human element*. Stockholm: Nordregio. https://doi.org/10.30689/r2019:4.1403-2503

Randma-Liiv, T. (2002). Small states and bureaucracy: Challenges for public administration. *TRAMES*, *6*(4), 374-390.

Randma-Liiv, T., & Sarapuu, K. (2019). Public governance in small states: From paradoxes to research agenda. In A. Massey (ed.). *A research agenda for public administration* Northampton, MA. Edward Elgar. https://doi.org/10.4337/9781788117258.00016

Richards, J. (1982). Politics in small independent communities: Conflict or consensus? *The Journal of Commonwealth & Comparative Politics*, *20*(2), 155-171. https://doi.org/10.1080/14662048208447405

Sarapuu, K. (2010). Comparative analysis of state administrations: The size of state as an independent. *Halduskultuur: Administrative Culture*, *11*(1), 30-43.

TAKS (2019). Individual tax. Retrieved from https://www.taks.fo/en/individuals/tax/tax/#General%20information%20about%20taxation%20in%20the%20Faroes

Talgildu Føroyar (2019). Heldin. Retrieved from https://heldin.fo/catis

Talgildu Føroyar (2016). Talgildur samleiki: Undirskjal 7 – Mobil ID. Retrieved from https://d3pnpprk515r42.cloudfront.net/media/1045/undirskjal-7-mobil-id.pdf

Talgildu Føroyar (2015). The national digitalisation programme of the Faroe Islands. Retrieved from https://d3pnpprk515r42.cloudfront.net/media/1990/digital-strategy-v1.pdf

Torres, L., Pina, V., & Royo, S. (2005). E-government and the transformation of public administrations in EU countries: Beyond NPM or just a second wave of reforms? *Online Information Review*, *29*(5), 531-553. https://doi.org/10.1108/14684520510628918

Umhvørvisstovan (2019). Føroyakort. Retrieved from https://www.føroyakort.fo/

United Nations (2018). *United Nations e-government survey 2018*. United Nations. https://doi.org/10.18356/5dbe3354-en

Útlendingastovan (2017). *New to the Faroe Islands: Practical information from public agencies*. Tórshavn: Útlendingastovan.

Visit Faroe Islands. (2017). Faroe Islands translate. Retrieved from https://www.faroeislandstranslate.com/#!/

Yang, K., & Rho, S. Y. (2007). E-government for better performance: Promises, realities, and challenges. *International Journal of Public Administration*, *30*(11), 1197-1217. https://doi.org/10.1080/01900690701225556

Yazan, B. (2015). *The qualitative report: Three approaches to case study methods in education: Yin, Merriam, and Stake*. Retrieved from http://www.nova.edu/ssss/QR/QR20/2/yazan1.pdf

Yin, R. K. (1989). *Case study research : Design and methods*. Newbury Park: Sage.

Appendix

#	Name	Title	Area
1	Nicolai Balle	Program Manager, Talgildu Føroyar	Government
2	Diana Gilstón	Manager of Customer Support, TAKS	Government
3	Lars Black	IT Manager, Tórshavn	Municipality
4	Jóanis Køtlum	Manager of Faroese Hospital System	Government
5	Ulla Joensen	CEO, Elektron	Private
6	Poula Lidarenda	Manager of Business Tax, TAKS	Government
7	Gert Joenson	Head of Software Solutions, Formula	Private
8	Gilli Wardum	Department Head, Faroese Statistical Office	Government
9	Jósup Henriksen	Legal Advisor, Talgildu Føroyar	Government
10	Ann Damgaard	Project Manager, TAKS	Government
11	Jan Ziskasen	CEO, Føroya Tele	Private
12	Sofus Johannesen	Project Manager, TAKS	Government
13	Petur Nielsen	Director, Ministry of Environment	Government
14	Ólavur Ellefsen	Chairman, Klintra	Private/Academia
15	Jacob Vestegaard	Parliament Member	Government
16	Ásla Rasmussen	UX Designer, Talgildu Føroyar	Government
17	Rolf Olsen	eID Project Manager, Talgildu Føroyar	Government
18	Leif Abrahamsen	Head of Gjaldstovan	Government
19	Heini Hátún	Basic Data Project Manager, Talgildu Føroyar	Government
20	Helena Højgaard	Head of HR, TAKS	Government
21	Jóhannes Miðskarð	Associate Professor, Setur	Citizen/Academia
22	Johan Heinesen	Head of Citizen Tax, TAKS	Government
23	Kristina Háfoss	Minister of Finance	Government

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How does open government data driven co-creation occur? Six factors and a 'perfect storm'; insights from Chicago's food inspection forecasting model

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ABSTRACT

It is becoming increasingly clear that the concepts of open government data (OGD) and co-creation are related; however, there is currently only limited empirical material available exploring the link between the two. This paper aims to help clarify the relationship between these two concepts by exploring a recently coined phenomenon: OGD-driven co-created public services. These services 1) utilize or are driven by OGD; 2) are co-created by stakeholders from different groups; and 3) produce public value for society. Due to the relative newness of the phenomenon an inductive exploratory case study is undertaken on Chicago's use of OGD in the co-creation of their food safety inspection forecasting model. This model forecasts critical food safety violations at food serving establishments and sends inspectors to the highest risk establishments first. The results of this exploratory work led to the discovery of a 'perfect storm' of six factors that seem to play a key role in allowing OGD-driven public service co-creation to take place. These factors are motivated stakeholders, innovative leaders, proper communication, an existing OGD portal, external funding, and agile development.

1. Introduction

On May 09, 2013 President Obama declared that the new default for government data would be open due to the ability of open government data (OGD) to "promote continued job growth, government efficiency, and the social good" (Obama, 2013). Many governments around the world are also taking up this pledge and are striving to release and maintain OGD portals; in the European Union this pledge was recently taken up as part of the 2017 e-Government Ministerial Tallinn Declaration where it was declared that the EU would "increase the availability and quality of Open government data that is of value to economy and society" (European Union, 2017). Within the European Union alone it has been stated that OGD will lead to the creation of up to 100,000 jobs by 2020, lead to savings in the amount of 1.7 bn EUR, lead to efficiency gains, and create large economic benefits ("Benefits of Open Data - European Data Portal,", 2018). Due to the newness of OGD in public administration and society and the widely touted benefits (though not largely studied or validated), the field of e-Government is seeing increased interest in research dedicated to understanding OGD (Scholl, 2016). Scholars in the field have started to look at the drivers and barriers (Barry & Bannister, 2014; Conradie & Choenni, 2014; Janssen, Charalabidis, & Zuiderwijk, 2012), benefits (Carrara, San Chan, Fischer, & van Steenbergen, 2015), and the innovative potentials of OGD (Mergel, Kleibrink, & Sörvik, 2018).

In a similar vein, the concept of co-creation that originated in service management and marketing literature (Osborne, Radnor, & Strokosch, 2016) has been adopted and is being studied by scholars in the fields of public administration and e-Government (Cordella, 2017; Uppström & Lönn, 2017). Though there have been many new and emerging studies on co-creation, there is not a widely agreed upon definition as it pertains to public administration and the term is often used synonymously with co-production; for the purpose of this study, co-creation is understood as the "involvement of outside, non-typical, stakeholders in the initiation, design, implementation, and/or evaluation of a public service" (Toots, McBride, Kalvet, & Krimmer, 2017). In a fashion similar to OGD, governments around the world are beginning to test out or implement co-creation practices in their public service creation process; it is believed that co-creation may lead to innovative public services, solve societal challenges, increase government transparency, and help build a bridge between citizens and government to provide higher levels of public value (Osborne et al., 2016; Voorberg, Bekkers, & Tummers, 2015).

Though both OGD and co-creation appear to have similar motivations driving their use (transparency, effectiveness, inclusion, innovation), there has, to-date, been limited empirical work examining how these concepts are related. As co-creation requires the involvement of

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non-traditional stakeholders, any technologies that removes or decreases the barriers for stakeholders to participate in co-creation would theoretically allow for more co-creation and thus higher levels of public value. The topic of "public value" is, of course, very much debated in the current academic literature, with no widely agreed upon definition. However, what is generally understood is that public value is something that is created at a societal level, that is to say, it is something that emerges when people use or create something. What also seems to be the case is that public service delivery is changing, it is becoming more open and collaborative and less top-down driven; this creates a new landscape where new technologies, such as OGD, allow stakeholders to create new services that are valuable to them.

In a recent paper, Khayyat and Bannister (2017) present a model that links the concepts of co-creation and demonstrates through multiple case studies that OGD can help to drive and foster co-creation ecosystems. In the same year, another paper linked the topics of OGD and co-creation through a discussion of "OGD-driven co-created public services" (Toots, McBride, Kalvet, & Krimmer, 2017). There are three critical components to an OGD-driven co-created public service: 1) It must utilize or be driven by OGD; 2) It must be co-created by stakeholders from different groups (for example, members from government, private sector, and citizens working together); and 3) It must produce public and societal value.

Other authors have begun to work on understanding the concept of co-creation and how it fits into the context of today's digital society, yet these works are largely theoretical and not backed by empirical evidence. One such example is Lember, 2017 where the author notes that OGD may transform how co-creation happens. There has also been work examining the innovative potential of OGD in service design (Juell-Skielse, Hjalmarsson, Johannesson, & Rudmark, 2014) and how private sector organization may use OGD to create new economic value (Carrara et al., 2015; Jetzek, Avital, & Bjorn-Andersen, 2014); however, the literature on OGD-driven innovation does not explicitly address how OGD can a) play a catalytic role in the co-creation of new public services or b) discuss the relationship between co-creation and OGD.

There appears to be two primary reasons for a lack of work so far on OGD-driven co-created public services, the first is due to the relative newness of the concept, and, secondly, due to what appears to be a general lack of real-world examples of OGD-driven co-created public services; though a recent paper by (McBride, Toots, Kalvet, & Krimmer, 2018) discusses an example in Estonia. However, one real-world example that met all three criteria required for it to be considered an OGD-driven co-created public service was discovered providing a unique opportunity for conducting the first inductive study on OGD-driven co-created public services. This case is the City of Chicago's OGD-based model for forecasting critical food safety violations.

The service relies almost completely on OGD that was already available on the City's OGD portal, it was co-created by stakeholders from city governmental agencies, private sector companies, citizens, and NGOs, and has been in use by the City for years since its development where it continues to create public value. In essence, the service is a machine learning model that takes in different data, predicts which restaurants may have critical food safety violations (critical safety violations "create an immediate health hazard that carries a greater risk of causing food-borne illness" (City of Chicago, 2018a), and then sends food inspectors to the highest risk restaurants first. This case is also strengthened by the fact that previous case studies have studied and demonstrated the effectiveness of the OGD portal in Chicago (Kassen, 2013).

The research is inductive in nature and aims to generate initial propositions related to the concept of OGD-driven co-created public services. As the research in inductive, an exploratory case study is conducted that focuses on the City of Chicago's OGD-based food safety inspection forecasting model. Specifically, this paper aims to explore two research questions:

1) How can OGD contribute to the co-creation of new public services?
2) What factors play a role in the co-creation of OGD-driven public services?

This paper makes contributions to the current academic body of knowledge in e-Government discourse by conceptualizing OGD-driven co-created public services. Additionally, the research provides empirical work on the relationship between OGD and co-creation and studies the factors that play a role in the co-creation of OGD-driven public services; this exploration could be of interest to policy makers, academics, and those who work with OGD and/or co-creation. The paper is rather inductive in nature rather than deductive and it aims at providing initial theoretical propositions on the nature of OGD-driven co-creation; specifically, this paper hopes to identify a network of key enabling factors for OGD-driven co-creation.

2. Background

When looking at new forms of public service delivery, in particular OGD-driven co-creation thereof, it can be noted that the understanding of public value has shifted. However, though the words "public value" are thrown around in many papers, there is still, to a large extent, little agreement as to what they actually mean. One article that provides a thorough overview of these different approaches is (Bryson, Crosby, & Bloomberg, 2014) where the authors present the predominant views on public value. One of the most commonly cited authors on public value is Mark Moore, who believes that "the task of a public sector manager is to create public value" (Moore, 1994) and that public value could be created by aligning different factors in a "strategic triangle" managers could create public value (Bryson, Sancino, Benington, & Sørensen, 2017). Gerry Stoker further investigates the notion of public value through the idea of networks and highlights the importance of the fact that you only know if public value is delivered by talking and engaging with stakeholders, and that the created "public value" can change over time (Stoker, 2006). However, this shift in the understanding of public value is visible as many authors talk of "public value" and "public value management" it is important not to overlook the fact that public value is not "created by the public sector alone" (Benington, 2007). This leads to a situation where the following appears to be true about public value: 1) public value is not static, 2) public value is something that is created at the societal level, 3) public value is the outcome or result of some service or activity.

One of the most prolific authors dealing with public value, is Elinor Ostrom who noted that, through a process of co-production, public value is created (Ostrom, 1972), that is to say that when a public service is used, the value society receives depends on the interactions with the service. In recent works, Stephen Osborne has been building on this idea of public value and co-production through his New Public Governance (NPG) paradigm (Osborne, 2006) and Public Service Logic (PSL) (Osborne, 2017). The primary focus of NPG and PSL is that public services can be created by any actor, that there should be a focus on public value, and that this public value emerges via interactions between service user and service provider (Osborne et al., 2016).

Closely linked to the concepts of public value and co-production, is the concept of co-creation. Similar to public value, co-creation is still being theorized in the literature and there are not many widely agreed upon definitions. Table 1, shows an overview of how the literature has evolved its understanding of coproduction and co-creation through the decades. There are three important takeaways: firstly, some definitions view coproduction and co-creation as something that involves only citizens in a G2C (government-to-citizen) type relationship whereas others posit that any actor can be involved in co-creation. Secondly, many understandings of co-creation and coproduction view it in a somewhat cyclical fashion where co-creators can get involved at many different stages of public service delivery. Thirdly, and most recently, there has been increased interest in the role of ICT in the co-creation

Table 1
Adapted from: (McBride, 2017).

Authors	Types of "coproduction/co-creation"
Whitaker (1980):	▪ Citizens requesting assistance from public agents ▪ Citizens providing assistance to public agents ▪ Citizens and agents interacting to adjust each other's service expectations and actions
Pollitt, Bouckaert, Loeffler (2006):	▪ Co-Planning ▪ Co-Design ▪ Co-Delivery ▪ Co-Evaluation
Bracci et al. (2016), Pestoff (2012):	▪ Individual acts of coproduction ▪ Collective acts of coproduction ▪ A mix of individual and collective acts of coproduction
Osborne & Strokosch, 2013:	▪ Consumer coproduction ▪ Participative coproduction ▪ Enhanced coproduction
Voorberg et al., 2015:	▪ Citizen as a co-implementer ▪ citizen as a co-designer ▪ citizen as an initiator
Osborne et al., 2016:	▪ Coproduction ▪ Co-Design ▪ Co-Construction ▪ Co-Innovation
Paletti (2016):	▪ Coproduction through ICT: ▪ Applications to report problems ▪ Applications to crowdsource data ▪ Applications to involve citizens in the public service delivery
Lember, 2017:	▪ ICT Indirectly affects Coproduction ▪ ICT Transforms Coproduction ▪ ICT Substitutes for Coproduction

process.

For the purpose of this paper, as we are discussing the role of OGD in a co-creation process, the conceptualizations by Paletti (2016) and Lember, 2017 are of high interest; OGD-driven public service co-creation may be understood as co-creation that occurs as a result of the availability and exploitation of OGD. In Lember's, 2017 piece, he also notes that OGD is one technology that has the potential to transform the co-creation process by creating new ways and avenues for co-creation to occur that were not previously possible (Lember, 2018).

In recent years, ample research has been published on OGD and its different aspects. One of the main recurring topics in literature is the benefits that are associated with OGD (Foulonneau, Turki, Vidou, & Martin, 2014; K. Janssen, 2011; M. Janssen et al., 2012; OECD, 2016). OGD has been claimed to have the potential to drive innovation (Chan, 2013; M. Janssen et al., 2012; Juell-Skielse et al., 2014; Toots, McBride, Kalvet, & Krimmer, 2017), foster transparency and accountability (Gonzalez-Zapata & Heeks, 2015; M. Janssen et al., 2012), drive the creation or implementation of new public services (Chan, 2013; Foulonneau et al., 2014; M. Janssen et al., 2012; Toots, McBride, Kalvet, Krimmer, Tambouris, et al., 2017), and empower citizens and communities (Gonzalez-Zapata & Heeks, 2015; M. Janssen et al., 2012).

However, the manifestation of the potential benefits of OGD in practice requires the available data to be actually used – simply providing OGD does not automatically result in significant value for society (M. Janssen et al., 2012). As OGD is seen to be able to drive innovation and new ways of interaction, thus changing the ways in which services are created, it has the potential to contribute to the creation of innovative services that provide public value. However, a clear research gap has been indicated in this domain as "little is known about the conversion of public data into services of public value" (M. Janssen et al., 2012). That being said, what is known, is that public value is a networked and systemic process; it is something that is created as a result of services being used and the interactions between service user and service providers. It is also known that public value is something that can change over time and is heavily sensitive to individual and societal beliefs. OGD is one technology that allows for society to express what it values in two clear ways. Firstly, the demand for OGD demonstrates a high value placed on the availability of OGD for reasons such as transparency or accountability. Secondly, the availability of OGD allows for any stakeholder to ask a question that is interesting to them, analyze or exploit OGD, and find the answer to the question on their own and then share any new services created in the process. This thus helps bridge the gap between service user and service provider and give clearer overviews on this notion of "public value".

This relationship between OGD-driven co-creation and public value has not been widely touched upon, but there seems to be increasing interest in research in exploring this link (Khayyat & Bannister, 2017; Millard, 2015; Toots, McBride, Kalvet, Krimmer, Tambouris, et al., 2017; Van der Graaf & Veeckman, 2014). Millard, 2015 finds that one of the new responsibilities of government agencies is to provide tools and incentives for citizens to engage in co-creation (Millard, 2015) and Van der Graaf et. Al note that the availability of OGD may allow for new forms of co-creation (Van der Graaf & Veeckman, 2014). However, these two papers fall short in describing the process of OGD-driven co-creation and also appear to be government-centric describing a co-creation process where the government remains in the driver's seat, whereas this runs counter to the understanding of co-creation put forth in this paper. Khayyat & Bannister, 2017 provide one of the most thorough overviews and discussions of OGD-driven co-creation through their integration of activity theory into a framework describing the OGD co-creation process.

Outside of the literature discussing co-creation and OGD, lies the idea of OGD-driven innovation. One paper that discusses turning OGD into public value is put forth by Carrara et al. (2015) where they introduce the concept of "Data Value Chain" that offers a basis for understanding different types of re-use of data and covers various stages, such as data creation, data validation, data aggregation, data analysis, data services and products and aggregated services. They also see a major role for external stakeholders - for individuals or companies that analyze the data and create services and products. However, this model does explicitly address the relationship between OGD and co-creation.

Another interesting paper, "Is the Public Motivated to Engage in Open Data Innovation?" was put forth by Juell-Skielse et al. (2014). Though this paper discusses the relationship between coproduction and OGD, it does not quite address the issue of OGD-driven co-created public services as it focuses on the government specifically as the driver and organizer of events where services are to be co-created. This runs in contrast to the understanding of co-creation used in this paper, as it is believed that any stakeholder may lead and drive public service co-creation, not only the government. When discussing the role of OGD in service co-creation a 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." (Foulonneau et al., 2014). They also find that OGD is currently underutilized, and applications that create public value only utilize a small number of datasets. Charalabidis, Alexopoulos, and Loukis (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.

To briefly summarize, the main benefits of an OGD-driven co-creation approach are as follows:

- There is a transformation in how public services are delivered. Any stakeholder now has the power/potential to create services that exploit OGD to create public value.
- OGD lowers the barriers to participation on co-creation by providing more opportunities for more stakeholders to use and exploit data to create services. Additionally, it allows for creativity to flow as the data can be used in any way to create any sort of service desired.

- OGD-driven Co-creation leads to higher levels of public value compared to other types of co-created services. Whereas other services only produce public value once the service is delivered, OGD-driven co-creation provides insights into public value both when stakeholders demand and ask for the data, and then also when the service is created/used.

2.1. Factors influencing OGD-driven co-creation

So far, there is only limited research on the factors influencing OGD-driven co-creation specifically, with the exception of Toots, McBride, Kalvet, & Krimmer (2017). This paper found that in situations involving both OGD and co-creation, the barriers to both tend to reinforce each other: the supply of OGD depends on its perceived value, whereas the perception of value depends on awareness of the benefits of open data, which can best be demonstrated through actual OGD-driven services. At the same time, as long as the barriers to OGD availability are not solved and there is a lack of usable OGD, the co-creation of new OGD-driven services remains limited. As there is limited research on OGD-driven co-creation specifically, the influencing factors for OGD and co-creation are presented individually.

2.2. Factors influencing usage of OGD

Despite the potential of OGD to drive the co-creation of innovative services, there are many barriers that hinder the publication and reuse of OGD (Barry & Bannister, 2014; Martin, Foulonneau, Turki, & Ihadjadene, 2013; Zuiderwijk, Janssen, Choenni, Meijer, & Alibaks, 2012). Some of the main barriers are associated with a widespread absence of understanding of OGD and its benefits (Gonzalez-Zapata & Heeks, 2015; M. Janssen et al., 2012; Misuraca & Viscusi, 2014; Toots, McBride, Kalvet, Krimmer, Tambouris, et al., 2017; Zuiderwijk et al., 2012), problems with the availability, usability, quality and compatibility of data (M. Janssen et al., 2012; Martin et al., 2013; Toots, McBride, Kalvet, & Krimmer, 2017; Zuiderwijk et al., 2012), lack of political interest in OGD (Gonzalez-Zapata & Heeks, 2015; M. Janssen et al., 2012; Martin et al., 2013; Zuiderwijk et al., 2012) and limited interaction between data providers and users (Barry & Bannister, 2014; Martin et al., 2013; Zuiderwijk et al., 2012). Barriers also emerge from the ambiguity of open data policies and regulations (Ganapati & Reddick, 2012; Huijboom & van den Broek, 2011; O'Hara & Kieron, 2012; Veenstra & Broek, 2013).

Interestingly, while many barriers emerge from the public sector context, the drivers tend to come from forces external to the government. Some of the major drivers relate to “citizen pressure, market initiatives, emerging technologies and the ideas of thought leaders” (Huijboom & van den Broek, 2011), but also to the promises of benefits such as economic value, better governance, increased transparency, participation, improved government data infrastructure and improvements in public services (Gonzalez-Zapata & Heeks, 2015). However, some barriers also exist at the user side, for example users' limited understanding of data (Johnson, 2014; Zuiderwijk et al., 2012).

2.3. Factors influencing co-creation of public services

Similar barriers are present with regard to co-creation between governmental and non-governmental stakeholders. Previous research has noted a number of barriers in the organizational context of the public sector, including the incompatibility of organizational structures and processes with the process of co-creation, lack of open attitude to citizen participation, risk aversion (Bovaird & Loeffler, 2012; Voorberg et al., 2015).

Other co-creation drivers and barriers are related to the citizen side. These include the internal motivation of participants (Juell-Skielse et al., 2014), 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 (Voorberg et al., 2015) relative importance of the service that is being co-produced, money, time and other resources (Jakobsen, 2013; Verschuere, Brandsen, & Pestoff, 2012), and mutual trust between government and citizens (Osborne & Strokosch, 2013; Tuurnas, 2016). One of the key challenges to co-creating public services is the need to redefine the roles of public and private actors in the public service creation process (Hartley, Sørensen, & Torfing, 2013).

3. Methodology

A case study allows for a contemporary phenomenon to be observed and investigated in context and is often viewed as an acceptable research method for generating theory and understanding of issues in the social sciences such as in the public administration or societal domain (Yin, 1989). This study was designed as a single exploratory case study (Yin, 1989). This sort of exploratory case study is conducted when there is a need to construct new theory or generate propositions for current and contemporary events that are thus far understudied or not understood (Yin, 1989). The holistic aspect of the case study implies that the case is not divided into smaller sub-units or specific variables. Instead, there is a single unit of analysis, and in the context of this research the unit of analysis is the whole process that was undergone to co-create the OGD-driven public service in the City of Chicago. Single case studies are often criticized for having low levels of external validity, but it is also argued that case study research can be a valuable method to gain insights that allow researchers to make theoretical postulations and analytic generalizations about the phenomenon that is being investigated (Yin, 1989). In order to strengthen internal validity, multiple sources of evidence are used (semi-structured interviews, news articles, government document analysis) which can be used to triangulate conclusions and ensure higher levels of internal validity. Furthermore, triangulation also helps to mitigate against subjectivity in the research and thus strengthens the overall research design.

3.1. Empirical data collection

The first evidence that was collected came from reviewing the executive orders, laws, and government mandates in effect within the City of Chicago that related to OGD; these records were documented and then analyzed using thematic analysis. After the initial legal overview was conducted, news articles related to OGD in Chicago and also to the case specifically were reviewed for relevance, documented, and then coded and analyzed using thematic analysis. In addition to that, the researchers consulted the video material available on the case on Youtube, taking notes and extracting background information on the project's goals, service development process, and stakeholders involved. This initial step allowed for a broad overview of the case to be gathered, and set the foundation for follow-up semi-structured interviews.

Six semi-structured interviews were conducted with stakeholders representing the different parties involved in the co-creation of the food safety inspection forecasting model for the City of Chicago. Though six interviews is normally a small sample, these six interviewees represent every key player involved in the project and provide an overview of every point of view on the project. An initial list of relevant interviewees was identified based on the key contributors listed on the project's GitHub page (https://github.com/Chicago/food-inspections-evaluation). The first interview was conducted with Tom Schenk, the main person behind the case, and then, using snowballing, other interviewees were selected. As a result, the final list of interviewees included one person from Chicago Department of Innovation and Technology (CDoIT) (Tom Schenk, Chicago CDO), Civic Consulting Alliance (CCA) (Anonymous), Allstate (Stephen Collins, Model Developer), and Montgomery County (Daniel Hoffman, Chief Innovation Officer), whereas two members were interviewed from the

Table 2
List of interview questions.

	Guiding question	Important aspects for the case study
1.	Could you tell us about the project from your perspective? What was the main focus of the project? What were the main drivers?	Project background, drivers
2.	Do you believe that there were any special factors/motivations that made it possible for the model initiative to be created in Chicago?	Motivation, drivers, enablers
3.	What was your role in the project? Who were the other main stakeholders in the project and how were the roles divided? Were all stakeholders involved in all stages of the creation of the model?	Co-creation process, roles of stakeholders
4.	What did the planning and development process look like? How was the initial problem identified and described?	Co-creation process, co-creation phases
5.	Was this the first attempt for the city of Chicago to turn open government data (together with external partners) into a service that creates public value? Is there an overall willingness to use open government data in the city of Chicago?	Enablers, drivers
6.	Do you feel including people from outside of your organization benefited the creation of the model? If yes, In which ways? If no, why not?	Benefits of a co-creation approach
7.	How do you evaluate the success of the service? How are the users involved in the evaluation process and what do you do to react to the feedback?	Outcomes of co-creation process, end user involvement in co-creation

Chicago Department of Public Health (CDoPH) (Gerrin Butler, Head of Department and Raed Mansour, Health Analytics). The interviewee from the Montgomery County Department of Innovation was selected following the previous interviewees' suggestions due to the county's relationship with the project (Montgomery County implemented Chicago's code with the help of a private sector partner), though they were not directly involved in the initial model development. The interviews were conducted during April and May 2017 over the phone or through Skype and lasted from between 15 and 40 min each. All interviews were conducted by two different members of the research team, recorded, and then transcribed.

The interview questions aimed to provide a better understanding of the interviewee's role in the project, how they got involved, how the process unfolded, and the factors behind the success, building on the theoretical base introduced in the theoretical sections of the current paper. The main guiding questions for the semi-structured interviews can be found in Table 2.

After the interviews had been transcribed, two researchers went through the transcripts and individually coded them. To strengthen the reliability of the coding, the researchers then compared the results and discussed the differences to come up with an agreement. A theme-based coding scheme was used to identify key motivations and drivers, important aspects of the co-creation process, contextual factors, enablers and barriers and key success factors.

Commonly mentioned themes and facts were further used to draft initial propositions on what seems to influence the success of a co-created OGD-driven public service, as well as what factors seem to be needed to allow OGD-driven public service co-creation to take place. The interviews served as a way to gain further insight into the case, provide new information to the researchers, and also to clarify information that had been found during previous evidence collection.

4. The case

In the realm of OGD, Chicago has been described as one of the leaders in the field (Kassen, 2013). Because of the City's efforts to push OGD, it now has one of the best examples of a high-usage and value generating OGD portal. The OGD portal has grown rapidly and currently provides access to over 550 datasets, applications built by the city and private developers, provides tutorials on how the available data may be exploited or analyzed, provides tools that allow for easy visualization of data, and has been visited over 38 million times (City of Chicago, 2018b).

The OGD portal has been consistently improved since 2012 when executive order 2012–02 was issued, which established the legal requirement for Chicago to establish and maintain an OGD portal, the creation of a chief data officer (CDO) position, and chief information officer (CTO). This executive order stated that every city agency must "make available online… at a level of granularity acceptable to DOIT (Department of Innovation and Technology), all appropriate datasets and associated metadata under such agency's control" (Emanuel, 2012).

The use of OGD for predictive analytics in the City was a political priority and discussed in the Technology plan for the City; for example, Initiative 19 – 'Research Data-Driven Solutions to Major Urban Challenges' aims to "use data analytics to help managers across the City explore – and solve –some of the most vexing problems facing municipalities" (City of Chicago, 2013). In addition to the high-level influence pushing for the use OGD-analytics and citizens and civic hackers demanding more data (Chi Hacknight, 2018), there was also a third strong influential force, that of philanthropic funding. Bloomberg Philanthropies organized a competition that would "inspire American cities to generate innovative ideas that solve major challenges and improve city life – and that ultimately can be shared with other cities to improve the wellbeing of the nation" (Bloomberg Philanthropies, 2013). The City of Chicago entered this competition and was awarded a grant for one million USD to develop a new "SmartData" platform that would allow government agencies easier access to predictive analytics tool; one condition of this grant was that all software developed would be open source (Ash Center Mayors Challenge Research Team, 2014). Specifically, Chicago was selected to "create an open-source platform to harness the power of data to understand underlying trends and better direct limited resources" (Bloomberg Philanthropies, 2013). This grant provided the CDoIT funding to begin to undertake more ambitious OGD-driven predictive analytics models. This combination of factors set the stage for the development of a new and innovative OGD-driven public service: funding was available, stakeholders were motivated, there was political support from the City's executive office, and there was a desire to demonstrate the power of predictive analytics in the public sector.

4.1. First iteration

The City of Chicago and the CDoIT made it a mission to continue to expand their use of OGD and predictive analytics; it was believed that a movement in this direction would allow for increased efficiency of many government agencies' day-to-day operations and provide increased levels of public value. In order to do this, an initial list of potential use cases where OGD-driven predictive analytics capabilities could be used was drafted in 2014. Though there was high level political interest in these projects and funding was available, the CDoIT still lacked a full data science team, and outside technical assistance was needed; the CCA was an organization that was in a position to mediate and obtain such help for the CDoIT. The CCA is a Chicago based organization that aims to improve the quality of life in Chicago by bringing together stakeholders from public, private, and non-profit sector to work on new and innovative solutions for problems facing the City. Due to the organizations extensive public and private sector networks, they were able to provide the data science team at Allstate

Insurance with the list of use-cases initially drafted by the CDoIT. Ultimately, the Allstate team decided that a use-case that focused on predicting food safety violations was both possible based on the data available on the OGD portal and interesting, as these data scientists lived in the City of Chicago they felt that it was in their best interest for food served to them to be as safe as possible. The CDoIT agreed that this was also an interesting use-case for them and agreed to approach the CDoPH with the idea.

The initial development phase began in 2014, and, at the time, the City of Chicago had over 15,000 food serving establishments. To inspect these establishments, the City had only 36 food inspectors. There was a general requirement for each establishment to be inspected roughly twice a year, though there were some establishments with exceptions that required them to be inspected less and others needed to be inspected more; but, twice a year is the general rule (Interview, Gerrin Butler). Traditionally, food inspectors were sent out to establishments on a pseudo-random basis; there was minimal attempts to optimize or predict inspections. The lack of optimization combined with the high workload for each individual inspector led to a situation where critical food violations were not being detected as fast as the City would like and thus some preventable outbreaks were missed (Schenk, 2017). The CDoIT approached the CDoPH with a potential solution. They were going to build a model that would predict when critical food safety violations would occur, at what restaurants, and then send out food inspectors to the highest risk places first. The head of the CDoPH at the time was originally hesitant, unsure of whether or not technology could really do the job of a human or whether or not data could actually lead to these predictions. However, as she had originally read reports about a data-driven model to prevent rodent outbreaks in the City, she decided to embrace, trial, and test this new and innovative solution. At the initial stages, the head of the CDoPH proclaimed “I don't know what the hell an algorithm is, but let's go ahead and try it”.

At the beginning of the project, the CCA organized meetings between the relevant parties (Allstate, CDoIT, and CDoPH) and acted as a project manager. At these meetings, the business requirements of the CDoPH were discussed and presented to the developers and data scientists. It is also important to mention that the CDoPH completely hid this project from the food inspectors so that their behavior would not be altered based on the knowledge of a new solution being developed. After playing with different datasets on Chicago's OGD portal an initial list of variables was prepared and a General Linear Model was constructed by Allstate's data science team. However, due to a misunderstanding of how the inspectors conducted their inspections (it was not originally understood that inspectors served in the same geographic area), the first iteration was not successful and needed to be adjusted and updated. This failure ended up being a major learning point for all involved stakeholders and demonstrated the importance of thorough communication early on in the project as well as the importance of constant communication throughout the duration of the project.

4.2. Second iteration

Though the first implementation was not able to provide accurate results, the general model and structure was already in place. During this iteration, Allstate did not participate, but CDoIT and the CDoPH had the ability to make the needed changes to bring the model to production. This second iteration of the model is open source and the code is freely available on GitHub (see: https://github.com/Chicago/food-inspections-evaluation). This repository includes all the data that was used for the training and testing of the original model thus allowing for new versions to be tested by others under the same conditions. At the beginning, approximately sixteen different datasets on the portal were considered for use in the model (Interview, Stephen Collins). The developers selected datasets that they thought would provide interesting or useful predictive capability, such as rat sighting reports or sanitation complaints, and these were then tested and discussed in an iterative fashion with the best predictive ones remaining and those with limited predictive capability being dismissed. After playing with the data, nine variables were selected for the final model:

“

1. Establishments that had previous critical or serious violations
2. Three-day average high temperature.
3. Nearby garbage and sanitation complaints.
4. The type of facility being inspected.
5. Nearby burglaries.
6. Whether the establishment has a tobacco license or has an incidental alcohol consumption license.
7. Length of time since last inspection.
8. The length of time the establishment has been operating.
9. And the assigned Inspector.” (Schenk, 2017).

The model was tested over a two-month period (September and October 2014) during this time, assignments were given out following normal operations, but, in the background, the model was running simultaneously to see how it would compare to normal operations. After the two-month period was up, the results were analyzed and showed that there was a clear advantage in switching to the data-driven model. The model would have sent inspectors to restaurants with critical food safety violations, on average, 7.4 days earlier over the eight week test period (Schenk, 2017). Thus, this would allow for potential food borne illness outbreaks to be prevented, or have their severity limited, as the violations responsible were being caught and addressed earlier. The model was thus validated and went into the CDoPH's live operations in February of 2015.

The model works by classifying food serving establishments based on how likely they are to have a critical food safety violation. This ranking of establishments based on order of risk is then accessed by the head of the CDoPH through a simple Shiny Application and the department head is then able to assign food inspectors to the highest risk restaurants first. Fig. 1 was created by the CDoIT and demonstrates how this process works.

Interestingly, the developers wanted to make a more complex model and create an application that allowed for in-depth statistical analysis and visualizations, but, as one interviewee stated, at the end of the day all the CDoPH wanted was a simple list (Interview, Tom Schenk); so, a minimalistic approach was adopted that simply solved the problem of being understaffed and allowed for the CDoPH to do their job better.

4.3. Impact and future

Though the model was operational in February of 2015, the improvement did not stop there. Once the code had been made open source, citizens and outside stakeholders have also been able to get involved. For example, on Feb 3, 2017 a citizen of Chicago made a pull request demonstrating how the XGBoost model was finding critical violations, on average, 7.79 days earlier; this represented an improvement on the current model in use. Four days later the Chief Data Officer of Chicago had commented on it and a code review has been initiated and stated, “If the results hold, we will incorporate your contributions to the model that drives food inspections in the city. Thank you and we will be in touch soon”.[1] This provides a clear demonstration of how outside stakeholders are able to play a role in the co-creation of OGD-driven public services. The model is still in use by the CDoPH today and it is still actively maintained by the CDoIT, and stakeholders are still able to suggest improvements to the model through GitHub.

This case is truly interesting as it represents one of the only examples that the authors found that seems to represent a co-created

[1] This pull request can be found here: https://github.com/Chicago/food-inspections-evaluation/pull/98 Accessed 13.05.2018

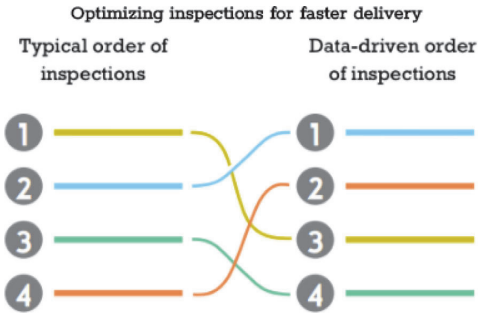

Fig. 1. Optimized food inspection process (Schenk, 2017).

OGD-driven public service. It is also a service that is able to continue to provide value moving into the future. As more data is generated, the model is likely to become more accurate in predicting critical violations. It will be interesting to follow up on this case in the future to see how the co-creation of the service progressed as well as how the accuracy improves over time.

5. Observations

The case at hand has interesting implications for the current understanding of the role of OGD in public service co-creation, and also for enhancing the current knowledge on what factors influence or play a role in OGD-driven public service co-creation. While conducting interviews for the case, many interviewees made it clear that it was not just about the availability of data, the environment that the development of the model took place in was what was key here. One interviewee described it as a 'perfect storm': "the data was out there to increase transparency, the food inspections were already happening, the licensing was there, the civic tech community was motivated, the potential was already there, but it was the environment that was key" (Interview, Raed Mansour). In order to better understand this environment or 'perfect storm' better, different key factors that were brought up by the interviewees were analyzed and discussed. The picture that emerged was a 'perfect storm' consisting of six factors: motivated stakeholders, innovative leaders, proper communications, existing OGD portal, external funding, and agile development. Though it is always possible to argue that other factors may also have played a role, these six appear to be the factors that were crucial for the co-creation of Chicago's food safety inspection forecasting model to take place; that is to say, if any of these factors were changed or missing this case would not have happened. The rest of this discussion section is dedicated to describing each of these factors in detail.

5.1. Motivated stakeholders

One of the key factors of the "perfect storm" seemed to be motivated stakeholders. The theoretical literature also views internal motivation of participants as one of the drivers of co-creation (Juell-Skielse et al., 2014). This internal motivation came from different places for different stakeholders. For example, the Allstate data science team was motivated to create this model as it allowed for their city to have higher levels of food safety, and, additionally, it provided an interesting learning opportunity. This differs, for example, from the motivation for the head of the CDoPH who wanted to improve her department's business processes and do more with less. Though originally hesitant, to get on board with the model development the head of the CDoPH needed to be convinced. To do this, Tom Schenk contextualized the problem to the CDoPH by saying that "you have 100,000 decisions to make a day, let us just make this one easier for you" and then noted in the interview that when you "focus on needs, it helps foster cooperation" (Interview, Tom Schenk). In regards to the motivation for citizens to participate, this motivation appeared to be rather intrinsic and was driven by the desire to do something positive for the city and make it a safer place. Since stakeholder motivation appears to play a key role in OGD-driven public service co-creation, and one of the main motivational factors is having a pain point or problem, it seems likely that OGD-driven public service co-creation is more likely to occur when providing an innovative solution to an old problem rather than during the development of a new service.

5.2. Innovative leaders

Having innovative leaders seems to be an important part of success. While conducting interviews, two names were always stated as playing a critical role in the success of the project; Tom Schenk (Chief Data Officer of Chicago) and Gerrin Butler (Director of Food Protection for the City of Chicago). Tom was said to be the main driving force behind the model and had it in mind for the code to be open source since the idea was conceived. Gerrin was the owner of the food inspection process and from the beginning she agreed to work with the plan for data-driven food analytics. Gerrin did not initially understand what or how a data analytics model would work and improve current operations, but was willing to try and played an active role throughout. As one of the interviewees mentioned, "Gerrin said that she did not think this would work, but she was still willing to actively participate" (Interview, Tom Schenk). Without the work and willingness of these leaders to push for and try new things, this case would not have been possible.

5.3. Proper communication

Another key success factor identified was good communication. It was highlighted by several interviewees that in order to improve the existing processes, full understanding of how the CDoPH operates was needed. It was crucial to understand how the food inspectors are assigned to their tasks, what and why do they do, what kind of data they used and also, what kind of municipal codes and state and federal laws are involved. At the beginning stages of development, the different stakeholders did not understand each other's terminology. The head of the CDoPH painted a picture of this during her interview: "They would use very technical words. I would ask for their meaning and write down what it meant. I was also doing the same for them, I would explain how our system and business processes worked and provided them with a list of important definitions and risk factors. Basically, we created and used 'cheat-sheets'" (Interview, Gerrin Butler). These cheat-sheets allowed for effective communication and ensured that all partners understood each other during communications and helped to prevent misunderstandings, as stated by Raed Mansour, "the power often lays in the terminology".

5.4. Existing OGD portal

In the current literature on OGD, it is often pointed out that OGD available from portals is often not clean, accessible, or user friendly (Young & Yan, 2017). However, in the case of Chicago, this barrier did not occur. In fact, multiple interviewees praised the OGD that was available on Chicago's OGD portal and all the data that was used in the development of the model was freely available on the portal to any user. Due to the high quality of the available data, it was possible to focus on developing innovative use cases for the data rather than working on data cleaning or finding what datasets were available. One reason for the high quality of the data on Chicago's OGD portal is because the data that is available on the portal is the same data that government agencies use in production. The ETL is linked up to the core database of the data provider, it is extracted, transformed, and then uploaded to the Chicago OGD portal; 99% of the data in the Chicago OGD portal arrives there automatically via the ETL (Goldstein, 2013).

Architecturally, the City decided that it was more important to "focus on building direct pipelines rather than building data warehouses or datamarts to power the portal" (Schenk - Email Communication). The ETL ensures that the OGD portal is sustainable as it enables accurate and up-to-date information to be always available. Furthermore, it also allows the traditional data silos to be dealt with and ensure that data that should be open is opened. The use of this ETL also integrates the provision of OGD to the regular business process and does not require a large amount of human overhead to deal with.

5.5. External funding

Maintaining an OGD portal, developing new services, and maintaining a team focused on OGD innovation requires funding. Interestingly, lack of funding is often pointed to as a barrier for OGD availability in the current literature (Barry & Bannister, 2014). Though the City of Chicago did devote some funding to the CDoIT, the availability of External funding was a major driver in this case. Funding from Bloomberg Philanthropy provided the necessary extra funds for developing the City's predictive analytics capabilities, without this funding the service may not have been created.

5.6. Agile development

When talking about the development of the service, one interviewee noted that all the participants were working on multiple projects and thus could not focus on one project for a long period of time (Interview, Tom Schenk). This led to a situation where development was done in an incremental way over time by a wide variety of stakeholders. However, as noted by one interviewee, "if you're running an innovation program, you need to be flexible and agile. If you have one hypothesis and it is proven wrong, you must be able to pivot" (Interview, Raed Mansour). Though the service did not follow a traditional agile development methodology with sprints, many aspects of agile development were present and highlighted as key to the success of the project by interviewees. These aspects included rapid development, release of an MVP, validated learning, incremental development, constant testing, and being able to respond quickly to feedback and evaluations.

Reflecting back on the literature, many barriers that normally hinder OGD usage and development of new services were present, but overcome. For example, the quality of OGD on portals is often described as poor quality, messy, and not user-friendly (Young & Yan, 2017). However, the City of Chicago was able to overcome this by focusing on the sustainability of their OGD portal and automating the movement of data from government agency databases to the OGD portal. Barriers such as lack of personal or political interest were dealt with by motivating leaders and stakeholders through problem contextualization, focusing on one problem at a time, and ensuring that development did not require a large amount of effort from the co-creators or a major change in the service users' business processes. Interestingly, the drivers and barriers are often viewed as independent of each other, but what this case seems to drive home is that this is often not the case; the drivers and barriers are almost always linked and, in the case of OGD-driven co-creation, it does not take place within a vacuum, but rather, within a system where everything is connected. Thus, it does appear to be the case that it was really a 'perfect storm' of factors that allowed for the City of Chicago to fight past traditional and expected barriers.

6. Conclusion

This paper presents an empirical example of a co-creation OGD-driven public service, however, it must be stressed that it only is only one example of an OGD-driven co-created public service and future research should be carried out exploring different sorts of applications (such as web or mobile applications), co-created with different stakeholder configurations (for example, with citizens as the driver of the service), and with different target groups (such as citizen focused or business focused). Though this paper represents a single exploratory case study, there appear to be some interesting implications for the current scholarly debate on OGD and co-creation, and, additionally, new insights have been gained that may be beneficial for any stakeholder interested in OGD and/or co-creation.

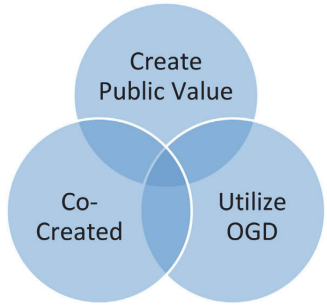

Fig. 2. OGD-Driven Co-Created Public Services. Source, Author.

The first major contribution of this paper is its conceptualization and initial work in defining what is meant by OGD-driven co-created public services. The initial definition has three requirements: the service must utilize OGD, it must be co-created, and it must produce public value for society. This definition is summarized by Fig. 2.

A second contribution of this paper is that it demonstrates that OGD appears to have the potential to play a catalytic role in driving and enabling the co-creation of new public services. In the presented case, it was the presence of OGD that allowed for this new service to be co-created. Of course, it is also possible to co-create services without utilizing OGD, but it does seem that the presence of OGD breaks down the barriers for those who want to engage in public service co-creation. However, it is also well known within the literature that in many instances OGD goes unused and does not produce value. How then, did the City of Chicago create an environment that was conducted for OGD-driven co-creation and public value creation? Based off of this initial exploration, it appears to be the case that a 'perfect storm' existed within the City of Chicago that when exposed to OGD allowed for something new to occur. This perfect storm consisted of motivated stakeholders, innovative leaders, proper communication, an existing OGD portal, external funding, and agile development. This is interesting as if OGD-driven co-creation of public service does indeed quire a 'perfect storm', it is actually quite a complex process that is sensitive to many different conditions. It is not only about the data, but the system as a whole must be taken into account when studying OGD-driven co-created public services.

For stakeholders who want to try to duplicate Chicago's approach to OGD-driven public service co-creation, there are a few different suggestions that can be made to try to foster or develop this same 'perfect storm' in other locations.

- Make the problem relatable to the stakeholder, if stakeholders are directly involved or related to the problem they may become more motivated.
- Start simple, only develop what you need and try to integrate it with the traditional business process.
- Communicate, make sure that everyone has an understanding of key definitions and business processes. Having a clear list of definitions among stakeholder groups decreases the risk of misunderstandings.
- Be open, develop services in a way where they are easily shareable and accessible, for example, host code on GitHub and be responsive to issues and pull requests.

This paper sets the initial groundwork for future research on OGD-

driven co-created public services. However, it is limited by the fact that it is only a single exploratory case study that focuses on one specific configuration of an OGD-driven co-created public service. When analyzing other OGD-driven co-created public service configurations, the following questions may be of interest: What type of service is it (web application, mobile application, data analytics model, etc)? Is the application internal or external facing? What is the leading stakeholder group (citizen, government, business, etc) and what other stakeholders are participating in the co-creation? What is the scale of the service (municipal, state, national)? What is the value being created? It may be the case that different configurations have a different 'perfect storm' and this should be empirically analyzed and tested.

Acknowledgements

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References

Ash Center Mayors Challenge Research Team (2014). Chicago's smartdata platform - Pioneering open source municipal analytics. Retrieved June 13, 2017, from http://datasmart.ash.harvard.edu/news/article/chicago-mayors-challenge-367.

Barry, E., & Bannister, F. (2014). Barriers to open data release: A view from the top. *Information Polity, 19*(1/2), 129–152. https://doi.org/10.3233/IP-140327.

Benefits of Open Data (2018). European data portal. Retrieved September 26, 2018, from https://www.europeandataportal.eu/en/using-data/benefits-of-open-data.

Benington, J. (2007). From private choice to public value? *In search of public value – Beyond private choice*.

Bloomberg Philanthropies (2013). Bloomberg philanthropies announces mayors challenge winners providence, Chicago, Houston, Philadelphia, and Santa Monica. Retrieved June 13, 2017, from https://www.bloomberg.org/press/releases/bloomberg-philanthropies-announces-mayors-challenge-winners-providence-chicago-houston-philadelphia-and-santa-monica/.

Bovaird, T., & Loeffler, E. (2012). From engagement to co-production: The contribution of users and communities to outcomes and public value. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 23*(4), 1119–1138. https://doi.org/10.1007/s11266-012-9309-6.

Bracci, E., Fugini, M., & Sicilia, M. (2016). Co-production of public services: meaning and motivations. *Co-production in the Public Sector* (pp. 1–11). Cham: Springer.

Bryson, J., Sancino, A., Benington, J., & Sørensen, E. (2017). Towards a multi-actor theory of public value co-creation. *Public Management Review, 19*(5), 640–654. https://doi.org/10.1080/14719037.2016.1192164.

Bryson, J. M., Crosby, B. C., & Bloomberg, L. (2014). Public value governance: Moving beyond traditional public administration and the new public management. *Public Administration Review, 74*(4), 445–456. https://doi.org/10.1111/puar.12238.

Carrara, W., San Chan, W., Fischer, S., & van Steenbergen, E. (2015). *Creating value through open data digital agenda for Europe creating value through open data: Study on the impact of re-use of public data resources.* https://doi.org/10.2759/328101.

Chan, C. M. L. (2013). From open data to open innovation strategies: Creating e-services using open government data. *Proceedings of the 46th Hawaii international conference on system sciences (HICSS-46). Vol. 0. Proceedings of the 46th Hawaii international conference on system sciences (HICSS-46)* (pp. 1890–1899). Wailea, HI, USA: IEEE Computer Society.

Charalabidis, Y., Alexopoulos, C., & Loukis, E. (2016). A taxonomy of open government data research areas and topics. *Journal of Organizational Computing and Electronic Commerce, 26*(1–2), 41–63.

City of Chicago (2013). The city of Chicago technology plan. Chicago. Retrieved from https://techplan.cityofchicago.org/wp-content/uploads/2013/09/cityofchicago-techplan.pdf.

City of Chicago (2018a). Chicago department of public health - Food protection: Code violations. Retrieved September 26, 2018, from https://webapps1.cityofchicago.org/healthinspection/Code_Violations.jsp.

City of Chicago (2018b). City of Chicago developers. Retrieved June 13, 2017, from http://dev.cityofchicago.org.

Conradie, P., & Choenni, S. (2014). On the barriers for local government releasing open data. *Government Information Quarterly, 31*(S1), S10–S17. https://doi.org/10.1016/j.giq.2014.01.003.

Cordella, A. (2017). *Value creation, ICT, and co-production in public sector: Bureaucracy, opensourcing and crowdsourcing*.

Emanuel, R. (2012). Open data executive order, Pub. L. No. (No. 2012-2). Retrieved from https://www.cityofchicago.org/city/en/narr/foia/open_data_executiveorder.html.

European Union (2017). Tallinn Declaration on eGovernment at the ministerial meeting during Estonian Presidency of the Council of the EU on 6 October 2017. Tallinn. Retrieved from https://ec.europa.eu/digital-single-market/en/news/ministerial-declaration-egovernment-tallinn-declaration.

Foulonneau, M., Turki, S., Vidou, G., & Martin, S. (2014). Open data in service design. *Electronic Journal of E-Government, 12*(2), 99–107.

Ganapati, S., & Reddick, C. G. (2012). Open e-government in U.S. state governments: Survey evidence from chief information officers. *Government Information Quarterly, 29*(2), 115–122. Retrieved from http://www.sciencedirect.com/science/article/pii/S0740624X12000056.

Goldstein, B. (2013). Open data in Chicago: Game on. Retrieved June 13, 2017, from http://beyondtransparency.org/chapters/part-1/open-data-in-chicago-game-on/.

Gonzalez-Zapata, F., & Heeks, R. (2015). The multiple meanings of open government data: Understanding different stakeholders and their perspectives. *Government Information Quarterly, 32*(4), 441–452. https://doi.org/10.1016/j.giq.2015.09.001.

Hacknight, C. (2018). Chi Hacknight. Retrieved September 26, 2018, from https://chihacknight.org/.

Hartley, J., Sørensen, E., & Torfing, J. (2013). Collaborative innovation: A viable alternative to market competition and organizational entrepreneurship. *Public Administration Review, 73*(6), 821–830. https://doi.org/10.1111/puar.12136.

Huijboom, N., & van den Broek, T. A. (2011). Open data: An international comparison of strategies. *European Journal of EPractice, 12*(1), 1–13. Retrieved from https://research.vu.nl/en/publications/open-data-an-international-comparison-of-strategies.

Jakobsen, M. (2013). Can government initiatives increase citiz. *Journal of Public Administration Research and Theory, 23*(1), 27–54. https://doi.org/10.1093/jopart/mus036.

Janssen, K. (2011). The influence of the PSI directive on open government data: An overview of recent developments. *Government Information Quarterly, 28*(4), 446–456. Retrieved from http://www.sciencedirect.com/science/article/pii/S0740624X11000517.

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, adoption barriers and myths of open data and open government. *Information Systems Management, 29*(4), 258–268. https://doi.org/10.1080/10580530.2012.716740.

Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2014). Data-driven innovation through open government data. *Journal of Theoretical and Applied Electronic Commerce Research, 9*(2), 15–16. https://doi.org/10.4067/S0718-18762014000200008.

Johnson, J. A. (2014). From open data to information justice. *Ethics and Information Technology, 16*(4), 263–274. https://doi.org/10.1007/s10676-014-9351-8.

Juell-Skielse, G., Hjalmarsson, A., Johannesson, P., & Rudmark, D. (2014). Is the public motivated to engage in open data innovation? In M. Janssen, H. J. Scholl, M. A. Wimmer, & F. Bannister (Vol. Eds.), *Electronic government: proceedings of the 13th IFIP WG 8.5 international conference, EGOV 2014. Vol. 8653. Electronic government: proceedings of the 13th IFIP WG 8.5 international conference, EGOV 2014* (pp. 277–288). . Dublin, Ireland. Retrieved from https://doi.org/10.1007/978-3-662-44426-9_23.

Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly, 30*(4), 508–513. https://doi.org/10.1016/j.giq.2013.05.012.

Khayyat, M., & Bannister, F. (2017). Towards a model for facilitating and enabling co-creation using open government data. *Information Polity, 22*(4), 211–231. https://doi.org/10.3233/IP-170406.

Lember, V. (2017). The increasing role of digital technologies in co-production. *The other canon foundation and Tallinn university of technology working papers in technology governance and economic dynamics*. Retrieved from https://ideas.repec.org/p/tth/wpaper/75.html.

Lember, V. (2018). The increasing role of new technologies in co-production. In T. Brandsen, T. Steen, & B. Verschuere (Eds.). *Co-production and co-creation: Engaging citizens in public service delivery*Routledgehttps://doi.org/10.13140/RG.2.2.10934.80966.

Martin, S., Foulonneau, M., Turki, S., & Ihadjadene, M. (2013). Risk analysis to overcome barriers to open data. *Electronic Journal of E-Government, 11*(2), 348–359.

McBride, K. (2017). *Government as a platform: Exploiting open government data to drive public service co-creation.* Tallinn University of Technology.

McBride, K., Toots, M., Kalvet, T., & Krimmer, R. (2018). *Open government data driven co-creation: Moving towards citizen-government collaboration.* Cham: Springer184–195. https://doi.org/10.1007/978-3-319-98690-6_16.

Mergel, I., Kleibrink, A., & Sörvik, J. (2018). Open data outcomes: U.S. cities between product and process innovation. *Government Information Quarterly*. https://doi.org/10.1016/J.GIQ.2018.09.004.

Millard, J. (2015). Open governance systems: Doing more with more. *Government information quarterly, (January)* (pp. 1–11). . https://doi.org/10.1016/j.giq.2015.08.003.

Misuraca, G., & Viscusi, G. (2014). Is open data enough? *International Journal of Electronic Government Research, 10*(1), 18–34. https://doi.org/10.4018/ijegr.2014010102.

Moore, M. (1994). Public value as the focus of strategy. *Australian Journal of Public Administration, 53*(3), 296–303. https://doi.org/10.1111/j.1467-8500.1994.tb01467.x.

Obama, B. (2013). Making open and machine readable the new default for government information. *Executive Order*. Retrieved from https://obamawhitehouse.archives.gov/the-press-office/2013/05/09/executive-order-making-open-and-machine-readable-new-default-government.

OECD (2016). Rebooting public service delivery: How can open government data help to drive innovation? Retrieved from http://www.oecd.org/gov/Rebooting-Public-Service-Delivery-How-can-Open-Government-Data-help-to-drive-Innovation.pdf.

O'Hara, K., & Kieron (2012). Transparency, open data and trust in government. *Proceedings of the 3rd annual ACM web science conference on - WebSci '12* (pp. 223–232). New York, New York, USA: ACM Press. https://doi.org/10.1145/2380718.2380747.

Osborne, S. P. (2006). *The new public governance?* Taylor & Francis.

Osborne, S. P. (2017). From public service-dominant logic to public service logic: Are public service organizations capable of co-production and value co-creation? *Public Management Review, 00*(00), 1–7. https://doi.org/10.1080/14719037.2017.1350461.

Osborne, S. P., Radnor, Z., & Strokosch, K. (2016). Co-production and the co-creation of value in public services: A suitable case for treatment? *Public Management Review, 18*(5), 639–653. https://doi.org/10.1080/14719037.2015.1111927.
Osborne, S. P., & Strokosch, K. (2013). It takes two to tango? Understanding the co-production of public services by integrating the services management and public administration perspectives. *British Journal of Management, 24*, S3. https://doi.org/10.1111/1467-8551.12010.
Ostrom, E. (1972). Metropolitan reform: Propositions derived from two traditions. *Social Science Quarterly,* 474–493.
Paletti, A. (2016). Co-production through ICT in the Public Sector: when citizens reframe the production of public services. *Digitally Supported Innovation* (pp. 141–152). Cham: Springer.
Pestoff, V. (2012). Co-production and third sector social services in Europe: Some concepts and evidence. *Voluntas: International Journal of Voluntary and Nonprofit Organizations, 23*(4), 1102–1118.
Pollitt, C., Bouckaert, G., & Löffler, E. (2006, September). Making quality sustainable: co-design, co-decide, co-produce, co-evaluate. *Report by the Scientific Rapporteurs of the 4th Quality Conference*. Helsinki: Ministry of Finance.
Schenk, T. (2017). Food inspection forecasting - City of Chicago. Retrieved April 21, 2017, from https://chicago.github.io/food-inspections-evaluation/.
Scholl, H. J. (2016). *The EGOV research community: An update on where we stand the EGOV research community: An update on where we stand, (May)*. https://doi.org/10.1007/978-3-662-44426-9.
Stoker, G. (2006). Public value management. *The American Review of Public Administration, 36*(1), 41–57. https://doi.org/10.1177/0275074005282583.
Toots, M., McBride, K., Kalvet, T., & Krimmer, R. (2017). Open data as enabler of public service co-creation: Exploring the drivers and barriers. *International conference for e-democracy and open government* (pp. 102–112). Krems, Austria: IEEE.
Toots, M., McBride, K., Kalvet, T., Krimmer, R., Tambouris, E., Panopoulou, E., ... Tarabanis, K. (2017). A framework for data-driven public service co-production. *International conference on electronic government* (pp. 264–275). St.Petersburg: Springer.
Tuurnas, S. (2016). Looking beyond the simplistic ideals of participatory projects: Fostering effective co-production? *International Journal of Public Administration,* 1–11. https://doi.org/10.1080/01900692.2016.1178284.
Uppström, E., & Lönn, C.-M. (2017). Explaining value co-creation and co-destruction in e-government using boundary object theory. *Government Information Quarterly, 34*(3), 406–420. https://doi.org/10.1016/J.GIQ.2017.08.001.
Van der Graaf, S., & Veeckman, C. (2014). Designing for participatory governance: Assessing capabilities and toolkits in public service delivery. *Info, 16*(6), 74–88. https://doi.org/10.1108/info-07-2014-0028.
Veenstra, A. F. van, & Broek, T. A. van den. (2013). Opening moves – Drivers, enablers and barriers of open data in a semi-public organization. In M. A. Wimmer, M. Janssen, & H. J. Scholl (Eds.), Electronic government: Proceedings of the 12th IFIP WG 8.5 international conference, EGOV 2013 (Vol. 8074, pp. 50–61). Koblenz, Germany. Retrieved from https://doi.org/10.1007/978-3-642-40358-3_5
Verschuere, B., Brandsen, T., & Pestoff, V. (2012). Co-production: The state of the art in research and the future agenda. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 23*(4), 1083–1101. https://doi.org/10.1007/s11266-012-9307-8.
Voorberg, W. H., Bekkers, V. J. J. M., & Tummers, L. G. (2015). A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public Management Review, 17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505.
Whitaker, G. P. (1980). Coproduction: delivery in service participation citizen. *Public Administration Review, 40*(3), 240–246.
Yin, R. K. (1989). *Case study research: Design and methods. Applied social research methods series; v. 5 (Rev.).* Newbury Park, Calif: Sage Publications.
Young, M., & Yan, A. (2017). Civic hackers' user experiences and expectations of Seattle's open municipal data program. *Proceedings of the 50th Hawaii international conference on system science (HICSS-50). Waikoloa Village, Hawaii, USA*https://doi.org/http://hdl.handle.net/10125/41480.
Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. S. (2012). Socio-technical impediments of open data. *Electronic Journal of Electronic Government, 10*(2), 156–172.

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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.

References

Albano, Claudio Sonaglio and Reinhard, Nicolau (2014), "Open Government Data: Facilitating and Motivating Factors for Coping with Potential Barriers in the Brazilian Context", *in Electronic Government: Proceedings of the 13th IFIP WG 8.5 International Conference, EGOV 2014*, edited by Marijn Janssen, Hans Jochen Scholl, Maria A Wimmer, and Frank Bannister, 8653:181–93. Dublin, Ireland. http://link.springer.com/chapter/10.1007/978-3-662-44426-9_15.

Attard, Judie; Orlandi, Fabrizio; Scerri, Simon and Auer, Sören (2015), "A Systematic Review of Open Government Data Initiatives", *Government Information Quarterly* 32 (4): 399-418. doi:10.1016/j.giq.2015.07.006.

Barry, Emily and Bannister, Frank (2014), "Barriers to Open Data Release: A View from the Top", *Information Polity* 19 (1/2): 129–52. doi:10.3233/IP-140327.

Beno, Martin; Figl, Kathrin; Umbrich, Jürgen and Polleres, Axel (2017), "Open Data Hopes and Fears Determining the Barriers of Open Data," 69–81. doi:10.1109/CeDEM.2017.22.

Burwell, Sylvia M; Vanroekel, Steven; Park, Todd and US Chieftechnolo (2013), "Open Data Policy – Managing Information as an Asset", *Executive Office of the President* M-13-13: 1-12.

Conradie, Peter and Choenni, Sunil (2014), "On the Barriers for Local Government Releasing Open Data", Government Information Quarterly 31 (S1): S10-17. doi:10.1016/j.giq.2014.01.003.

Dawes, Sharon S.; Vidiasova, Lyudmila; Parkhimovich, Olga (2016. "Planning and Designing Open Government Data Programs: An Ecosystem Approach", *Government Information Quarterly* 33 (1). Elsevier Inc.: 15-27. doi:10.1016/j.giq.2016.01.003.

Enterprise Estonia (2018), "Interoperability Services – E-Estonia", *Accessed August* 19, https://e-estonia.com/solutions/interoperability-services/.

European Commission (2017), "EGovernment Benchmark 2017 Taking Stock of User-Centric Design and Delivery of Digital Public Services in Europe", doi:10.2759/742892.

European Commission (2017), "Open Data Maturity in Europe 2017", https://www.europeandata-portal.eu/sites/default/files/edp_landscaping_insight_report_n3_2017.pdf.

European Commission (2018), "Digital Economy and Society Index 2018", http://ec.europa.eu/information_society/newsroom/image/document/2018-20/ee-desi_2018-country-profile_eng_B43FFF58-F3FD-633C-F5833D8295BB9EB0_52221.pdf.

Eurostat (2018), "Individuals Using the Internet for Interaction with Public Authorities", http://ec.europa.eu/eurostat/web/products-datasets/-/tin00012.

Foulonneau, Muriel; Martin, Sébastien and Turki, Slim (2014), "How Open Data Are Turned into Services?", *Lecture Notes in Business Information Processing* 169 LNBIP (June): 31-39. doi:10.1007/978-3-319-04810-9.

Goldstein, Brett (2013), "Open Data in Chicago: Game On", *Beyond Transparency*. http://beyondtransparency.org/chapters/part-1/open-data-in-chicago-game-on/.

Gonzalez-Zapata, Felipe and Heeks, Richard (2015), "The Multiple Meanings of Open Government Data: Understanding Different Stakeholders and Their Perspectives", *Government Information Quarterly* 32 (4): 441-52. doi:10.1016/j.giq.2015.09.001.

Henry, Nicholas L. (1974), "Knowledge Management: A New Concern for Public Administration", *Public Administration Review* 34 (3), WileyAmerican Society for Public Administration: 189. doi:10.2307/974902.

Janssen, Katleen (2011), "The Influence of the PSI Directive on Open Government Data: An Overview of Recent Developments", *Government Information Quarterly* 28 (4): 446-56, http://www.sciencedirect.com/science/article/pii/S0740624X11000517.

Janssen, Marijn; Charalabidis, Yannis and Zuiderwijk, Anneke (2012), "Benefits, Adoption Barriers and Myths of Open Data and Open Government", *Information Systems Management* 29 (4): 258-68. doi:10.1080/10580530.2012.716740.

Janssen, Marijn; Konopnicki, David; Snowdon, Jane L. and Ojo, Adegboyega (2017), "Driving Public Sector Innovation Using Big and Open Linked Data (BOLD)", *Information Systems Frontiers* 19 (2): 189-95. doi:10.1007/s10796-017-9746-2.

Kalvet, Tarmo (2012), "Innovation: A Factor Explaining E-Government Success in Estonia", *Electronic Government* 9 (2): 142-57. doi:10.1007/s13398-014-0173-7.2.

Kalvet, Tarmo; Tiits, Marek and Hinsberg, Hille (2013), *E-Teenuste Kasutamise Tulemuslikkus Ja Mõju Uuringu Aruanne,* Tallinn: Institutes of Baltic Studies. http://www.praxis.ee/fileadmin/tarmo/Projektid/Valitsemine_ja_kodanikeühiskond/E-teenuste_kasutamise_tulemuslikkus_ja_moju.pdf.

Kitsing, Meelis (2011), "Success Without Strategy: E-Government Development in Estonia", *Policy & Internet* 3 (1), Wiley-Blackwell: 86-106, doi:10.2202/1944-2866.1095.

Krimmer, Robert; Kalvet, Tarmo; Toots, Maarja; Cepilovs, Aleksandrs and Tambouris, Efthimios (2017), "Exploring and Demonstrating the Once-Only Principle: A European Perspective", *in Dg.O*, 546-51.

Krimmer, Robert; Kalvet, Tarmo; Toots, Maarja; Cepilovs, Aleksandrs (2017), "The Once-Only Principle Project Position Paper on Definition of OOP and Situation in Europe", www.toop.eu.

Linders, Dennis (2012), "From E-Government to We-Government: Defining a Typology for Citizen Coproduction in the Age of Social Media", *Government Information Quarterly* 29 (4), Elsevier Inc.: 446-54, doi:10.1016/j.giq.2012.06.003.

Martin, Sébastien; Foulonneau, Muriel; Turki, Slim and Ihadjadene, Madjid (2013), "Open Data: Barriers, Risks and Opportunities", *in 13th European Conference on EGovernment (ECEG 2013)*, 301-9, Como, Italy.

McBride, Keegan D; Aavik, Gerli; Kalvet, Tarmo and Krimmer, Robert (2018), "Co-Creating an Open Government Data Driven Public Service: The Case of Chicago's Food Inspection Forecasting Model", *in 51st Hawaii International Conference on System Sciences (HICSS)*, 2453-62, IEEE.

O'Reilly Media (2018), "The 8 Principles of Open Government Data", *2007*, Accessed August 18. https://opengovdata.org/.

Obama, President Barack, and White House (2009), "Transparency and Open Government – The White House", *Whitehouse. Gov*.

OECO (2011), *Estonia : Towards a Single Government Approach,* OECD.

OECD (2015), *OECD Public Governance Reviews: Estonia and Finland,* OECD Public Governance Reviews, OECD Publishing, doi:10.1787/9789264229334-en.

OECD (2016), "Rebooting Public Service Delivery: How Can Open Government Data Help to Drive Innovation?", http://www.oecd.org/gov/Rebooting-Public-Service-Delivery-How-can-Open-Government-Data-help-to-drive-Innovation.pdf.

OECD (2017), *Government at a Glance 2017,* OECD, doi:10.1787/gov_glance-2017-en.

RIA (2018), "Data Exchange Layer X-Road", *2018*, Accessed August 19, 2018; https://www.ria.ee/en/x-road.html.

Riigikogu (2000), *Public Information Act*, Estonia, https://www.riigiteataja.ee/en/eli/518012016001/consolide.

Runeson, Per; Host, Martin; Rainer, Austen and Regnell, Björn (2012), *Case Study Research in Software Engineering*, John Wiley & Sons, Inc, doi:10.1002/9781118181034.

Shepherd, Elizabeth; Stevenson, Alice and Flinn, Andrew (2011), "Freedom of Information and Records Management in Local Government: Help or Hindrance?", *Information Polity: The International Journal of Government & Democracy in the Information Age* 16 (2): 111-21.

Toots, Maarja; Kalvet, Tarmo and Krimmer, Robert (2016), "Success in EVoting – Success in EDemocracy? The Estonian Paradox", edited by Efthimios Tambouris, Panos Panagiotopoulos, Øystein Sæbø, Maria A Wimmer, Theresa A Pardo, Yannis Charalabidis, Delfina Sa Soares, and Tomasz Janowski, *Electronic Participation: Proceedings of the 8th IFIP WG 8.5 International Conference, EPart 2016*, Lecture Notes in Computer Science, Guimarães, Portugal, Springer International Publishing.

Toots, Maarja; Mcbride, Keegan; Kalvet, Tarmo and Krimmer, Robert (2017), "Open Data as Enabler of Public Service Co-Creation : Exploring the Drivers and Barriers", *in International Conference for E-Democracy and Open Government*, 102-12. Krems, Austria, IEEE.

United Nations (2018), "E-Government Development Index – Estonia", *UN EGDI Survey,* https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/57-Estonia.

World Wide Web Foundation (2017), "Opendata Barometer Global Report Fourth Addition", https://opendatabarometer.org/doc/4thEdition/ODB-4thEdition-GlobalReport.pdf.

Yin, Robert K (2013), *Case Study Research: Design and Methods. Applied Social Research Methods Series*, v. 5. Rev. Newbury Park, Calif., Sage publications.

Young, Meg and Yan, An (2017), "Civic Hackers' User Experiences and Expectations of Seattle's Open Municipal Data Program", *Proceedings of the 50th Hawaii International Conference on System Science (HICSS-50)*, Waikoloa Village, Hawaii, USA, 2681-90. doi:http://hdl.handle.net/10125/41480.

Zuiderwijk, Anneke; Janssen, Marijn; Choenni, Sunil; Meijer, Ronald and Sheikh Alibaks, Roexsana (2012), "Socio-technical Impediments of Open Data", *Electronic Journal of Electronic Government* 10 (2), 156-72. doi:10.1641/b570402?ref=search-gateway:885882d1830675b0f27af0760faeaef8.

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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-production1. 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]).

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

[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.

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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 project2. 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.

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.

[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.

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:

11. 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.
12. 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.
13. 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.
14. 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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References

[1] "A vision for public services," European Commission, Directorate-General for Communications Networks, Content and Technology, 2013.

[2] G. Galasso, G. Garbasso, G. Farina, D. Osimo, F. Mureddu, T. Kalvet, P. Waller., "Analysis of the Value of New Generation of eGovernment Services and How Can the Public Sector Become an Agent of Innovation through ICT," 2016.

[3] *Open Data Handbook*. Available: http://opendatahandbook.org/guide/en/what-is-open-data/

[4] European Commission. *COM(2011) 882 final, Open data: An engine for innovation, growth and transparent governance*. 2011.

[5] A. Zuiderwijk, M. Janssen, S. Choenni, R. Meijer, and R. S. Alibaks, "Socio technical Impediments of Open Data," *Electronic Journal of Electronic Government,* vol. 10, no. 2, pp. 156-172, 2012.

[6] *Open Government*. Available: http://www.oecd.org/gov/open-government.htm

[7] M. Frank and A. A. Oztoprak, "Concepts of Transparency: Open Data in UK Local Authorities," in *Proceedings of the 5th Conference for E-Democracy and Open Government (CeDEM 2015)*, Danube University Krems, Austria, 2015, pp. 185-196: Edition Donau-Universität Krems.

[8] M. Janssen, Y. Charalabidis, and A. Zuiderwijk, "Benefits, Adoption Barriers and Myths of Open Data and Open Government," *Information Systems Management (ISM),* vol. 29, no. 4, pp. 258-268, 2012.

[9] S. P. Osborne, Z. Radnor, and K. Strokosch, "Co-Production and the Co-Creation of Value in Public Services: A suitable case for treatment?," *Public Management Review,* vol. 18, no. 5, pp. 639-653, 2016.

[10] R. Kattel, A. Cepilovs, W. Drechsler, T. Kalvet, V. Lember, and P. Tõnurist, "Can we measure public sector innovation? A literature review," in "LIPSE Working papers," 2014.

[11] B. Verschuere, T. Brandsen, and V. Pestoff, "Co-production: The State of the Art in Research and the Future Agenda," *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations,* vol. 23, no. 4, 2012.

[12] W. H. Voorberg, V. J. J. M. Bekkers, and L. G. Tummers, "A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey," *Public Management Review,* vol. 17, no. 9, pp. 1333-1357, 2015.

[13] S. Martin, M. Foulonneau, S. Turki, and M. Ihadjadene, "Risk Analysis to Overcome Barriers to Open Data," *Electronic Journal of e-Government,* vol. 11, no. 2, pp. 348-359, 2013.

[14] E. Barry and F. Bannister, "Barriers to open data release: A view from the top," *Information Polity,* vol. 19, no. 1/2, pp. 129-152, June 2014 2014.

[15] T. Bovaird and E. Loeffler, "From Engagement to Co-production: The Contribution of Users and Communities to Outcomes and Public Value," *International Journal of Voluntary and Nonprofit Organizations,* vol. 23, no. 4, pp. 1119-1138, 2012.

[16] A. Zuiderwijk, N. Helbig, J. R. Gil-García, and M. Janssen, "Special Issue on Innovation through Open Data: Guest Editors' Introduction," *Journal of theoretical and applied electronic commerce research,* vol. 9, no. 2, pp. i-xiii, 2014.

[17] N. Huijboom and T. V. d. Broek, "Open data: an international comparison of strategies," *European journal of ePractice,* vol. 12, no. 1, pp. 4-16, 2011.

[18] F. Gonzalez-Zapata and R. Heeks, "The multiple meanings of open government data: Understanding different stakeholders and their perspectives," *Government Information Quarterly,* vol. 32, no. 4, pp. 441-452, 2015.

[19] K. Janssen, "The influence of the PSI directive on open government data: An overview of recent developments," *Government Information Quarterly,* vol. 28, no. 4, pp. 446–456, 2011.

[20] S. Ganapati and C. G. Reddick, "Open e-government in U.S. state governments: Survey evidence from Chief Information Officers," *Government Information Quarterly,* vol. 29, no. 2, pp. 115-122, 2012.

[21] A. F. v. Veenstra and T. A. v. d. Broek, "Opening Moves – Drivers, Enablers and Barriers of Open Data in a Semi-public Organization," in *Electronic Government: Proceedings of the 12th IFIP WG 8.5 International Conference, EGOV 2013*, Koblenz, Germany, 2013, vol. 8074, pp. 50-61.

[22] K. O'Hara, "Transparency, open data and trust in government: shaping the infosphere," in *WebSci '12 Proceedings of the 4th Annual ACM Web Science Conference*, Evanston, Illinois, USA, 2012, pp. 223-232.

[23] J. A. Johnson, "From open data to information justice," *Ethics and Information Technology,* vol. 16, no. 4, pp. 263-274, 2014.

[24] European Commission. *EU eGovernment Action Plan 2016-2020: Accelerating the digital transformation of government*. Available: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=15268

[25] C. Pollitt, G. Bouckaert, and E. Loeffler, "Making Quality Sustainable: Co-design, Co-decide, Co-produce, Co-evaluate," presented at the 4QC Conference, 2006. Scientific Rapporteurs report.

[26] S. Nambisan and P. Nambisan, "Engaging Citizens in Co-Creation in Public Services: Lessons Learned and Best Practices," in "Collaboration Across Boundaries Series," IBM Center for The Business of Government, 2013.

[27] G. Juell-Skielse, A. Hjalmarsson, P. Johannesson, and D. Rudmark, "Is the Public Motivated to Engage in Open Data Innovation?," in *Electronic Government: Proceedings of the 13th IFIP WG 8.5 International Conference, EGOV 2014*, Dublin, Ireland, 2014, vol. 8653, pp. 277-288.

[28] M. Jakobsen, "Can Government Initiatives Increase Citizen Coproduction? Results of a Randomized Field Experiment," *Journal of Public Administration Research and Theory,* vol. 23, no. 1, pp. 27-54, 2013.

[29] S. Tuurnas, "Looking beyond the Simplistic Ideals of Participatory Projects: Fostering Effective Coproduction?," *International Journal of Public Administration,* vol. 39, no. 13, pp. 1077-1087, 2016.

[30] S. P. Osborne and K. Strokosch, "It takes Two to Tango? Understanding the Co-production of Public Services by Integrating the Services Management and Public Administration Perspectives," *British Journal of Management,* vol. 24, pp. S31–S47, 2013.

[31] M. Toots, T. Kalvet, and R. Krimmer, "Success in eVoting – Success in eDemocracy? The Estonian Paradox," in *8th IFIP WG 8.5 International Conference*, Guimarães, Portugal, 2016, vol. 9821, pp. 55-66: Springer.

[32] R. Krimmer, A. Ehringfeld, and M. Traxl, "The Use of E-Voting in the Austrian Federation of Students Elections 2009," in *Proceedings of the 4th International Conference on Electronic Voting (EVOTE 2010)*, Bonn, 2010, vol. 167, pp. 33-44: GI.

[33] N. Edelmann, R. Krimmer, and P. Parycek, "Engaging youth through deliberative e-participation: a case study," *International Journal of Electronic Governance,* vol. 1, no. 4, pp. 385-399, 2008.

[34] J. Hartley, E. Sørensen, and J. Torfing, "Collaborative Innovation: A Viable Alternative to Market Competition and Organizational Entrepreneurship," *Public Administration Review,* vol. 73, no. 6, pp. 821–830, 2013.

[35] A. A. Armenakis and A. G. Bedeian, "Organizational Change: A Review of Theory and Research in the 1990s," *Journal of Management,* vol. 25, no. 3, pp. 293–315, 1999.

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Open Government Data Driven Co-creation: Moving Towards Citizen-Government Collaboration

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Abstract. It is believed that co-creation may lead to public service quality improvements, the provision and creation of new and innovative services, and bring public service providers closer to their service users. There has been an increased interest and focus on how new technological innovations are enabling and facilitating co-creation; one such digital innovation is open government data (OGD). This paper examines a relatively new concept, that of co-created OGD-driven public services and aims to understand how the availability and exploitation of OGD to co-create new public services allows service users to become collaborators rather than customers of public service providers. An exploratory case study is conducted on a pilot project within Estonia where a new public service has been co-created through the exploitation of OGD. The initial results show that in order for an OGD-driven public service to be effectively co-created, a new understanding of the role of stakeholders is needed.

Keywords: Open government data · Co-creation · Public service innovation

1 Introduction

Currently, within the fields of e-Government and public administration, scholars are proclaiming that public services are changing, Information Communication Technologies (ICTs) are helping to drive this change, and ICTs are empowering citizens, which may lead to higher rates of innovation in the public sector [1–5]. Similarly, there is talk of changing how we understand and define a public service; for the purpose of this paper, the following definition of public service is adopted: 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" [6].

One major way that ICTs are empowering citizens and transforming public service creation and delivery is through digitally enabled co-creation. Specifically, it seems that ICTs and digital technologies can be applied in a variety of ways to enable different forms of co-creation [7]. A recent paper notes that digital technologies and ICTs are primarily effecting co-creation in three different ways: changing traditional co-creation, enabling new forms of co-creation, and replacing traditional co-creation through

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automated processes [7]. However, as noted by [8], more work is needed when it comes to understanding how OGD may be used to create new and innovative services; it is also brought up by [9] that there is little empirical work and more research is needed into the emerging phenomenon of co-created OGD-driven public services. A recent paper, [10], discusses the relationship between OGD and co-creation, but the concept of co-created OGD-driven public services is not touched on in detail. To better address the research gap, two research questions were formulated that this paper aims to address: (1) How can OGD contribute to the co-creation of new public services? (2) How does OGD influence our understanding of stakeholder roles in the public service delivery process?

In order to answer these research questions, an exploratory case study was conducted on a pilot project that is being conducted as part of a Horizon2020 (H2020) project where a new public service is being co-created through the exploitation of OGD. This project aims to explore how OGD may be used to help drive co-creation and innovation within the public sector [11]. To demonstrate how this happens, six pilots are being conducted, one of which is taking place in Estonia. The Estonian Real Estate Pilot Program (EREPP) is a pilot project that is carried out in cooperation between the Estonian Ministry of Economic Affairs and Communications (MKM) and Tallinn University of Technology (TTU). The authors of this paper were directly involved with the project and in charge of the implementation of the pilot application in Estonia. This project gives the researchers direct access to the process of co-creating a new public service that is based on OGD; for this reason the project was selected as an appropriate case for answering the proposed research questions.

The paper starts with an initial overview of the concepts of co-creation, OGD, and OGD-driven co-created public services. Following this, the methodology for the paper is put forth and, additionally, a conceptual model is provided as it aids the investigation of co-created OGD-driven public services. In the next section, the context surrounding the case and the case itself is presented. Following this, a discussion of the results of the case will take place where propositions will be forth in addition to reflections and implications that this case may have for the current theory and understanding of co-created OGD-driven public services.

2 Co-creation and OGD

Co-creation. The term co-creation has its roots in the concept of "coproduction", which was first coined by Elinor Ostrom 1972 [12]. Ostrom found that in areas where citizens were more forthcoming and welcoming to law enforcement, there was a higher level of public service, or a higher production of public value, compared to areas where citizens were not as cooperative with the police [13, 14]. She thus concluded that the value of a public service was very much determined by not just the provider of the service, but by the interaction between the consumer of the service and the provider [13, 15, 16]. When Ostrom talks about coproduction, she defines it as "the process through which inputs used to produce a good or service are contributed by individuals who are not "in" the same organization" [17]. Ostrom also notes that using the term "client" when defining a service is not necessarily the best term as client is "a passive

term", and in her understanding of coproduction citizens can "play an active role in producing public goods and services of consequences to them" [17].

Though participation of service consumers is paramount for the success of a public service, one should not count on service consumers to be automatically engaged and active citizens once a new service is provided [18]. A new public service needs to motivate active coproduction; however, if a public service requires higher levels of motivation for participation it is also likely that there will be an increased effort "required of service consumers to overcome hurdles to participation" [19]. One way to lower the barriers to coproduction is to involve citizens at every stage of the public service creation process; this is known as co-creation. In this paper, the term "co-creation" may be understood as "the involvement of outside, non-typical, stakeholders in the initiation, design, implementation, and evaluation of a new public service" [6].

Open Government Data. This paper deals specifically with OGD rather than open data in general. There are currently many different definitions of OGD [8, 20, 21], but most definitions share some core components: data must be machine readable, it should be licensed in a way to allow easy sharing and reuse of data, and it should be usable and understandable by humans. With this in mind, for the purpose of this paper the following definition of OGD will be used: OGD is non-confidential data which is gathered, and subsequently released by a government organization in a machine readable format which is discoverable, usable, and freely available [8, 21, 22].

Benefits of OGD. There have been recent academic works such as [8, 22] that present some of benefits that may be provided by OGD. Some benefits (though there are likely many more) are increased transparency, new forms of social participation, innovation, creation of new public services, increased accountability, creation of new business models and improved data models [8], [23–25].

Barriers Relating to the Use and Release of OGD. If OGD is released, and it is truly open (it meets the requirements set out in the definition provided earlier), then it has the potential to create major benefits for society. However, as pointed out by [8], just making OGD available is not enough, as "the value is created by its use". OGD usage generally refers to any interaction an actor (a user of OGD can come from any sector be it private or governmental [22]) has with the data, such as downloading, analyzing, or exploiting the data [9, 26, 27].

There have been many attempts to provide a better understanding of OGD barriers [8, 22, 28–30]. On the user level, commonly cited barriers are the lack of technological understanding/ability; lack of domain knowledge; language barriers to the data; lack of time to use data [22, 28, 30, 31]. On the government level, commonly cited barriers are missing political motivation; no understanding of the potential benefits of open data; missing technical infrastructure or technical know-how; poor data quality; confidentiality or personal data issues related to the release of data [8, 22, 28, 30, 31].

On the government level, a majority of the barriers are directly related to the release and publishing of open data whereas, on the user level, a majority of the barriers relate to their ability to use or understand OGD. However, in the case where these user barriers do not apply, namely when the user of the data has a strong understanding of data analytics and a personal interest in open data, they may often struggle to use the

OGD which is provided. In this situation, the most relevant barriers are related to the poor quality (encoding issues, missing values, lack of metadata, etc.) of the OGD, lack of interesting information, outdated data, and lack of an application programming interface (API) functionality [31].

3 Framework for Understanding OGD-Driven Co-created Public Services

In order to better understand this concept of co-created OGD-driven public services, the framework (Fig. 1) put forth by [6] is to be used.

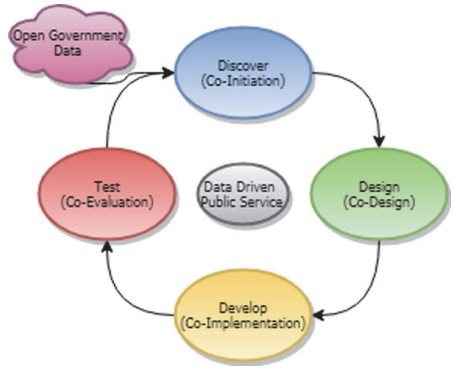

Fig. 1. OGD-driven Public Service Co-Creation Framework. Source: [6]

In previous research, the authors of the framework proposed that OGD plays an almost catalytic role in the co-creation process and, once OGD has been introduced, it may be exploited by any actor to co-create a new public service. This framework draws on the ideas of agile development, lean methodology, and co-creation to propose an OGD-driven co-creation cycle, which consists of four steps: co-initiation, co-design, co-implementation, and co-evaluation. This conceptualization of the process puts forth the idea that when OGD is released, any actor is able to exploit OGD and become an active participant in the co-creation of a new public service. This process is able to start when access to OGD becomes available and OGD becomes subsequently exploited.

In order to understand better how OGD exploitation occurs, four propositions have been put forth which will then be referred back to in the discussion.

- Proposition 1 (P1): In order for OGD to be able to contribute effectively to the co-creation of new public services, a change in the current understanding of stakeholders in the public service creation process must take place.
- Proposition 2 (P2): If OGD is released by government agencies, and this data is used to create a new public service, then the government is a participant in its co-creation.

- Proposition 3 (P3): OGD may be used as a base, or platform, from which new and innovative public services may be co-created between government agencies, who maintain and release the data, and with outside stakeholders.
- Proposition 4 (P4): OGD has the potential to enable, encourage, and drive public service co-creation.

4 Methodology

The research for this paper was carried out in the form of a single holistic exploratory case study [32]. For this paper, four different sources of evidence have been used: semi-structured interviews, workshops, survey, and documents. Six semi-structured interviews were conducted with members from Estonian public administration and from Estonian civil society; all members were selected due to the interest and role in OGD and service design and delivery. A list of five basic questions was drafted and used as the starting point for all interviews and all interviews were recorded, transcribed, coded, and then analyzed. Five interviews were done in person, and one interview was done through email. Two different workshops were attended (the first of which was organized by the authors). The workshop organized by the authors followed Nominal Group Technique [37]; in attendance were seven different public sector agencies and two Estonian start-ups; all participants played a role in either releasing, maintaining, or using OGD. The second workshop was a working group made up of members from private sector companies and public sector organizations in Estonia that were working together to plan and understand how government could become more data-driven. In the workshops, all responses to questions were written down by the participants and collected at the end of the day by the organizers, and then coded and analyzed. As part of a larger study, a survey was conducted that aimed to gain insight into how OGD could be used in the co-creation on new public services. This survey received 63 responses, however the responses received represented six different countries so only the responses from the Estonian stakeholders were included in this paper. Nine responses were received from Estonian stakeholders: three from the non-governmental sector and six from the public administration sector; for previous discussion on the results of the survey, please see [22]. Finally, for the document analysis, Estonian public policy documents, white papers, and laws were examined. For the purpose of anonymity, interview and survey responses are cited in this paper using codes: interviews are referred to by letters from “A” to “F” and survey respondents by four-letter codes where “EE” indicates Estonia, and “PA” or”NG” indicate whether the respondent represents the public sector or the non-governmental sector respectively.

5 The Case

5.1 Case Context

The pilot case was part of the H2020-funded project OpenGovIntelligence which had selected six different countries for pilot projects to be carried out. These pilot projects

should address a relevant and current societal issue and, if done successfully, the pilot should demonstrate how OGD is able to drive innovation, improve service quality, and overcome barriers relates to the use and exploitation of OGD in the public service creation context [11]. For the project, Estonia was able to provide a problem, potential datasets, and articulate a reasonable solution for the problem. Additionally, Estonia also came with the image of being a world leader and expert when it comes to ICT innovation, e-services, and e-society [33]. Thus, Estonia was expected to provide a good location for using OGD, in combination with newly created ICT tools, to create a new public service that has a high potential to create new benefit for society.

Once Estonia had been selected as a pilot country, the process to understand the current situation of OGD and co-creation began. The initial research included an overview of the potentially relevant legal texts, an overview of relevant government ministry documents, a survey, and further on in the project unstructured interviews were undertaken to get further knowledge of stakeholder perception of OGD and co-creation of publics services. The results of this research provide the necessary contextual foundation for understanding a more in depth discussion of the case. Inside Estonia OGD is regulated by the Public Information Act (PIA). In the act it is stated that all data that may be used for public purposes, that is to say it is not restricted by law, shall be opened to the public [34]. The PIA continues on to say that data should be released in machine readable format and come without any restriction on reuse of the data; however, it also states that this is only required if it would not involve "disproportionately great effort" for data holders [34]. Agencies should be following an "open by default" policy, but often what ends up happening is agencies hire a person to deal with all incoming data requests (Interview D). Estonia has made steps in the right direction for OGD, but as it is not a concrete requirement for all data to be made available in an open and machine-readable format, the availability of OGD in Estonia is lacking (Interviews A&C, Survey EENG1, EENG3, EEPA5).

The second important part of the background information relates to the current situation and understanding of co-creation of public services within Estonia. The idea of co-creation of public services within Estonia is one that does not have much government support (Interview A-F, Survey EENG1, EENG2, EENG3, EEPA3, EEPA5, EEPA6). Some of the reasons for this include not enough funding, not enough citizen demand, low levels of collaboration between citizens and government, and lack of understanding of the concept (Interviews A, B, C, D, E, F). With this in mind, steps are being taken to try to move towards creation of new public services that have been co-created with citizens (Interview E & F). Many agencies are going out to end users to ask for their input on what services they need and then trying to involve them in the design and creation process (Interview D).

Though Estonian public agencies are beginning to consult potential service end users at the beginning stages of development, this is often where the cooperation ends (Interview B). When looking at the usage of OGD for the co-creation of new public services inside Estonia there is not, yet, an example as it is not currently occurring. Some of the main reasons for this are the infancy stage of the Estonian OGD infrastructure and agencies not being willing to participate in co-creation of services with citizens and other stakeholders (Interviews B & F).

5.2 Case Description

Due to the poor quality of OGD in Estonia, one of the aims of the pilot project was to lobby for increased availability of OGD. The pilot project aimed to include users in the service design, development, implementation, and evaluation as often as possible. The events presented within this case study took place between June 2016 and December 2017 and represent the co-initiation, co-design, and co-implementation stage.

Co-initiation. The idea for the pilot project within Estonia was co-initiated. The initial topic was proposed by foreign academics and students within Estonia, the idea was then presented to the Ministry of Economic Affairs and Communications (MKM) where it was refined and accepted. The need for such a service has also been highlighted by numerous individuals in Estonian expat groups both in person and on social networks. Once the service had been accepted and put forth, the next steps were the co-design and co-implementation of the service.

Co-design. As the service aims to demonstrate how OGD may be used to create a new public service, the first task to be completed was to gain an overview of the OGD sets that were currently available. In order to identify these datasets, two different approaches were used. The first and initial starting point was a simple Google search using the Estonian term for open data, "Avaandmed". The second approach was to make requests to government agencies for datasets that could be useful for pilot development.

To aid in the initial design of the new service, two workshops were conducted. The first Estonian Real Estate Pilot Program Workshop was conducted on 16 September 2016. The workshop had nine attendees (excluding the organization team) who represented seven different government agencies and two private sector companies. The workshop was divided into two sessions. In the first session, the participants discussed and came up with four main benefits of an Estonian real estate portal based around OGD: fairer pricing, happier citizens, one stop shop for real estate data, and increased availability and usage of real estate information. The second session was titled "Constructing the Functionality" and dealt primarily with constructing user stories and personas. In any agile development project, personas and user stories play a critical role as they allow the development to reflect better the actual needs of the users [35]. Two core target groups consistent throughout the participants' work: foreign students and foreign employees who are moving to Tallinn were selected as the initial groups for the pilot.

Taking into account the personas and the user stories, the initial datasets that should be included in the pilot program were discussed, voted on, and selected. These five datasets were public transport data, safety data, price data, point of interest data (schools or doctor's offices), and property information (such as age of the building, amenities within the building, or the accessibility of the building).

A second presentation and workshop took place at a meeting of the Estonian Data Analytics Working Group, which is made up of members from multiple public and private sector organizations. What was discovered at the workshop, and matched the literature and the results of the previous workshop, was that OGD was generally looked upon favorably and as a needed innovation, but that there was no political will or user

demand for better OGD. The private sector representatives took a critical approach towards the presented service, the general criticism was that this work seemed to be better suited for private sector agencies and that the data that had thus far been cleaned would be very valuable for some private sector companies' business models.

Co-implementation After the workshops, the five OGD sets that had been selected for use were explored. These datasets required a large amount of cleaning and manipulation in order to make them usable, this initial work was conducted by staff members at TTU. At the same time this data cleaning was progressing, a hackathon sponsored by MKM that dealt with big and open data was announced. In order to test, design, and implement a new OGD driven service, the datasets that had been gathered and cleaned were brought to the hackathon (which took place from 21 to 23 October, 2016) and the idea for an OGD-driven real estate portal was pitched and selected.

A team was formed with members from the project team at TTU and members of the big data science team from the private sector company Nortal. As a compromise between these two groups, the datasets that had been cleaned and obtained by TTU's project team would be used, but it was to be a commercially oriented service rather than a free service; however, the creation of public value was still to be the main goal. Over the next 48 h, a new service MVP was built which used OGD to rate different addresses based on an individual's preferences. After 48 h, this idea was presented to the audience where it received an honorary mention for providing valuable location based information.

After the hackathon, development continued on the pilot project. Initially, MKM was intended to develop the new service in cooperation with TTU and outside stakeholders. However, there was much organizational push back, which eventually led to TTU taking the lead in pilot development. The initial development sprint took place between 15 and 18 March, 2017; the initial goal of the sprint was to develop a fairly simple and easy to understand user interface for the pilot project. As EREPP aims to encourage others to participate in the design and development of the service, the code is completely open source and hosted on GitHub.

6 Discussion

Earlier, four different propositions were put forth and investigated, the case will now be discussed, and the propositions reflected back upon. P1 stated that a change in the current understanding of stakeholders in the public service creation process must take place, if OGD was to be able to contribute effectively to the co-creation of new public services. Along with a change in understanding of the role of stakeholders, there must also be an organizational change in how public services are understood.

There are many different understandings of the definition of public service within Estonia, but one that is often referred to is as follows, "a public service is a service that the state, local government, or a person in private law performing public duties provides at the will (including the presumable will) of a person for the performance of their legal obligations or exercise of their rights" [36]. In the interviews it was claimed that a public service was, in essence, something that was paid for by public money and

carried out by a public agency (Interviews B,C,D,E,F). Thus, according to these definitions, citizens could not (should not) be able to create new public services. This understanding of public services also carries out into the understanding of the roles of the stakeholders in the public service creation process. When asked, interviewees often said that citizens should be consulted at the beginning stages of a new service and asked for feedback throughout (Interviews B,D,E,F). However, when asked if citizens should be able to play a role in the creation and design of a new public service, the answer appears to be no (Interviews B,F). The interviewees did state that though outside stakeholders are currently not able to play a role in public service co-creation, this may change in the future (Interviews B,F). There seem to be two primary reasons for why stakeholders are not currently viewed as being able to play a role in the co-creation of new public services in Estonia. The first relates back to the definition of a public service in Estonia, and the second is that citizens are referred to as clients or customers rather than as partners or collaborators (Interviews D,E,F). Throughout the case, resistance to the notion that government agencies could work with citizens as partners was clear. The clearest example of this is through the actions of MKM. During the case, TTU took over the pilot implementation from MKM. This was an interesting development, as TTU and MKM still worked together, but instead of the government agency developing the new public service, a university had taken the lead. Though a new public service is in the process of being created, and it does exploit some OGD sources, the effectiveness of the pilot program has been hindered by the lack of access to OGD and the organizational belief that outside stakeholders should not be able to play a part in the co-creation of new public services.

In regards to P2, there seems to be an interesting paradox currently in place in Estonia. On the one hand, some interviewees stated that citizens should not, or are not, able to play a role in the co-creation of a new public service (Interview B). On the other hand, government agencies do make some of their data open, and this data can be exploited to create public value (as demonstrated by this case). Thus, by releasing open data, government agencies are willingly becoming a participant in the co-creation of new services (whether they mean to or not). When government agencies release open data, citizens have the possibility to use, analyze, and exploit this data. In the Estonian case, government agencies were constantly communicated with to discuss issues in relation to data availability, data quality, data structure, etc. This communication accomplished a few different things: it increased communication between service developers and government agencies, it increased awareness of data issues, and, as noted by Interviewee A, these conversations help government agencies become aware of what data they have, what they do not, and what the current issues are.

Related to P3, by opening up datasets, government agencies allow other stakeholders to create public value through the exploitation of their data, while at the same time gaining valuable information in regards to their own data; thus, the government acts platform-like. Though this interaction takes place and does seem to provide tangible benefits for both government sector and other stakeholders, it is also one of the largest barriers present. The reason for this is that releasing data requires government agencies to acknowledge that there is an alternative way to create public services and that other stakeholders may come to be seen as partners or as collaborators rather than as customers or dependents. In line with P4, the case does seem to confirm that there is

a relationship between OGD and co-creation. If OGD is available, any actor is able to exploit or analyze this data to create new public value. Throughout the process where OGD becomes exploited, co-creation is occurring, at a minimum, between the government agency and the actor that is exploiting the data. Furthermore, the service provider is also acting a service user at the same time, as they are reliant upon the government's open data. Finally, if an application is developed on top of exploited OGD, a complex public service delivery system begins to emerge. These public service delivery systems are made up of many different stakeholders with different goals, motivations, and behaviors; based on this one case, it does seem to be true that networks, relationships, and feedback have a strong role in influencing the design, development, and implementation of the new public service.

7 Conclusion and Future Research

The aim of this paper was not to provide a thorough discussion and overview of all the drivers and barriers of OGD, but, rather, to explore and understand the process in which new public services can be co-created through the use and exploitation of OGD. The provision and creation of new and innovative services is one proposed benefit of OGD. Specifically, OGD seems to have the potential to play a catalytic role in the co-creation of new public services. Though this potential appears to exist, there is a large research gap and lack of empirical studies that aim to understand how this process actually occurs. To address this research gap, an exploratory case study was conducted to gain some initial empirical understanding of the process that is undergone to co-create an OGD-public service. An initial conceptual model for understanding co-created OGD-driven public services served as the foundational point for understanding this process.

As a result of this exploration, some interesting conclusions seem to appear. Firstly, the availability of OGD may lead to a change in our understanding of public service delivery and the roles that different stakeholders play in this process. In order for the co-creation of OGD-driven public services to take place, governments must be willing to acknowledge that non-traditional stakeholders can take the role of public service creator; if this does not occur, then it becomes increasingly difficult for other stakeholders to co-create new and innovative services. Secondly, it appears that there is genuine interest from non-traditional stakeholders to get involved in the co-creation of new public services; they just need to be given the opportunity to do so. This was shown by the participation of many stakeholder groups throughout the design of the Estonian pilot. Finally, some barriers that may inhibit the co-creation of OGD-driven public services that have been brought out in the literature seem to be reaffirmed: low data quality, organizational push back, inadequate legal frameworks, and a lack of government support.

Though the findings that have emerged from this paper seem to be confirmed from this case study, it must be noted that this is a single case study and, as such, further empirical research should be conducted to test these conclusions and recommendations. This future research could aim to understand how OGD influences public service co-creation, the sustainability of co-created OGD-driven public services, how the process differs depending on what stakeholder group drives the process, and how the presence

of OGD influences the relationships between public service producers and public service consumers.

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References

1. European Commission: A vision for public services (2013)
2. OECD: Together for Better Public Services: Partnering with Citizens and Civil Society. OECD Publishing (2011)
3. Dunleavy, P., Margetts, H., Bastow, S., Tinkler, J.: New public management is dead - Long live digital-era governance. J. Public Adm. Res. Theory **16**, 467–494 (2006)
4. Linders, D.: From e-government to we-government: defining a typology for citizen coproduction in the age of social media. Gov. Inf. Q. **29**, 446–454 (2012)
5. Osborne, S.P., Radnor, Z., Nasi, G.: A new theory for public service management? toward a (public) service-dominant approach. Am. Rev. Public Adm. **43**, 135–158 (2013)
6. Toots, M., et al.: A framework for data-driven public service co-production. In: Janssen M., et al. (eds.) Electronic Government, EGOV-EPART 2017, St.Petersburg, pp. 1–13 (2017)
7. Lember, V.: The increasing role of new technologies in co-production. In: Brandsen, T., Steen, T., Verschuere, B. (eds.) Co-production and Co-creation: Engaging Citizens in Public Service Delivery. Routledge, Abingdon (2018)
8. Janssen, M., Charalabidis, Y., Zuiderwijk, A.: Benefits, adoption barriers and myths of open data and open government. Inf. Syst. Manag. **29**, 258–268 (2012)
9. McBride, K.D., Aavik, G., Kalvet, T., Krimmer, R.: Co-creating an open government data driven public service: the case of Chicago's food inspection forecasting model. In: 51st Hawaii International Conference on System Sciences (HICSS), pp. 2453–2462. IEEE (2018)
10. Khayyat, M., Bannister, F.: Towards a model for facilitating and enabling co-creation using open government data. Inf. Polity **22**, 211–231 (2017)
11. Krimmer, R., Kalvet, T., Toots, M., McBride, K.: Deliverable 2.1 OpenGovIntelligence framework–first release (2016)
12. Ostrom, E.: Metropolitan reform: Propositions derived from two traditions. Soc. Sci. Q. **53**, 474–493 (1972)
13. Ostrom, E., Parks, R.B., Whitaker, G.P., Percy, S.L.: Formation of police and law enforcement policy. Policy Stud. J. **7**, 381–389 (1978)
14. Osborne, S.P., Radnor, Z., Strokosch, K.: Co-production and the co-creation of value in public services: a suitable case for treatment? Public Manag. Rev. **18**, 639–653 (2016)
15. Sharp, E.B.: Toward a new understanding of urban services and citizen participation: the coproduction concept. Am. Rev. Public Adm. **14**, 105–118 (1980)
16. Whitaker, G.P.: Coproduction: delivery in service participation citizen. Public Adm. Rev. **40**, 240–246 (1980)
17. Ostrom, E.: Crossing the great divide: synergy, and development. World Dev. **24**, 1073–1087 (1996)
18. Pestoff, V.: Co-production as a social and governance innovation in public services. Polityka Spoleczna **11**, 2–8 (2015)
19. Verschuere, B., Brandsen, T., Pestoff, V.: Co-production: the state of the art in research and the future agenda. Voluntas **23**, 1083–1101 (2012)

20. Gonzalez-Zapata, F., Heeks, R.: The multiple meanings of open government data: understanding different stakeholders and their perspectives. Gov. Inf. Q. **32**, 441–452 (2015)
21. Open Knowledge Foundation: What is Open Data?. http://opendatahandbook.org/guide/en/what-is-open-data/
22. Toots, M., McBride, K., Kalvet, T., Krimmer, R.: Open data as enabler of public service co-creation : exploring the drivers and barriers. In: International Conference for E-Democracy and Open Government, Krems, Austria, pp. 102–112. IEEE (2017)
23. Janssen, M., Charalabadis, Y., Krcmar, H.: Open data, information processing and datification of government. In: Proceedings of the 50th Hawaii International Conference on System Sciences, pp. 2668–2670 (2017)
24. Dawes, S.S., et al.: Planning and designing open government data programs: an ecosystem approach. Gov. Inf. Q. **33**, 15–27 (2016)
25. Hartog, M., Mulder, B., Spée, B., Visser, E., Gribnau, A.: Open data within governmental organisations: effects, benefits and challenges of the implementation process. JeDEM - eJournal eDemocracy Open Gov. **6**, 49–61 (2014)
26. Foulonneau, M., Martin, S., Turki, S.: How open data are turned into services? In: Snene, M., Leonard, M. (eds.) IESS 2014. LNBIP, vol. 169, pp. 31–39. Springer, Cham (2014). https://doi.org/10.1007/978-3-319-04810-9_3
27. Foulonneau, M., Turki, S., Vidou, G., Martin, S.: Open data in service design. Electron. J. e-Government. **12**, 99–107 (2014)
28. Zuiderwijk, A., Janssen, M.: Open data policies, their implementation and impact: a framework for comparison. Gov. Inf. Q. **31**, 17–29 (2014)
29. Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., Alibaks, R.S.: Socio-technical impediments of open data. Electron. J. Electron. Gov. **10**, 156–172 (2012)
30. Conradie, P., Choenni, S.: On the barriers for local government releasing open data. Gov. Inf. Q. **31**, S10–S17 (2014)
31. Young, M., Yan, A.: Civic hackers' user experiences and expectations of seattle's open municipal data program. In: Proceedings of 50th Hawaii International Conference on Systems Science, pp. 2681–2690 (2017)
32. Yin, R.K.: Case Study Research: Design and Methods. Sage publications, Newbury Park (2013)
33. Kalvet, T.: Innovation: a factor explaining e-government success in Estonia. Electron. Gov. Int. J. **9**, 142–157 (2012)
34. Riigikogu: Public Information Act. Estonia (2000)
35. Chamberlain, S., Sharp, H., Maiden, N.: Towards a framework for integrating agile development and user-centred design. In: Abrahamsson, P., Marchesi, M., Succi, G. (eds.) XP 2006. LNCS, vol. 4044, pp. 143–153. Springer, Heidelberg (2006). https://doi.org/10.1007/11774129_15
36. Estonian Ministry of Economic Affairs and Communications: Green Paper on the Organisation of Public Services (2013)
37. Delbecq, A.L., de Ven, A.H., Gustafson, D.H.: Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes. Scott Foresman, Glenview (1975)

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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

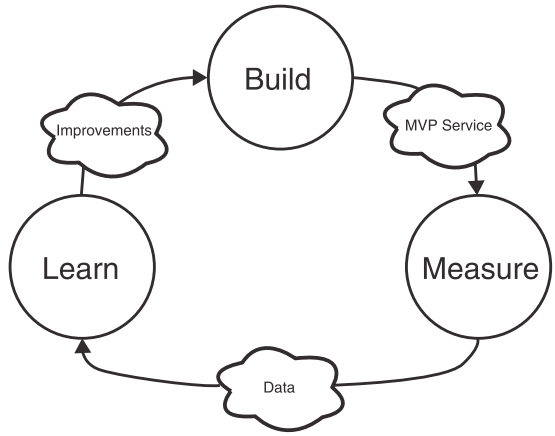

Fig. 1 Lean development cycle. (Source: authors, based on ideas by Ries, 2011)

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

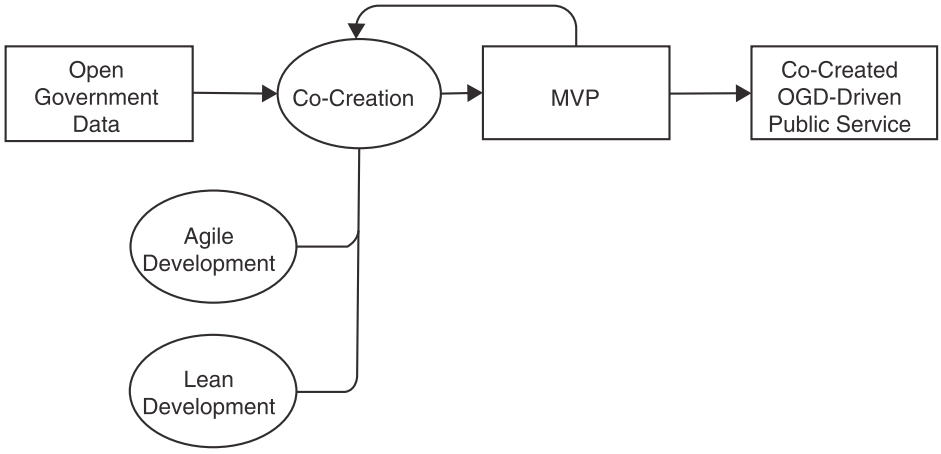

Fig. 2 Overview of framework components. (Source: authors)

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:

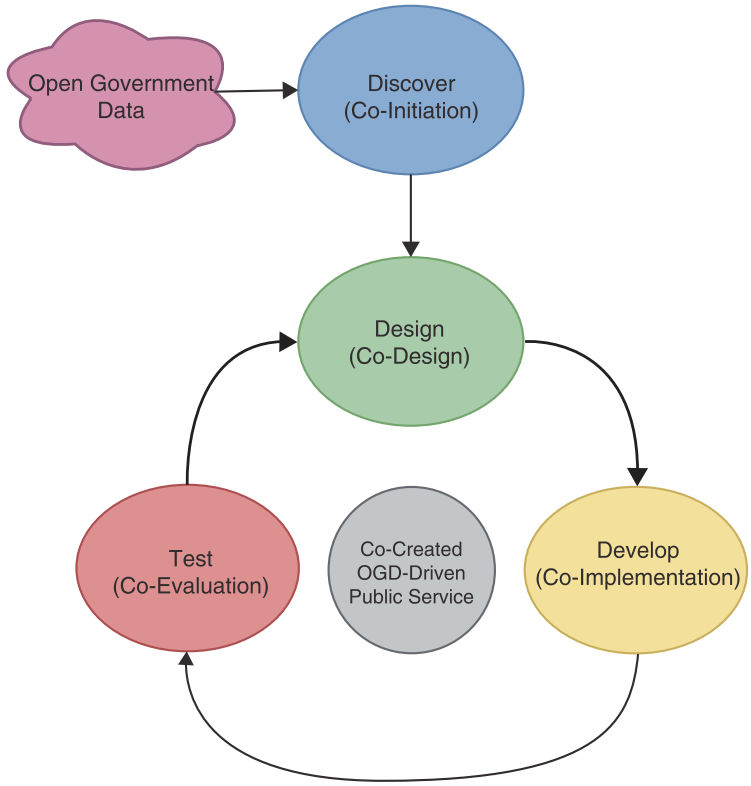

Fig. 3 Co-created OGD-driven public service cycle. (Source: authors)

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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References

Angelopoulos, S., Kitsios, F., Kofakis, P., & Papadopoulos, T. (2010). Emerging barriers in e-government implementation. In M. A. Wimmer, J.-L. Chappelet, M. Janssen, & H. J. Scholl (Eds.), *Electronic government: Proceedings of the 9th IFIP WG 8.5 international conference, EGOV 2010* (pp. 216–225). Lausanne.

Barry, E., & Bannister, F. (2014). Barriers to open data release: A view from the top. *Information Polity, 19*, 129–152.

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., … Thomas, D. (2001). Manifesto for Agile Software Development. Retrieved March 16, 2019, from https://agilemanifesto.org/iso/en/manifesto.html.

Bertot, J. C., Gorham, U., Jaeger, P. T., Sarin, L. C., & Choi, H. (2014). Big data, open government and e-government: Issues, policies and recommendations. *Information Polity, 19*, 5–16.

Bovaird, T., & Loeffler, E. (2012). From engagement to co-production: The contribution of users and communities to outcomes and public value. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 23*, 1119–1138.

Charalabidis, Y., Alexopoulos, C., Diamantopoulou, V., & Androutsopoulou, A. (2016). An open data and open services repository for supporting citizen-driven application development for governance. In *49th Hawaii international conference on system sciences (HICSS 2016)* (pp. 2596–2604). Kauai: IEEE.

Cockburn, A., & Highsmith, J. (2001). Agile software development: The people factor. *Computer (Long. Beach. Calif), 34*, 131–133.

Cordella, A., & Paletti, A. (2017). Value creation, ICT, and co-production in public sector: Bureaucracy, opensourcing and crowdsourcing. In Proceedings of the 18th Annual International Conference on Digital Government Research (pp. 185–194). ACM.

Cucciniello, M., Nasi, G., Mele, V., Valotti, G., Bazurli, R., Cucciniello, M., ... & Bazurli, R. (2014). Determinants and barriers of adoption, diffusion and upscaling of ICT-driven social innovation in the public sector: A systematic review (No. 6). LIPSE Project–Working Paper.

Cucciniello, M., Nasi, G., Mele, V., Valotti, G., & Bazurli, R. (2015). *Determinants and barriers of adoption, diffusion and upscaling of ICT-driven social innovation in the public sector: A systematic review*. Rotterdam.

Dawes, S. S., Vidiasovab, L., Parkhimovichc, O., Dawesa, S., Vidiasovab, L., Parkhimovichc, O., Dawes, S. S., Vidiasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly, 33*, 15–27.

De Vries, H., Bekkers, V., & Tummers, L. (2016). Innovation in the public sector: A systematic review and future research agenda. *Public Administration, 94*, 146–166.

Denhardt, R. B., & Denhardt, J. V. (2000). The new public service: Serving rather than steering. *Public Administration Review, 60*, 549–559.

dos Santos Brito, K., da Silva Costa, M. A., Garcia, V. C., & de Lemos Meira, S. R. (2015). Assessing the benefits of open government data: The case of Meu Congresso Nacional in Brazilian elections 2014. In *Proceedings of the 16th annual international conference on digital government research (dg.o 2015)* (pp. 89–96). Phoenix: ACM.

European Commission - DG Connect - The Public Services Unit. (2013). A vision for public services (Draft). Brussels. Retrieved from http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3179

Foulonneau, M., Martin, S., & Turki, S. (2014a). How open data are turned into services? In *Lecture notes in business information processing* (Vol. 169 LNBIP, pp. 31–39).

Foulonneau, M., Turki, S., Vidou, G., & Martin, S. (2014b). Open data in service design. *Electronic Journal of e-Government, 12*, 99–107.

Freeman, J., & Quirke, S. (2013). Understanding e-democracy: Government-led initiatives for democratic reform. Journal of e-democracy and open government, 5(2), 141–154.

Galasso, G., Garbasso, G., Farina, G., Osimo, D., Mureddu, F., Kalvet, T., & Waller, P. (2016). *Analysis of the value of new generation of eGovernment services and how can the public sector become an agent of innovation through ICT*. Brussels: European Commission. https://ec.europa.eu/futurium/en/system/files/ged/final report ogs web v3.0 0.pdf.

Gonzalez-Zapata, F., & Heeks, R. (2015). The multiple meanings of open government data: Understanding different stakeholders and their perspectives. *Government Information Quarterly, 32*, 441–452.

Hartley, J., Sørensen, E., & Torfing, J. (2013). Collaborative innovation: A viable alternative to market competition and organizational entrepreneurship. *Public Administration Review, 73*, 821–830.

Janssen, K. (2011). The influence of the PSI directive on open government data: An overview of recent developments. *Government Information Quarterly, 28*, 446–456.

Janssen, M., & van der Voort, H. (2016). Adaptive governance: Towards a stable, accountable and responsive government. *Government Information Quarterly, 33*, 1–5.

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, adoption barriers and myths of open data and open government. *Information Systems Management, 29*, 258–268.

Janssen, M., Konopnicki, D., Snowdon, J. L., & Ojo, A. (2017). Driving public sector innovation using big and open linked data (BOLD). *Information Systems Frontiers, 19*, 189–195.

Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly, 30*, 508–513.

Khayyat, M., & Bannister, F. (2017). Towards a model for facilitating and enabling co-creation using open government data. *Information Polity, 22*, 211–231.

Lember, V. (2018). The increasing role of new technologies in co-production. In T. Brandsen, T. Steen, & B. Verschuere (Eds.), *Co-production and co-creation: Engaging citizens in public service delivery*. London/New York: Routledge.

Lember, V., Kattel, R., & Kalvet, T. (2014). Public procurement and innovation: Theory and practice. In *Public procurement, innovation and policy* (pp. 13–34). Berlin/Heidelberg: Springer.

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly, 29*, 446–454.

Lönn, C.-M., & Uppström, E. (2015). Core aspects for value co-creation in public sector. In *Americas conference on information systems* (pp. 1–12).

Mcbride, K. D., Aavik, G., Kalvet, T., & Krimmer, R. (2018). Co-creating an open government data driven public service: The case of Chicago's food inspection forecasting model. In *51st Hawaii international conference on system sciences* (Vol. 9, pp. 2453–2462).

McBride, K., Aavik, G., Toots, M., Kalvet, T., & Krimmer, R. (2019). How does open government data driven co-creation occur? Six factors and a 'perfect storm'; insights from Chicago's food inspection forecasting model. *Government Information Quarterly, 36*(1), 88–97.

Melin, U. (2016). Challenges and benefits in an open data initiative – a local government case study of myths and realities. In *Electronic government and electronic participation: Joint proceedings of ongoing research and projects of IFIP WG 8.5 EGOV and EPart 2016*. Guimarães: IOS Press. https://doi.org/10.3233/978-1-61499-670-5-111.

Mergel, I. (2015a). Open collaboration in the public sector: The case of social coding on GitHub. *Government Information Quarterly, 32*, 464–472.

Mergel, I. (2015b). Opening government: Designing open innovation processes to collaborate with external problem solvers. *Social Science Computer Review, 33*, 599–612.

Mergel, I. (2016). Agile innovation management in government: A research agenda. *Government Information Quarterly, 33*, 516–523.
Mergel, I., Rethemeyer, R. K., & Isett, K. (2016). Big data in public affairs. *Public Administration Review, 76*, 928–937.
Minister for Government Policy. (2011). Open Public Services White Paper. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/255288/OpenPublicServices-WhitePaper.pdf.
Ministry of Economic Affairs and Communications. (2013). Green paper on the organisation of public services. Retrieved from https://www.mkm.ee/sites/default/files/green_paper_oige.pdf
Nambisan, S., & Nambisan, P. (2013). Engaging citizens in co-creation in public services: Lessons learned and best practices. In *IBM Center for the business of government* (Collaboration across boundaries series) (pp. 1–52). Retrieved from https://www.researchgate.net/publication/278391463_Engaging_Citizens_in_Co-Creation_in_Public_Services_Lessons_Learned_and_Best_Practices.
OECD. (2011). *Together for better public services: Partnering with citizens and civil society*. OECD Public Governance Reviews, OECD Publishing, Paris, https://doi.org/10.1787/9789264118843-en.
Open Knowledge International. (2018). Open knowledge: What is open? Retrieved March 16, 2019, from https://okfn.org/opendata/
Osborne, S. P. (2006). The new public governance? *Public Management Review, 8*(3), 377–387. https://doi.org/10.1080/14719030600853022.
Osborne, S. P. (2009). Debate: Delivering public services: Are we asking the right questions? *Public Money and Management, 29*, 5–7.
Osborne, S. P., Radnor, Z., & Nasi, G. (2013). A new theory for public service management? Toward a (public) service-dominant approach. *The American Review of Public Administration, 43*, 135–158.
Osborne, S. P., Radnor, Z., & Strokosch, K. (2016). Co-production and the Co-creation of value in public services: A suitable case for treatment? *Public Management Review, 18*(5), 639–653. https://doi.org/10.1080/14719037.2015.1111927.
Peristeras, V., & Tarabanis, K. (2008). The GEA: Governance enterprise architecture framework and models. In P. Saha (Ed.), *Advances in government enterprise architecture*. Hershey: IGI Global.
Pettigrew, A. M. (2011). The awakening giant (Routledge revivals): Continuity and change in imperial chemical industries 1st edition. Abingdon, Oxon: Routledge.
Pollitt, C., Bouckaert, G., & Löffler, E. (2006). Making quality sustainable: Co-produce and co-evaluate the quality journey to 4Qc. In *4QC Conference*.
Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Crown Business. isbn:978-0-307-88791-7.
Ruijer, E., Grimmelikhuijsen, S., & Meijer, A. (2017). Open data for democracy: developing a theoretical framework for open data use. *Government Information Quarterly, 34*, 45–52.
Schrock, A., & Shaffer, G. (2017). Data ideologies of an interested public: A study of grassroots open government data intermediaries. *Big Data & Society, 4*, 205395171769075.
Soe, R. M., & Drechsler, W. (2018). Agile local governments: Experimentation before implementation. Government Information Quarterly, 35(2), 323–335.
Symons, V. J. (1991). A review of information systems evaluation: Content, context and process. *European Journal of Information Systems, 1*, 205–212.
Toots, M., McBride, K., Kalvet, T., Krimmer, R., Tambouris, E., Panopoulou, E., Kalampokis, E., & Tarabanis, K. (2017a). A framework for data-driven public service co-production. In *EGOV-EPART2017*. St. Petersburg.
Toots, M., Mcbride, K., Kalvet, T., & Krimmer, R. (2017b). Open data as enabler of public service co-creation: Exploring the drivers and barriers. In *International conference for e-democracy and open government* (pp. 102–112). Krems: IEEE.
Vigoda, E. (2002). From responsiveness to collaboration: Governance, citizens, and the next generation of public administration. *Public Administration Review, 62*, 527–540.

Voorberg, W. H., Bekkers, V. J. J. M., & Tummers, L. G. (2015). A systematic review of co-creation and co-production: Embarking on the social innovation journey. *Public Management Review, 17*, 1333–1357.

Yin, R. K. (2013). *Case study research: Design and methods*. Newbury Park: Sage Publications.

Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government Information Quarterly, 31*, 17–29.

Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. S. (2012). Socio-technical impediments of open data. *Electronic Journal of Electronic Government, 10*, 156–172.

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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.

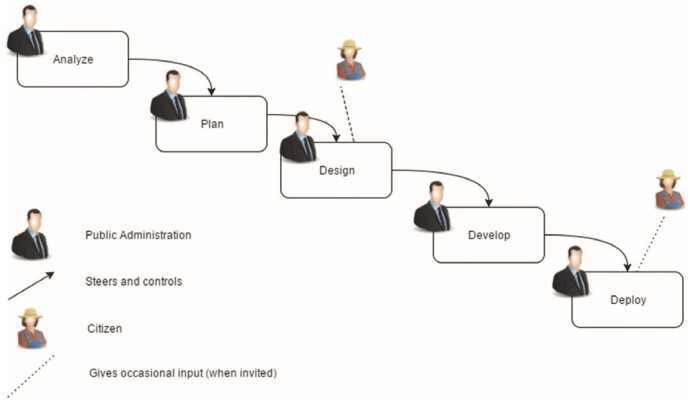

Fig. 1. Traditional model of public service creation

[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.

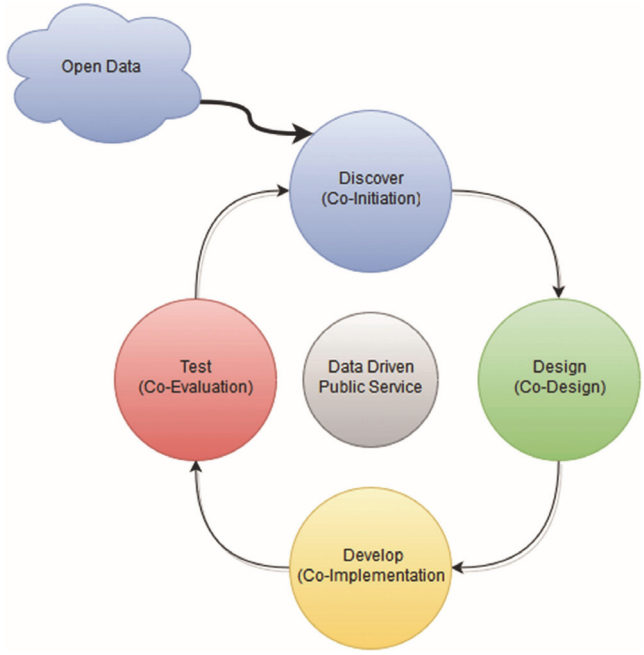

Fig. 2. Agile co-production framework for data-driven public services

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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References

1. Janssen, M., Charalabidis, Y., Zuiderwijk, A.: Benefits, adoption barriers and myths of open data and open government. Inf. Syst. Manag. (ISM) **29**(4), 258–268 (2012)
2. Martin, S., Foulonneau, M., Turki, S., Ihadjadene, M.: Open data: barriers, risks and opportunities. In: 13th European Conference on eGovernment (ECEG 2013), Como, Italy, pp. 301–309 (2013)
3. Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., Alibaks, R.S.: Socio-technical impediments of open data. Electron. J. Electron. Gov. **10**(2), 156–172 (2012)
4. Foulonneau, M., Turki, S., Vidou, G., Martin, S.: Open data in service design. Electron. J. e-Gov. **12**(2), 99–107 (2014)
5. Janssen, K.: The influence of the PSI directive on open government data: an overview of recent developments. Gov. Inf. Q. **28**(4), 446–456 (2011)
6. Rebooting Public Service Delivery—How Can Open Government Data Help Drive Innovation? OECD (2016). http://www.oecd.org/gov/digital-government/rebooting-public-service-delivery.htm
7. OMB, Memorandum M-13-13: Open Data Policy—Managing Information as an Asset (2013). https://project-open-data.cio.gov/policy-memo/
8. Open Definition 2.1. http://opendefinition.org/od/2.1/en/
9. Chan, C.M.L.: From open data to open innovation strategies: creating e-services using open government data. In: Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46), Wailea, HI, USA, pp. 1890–1899. IEEE Computer Society (2013)
10. Juell-Skielse, G., Hjalmarsson, A., Johannesson, P., Rudmark, D.: Is the public motivated to engage in open data innovation? In: Electronic Government: Proceedings of the 13th IFIP WG 8.5 International Conference, EGOV 2014, Dublin, Ireland, vol. 8653, pp. 277–288 (2014)
11. Gonzalez-Zapata, F., Heeks, R.: The multiple meanings of open government data: understanding different stakeholders and their perspectives. Gov. Inf. Q. **32**(4), 441–452 (2015)
12. Charalabidis, Y., Alexopoulos, C., Diamantopoulou, V., Androutsopoulou, A.: An open data and open services repository for supporting citizen-driven application development for governance. In: 49th Hawaii International Conference on System Sciences (HICSS 2016), Kauai, HI, USA, pp. 2596–2604. IEEE, Kauai, HI, USA (2016)

13. Misuraca, G., Viscusi, G.: Is open data enough? E-governance challenges for open government. Int. J. Electron. Gov. Res. **10**(1), 18–34 (2014)
14. Ostrom, E.: Crossing the great divide: synergy, and development. World Dev. **24**(6), 1073–1087 (1996)
15. Osborne, S.P., Radnor, Z., Strokosch, K.: Co-production and the co-creation of value in public services: a suitable case for treatment? Public Manag. Rev. **18**(5), 639–653 (2016)
16. Osborne, S.P., Strokosch, K.: It takes two to tango? Understanding the co-production of public services by integrating the services management and public administration perspectives. Br. J. Manag. **24**, S31–S47 (2013)
17. Bracci, E., Fugini, M., Sicilia, M.: Co-production of public services: meaning and motivations. In: Fugini, M., Bracci, E., Sicilia, M. (eds.) Co-production in the Public Sector. SAST, pp. 1–11. Springer, Cham (2016). doi:10.1007/978-3-319-30558-5_1
18. Pestoff, V.: Co-production and third sector social services in Europe. In: Verschuere, B., Brandsen, T., Pestoff, V. (eds.) New Public Governance, the Third Sector and Co-production. Routledge, New York (2012)
19. Pestoff, V.: Co-production as social and governance innovation in public services. Polittyka Spoleczna **11**(1), 2–8 (2015)
20. Pollitt, C., Bouckaert, G., Loeffler, E.: Making quality sustainable: co-design, co-decide, co-produce, co-evaluate. In: Presented at the 4QC Conference (2006)
21. Radnor, Z., Osborne, S.P., Kinder, T., Mutton, J.: Operationalizing co-production in public services delivery: the contribution of service blueprinting. Public Manag. Rev. **16**(3), 402–423 (2014)
22. Hartley, J., Sørensen, E., Torfing, J.: Collaborative innovation: a viable alternative to market competition and organizational entrepreneurship. Public Adm. Rev. **73**(6), 821–830 (2013)
23. Dwivedi, Y.K., et al.: Research on information systems failures and successes: status update and future directions. Inf. Syst. Front. **17**(1), 143–157 (2015)
24. Peristeras, V., Tarabanis, K.: The governance architecture framework and models. In: Saha, P. (ed.) Advances in Government Enterprise Architecture. IGI Global Information Science Reference, Hershey, PA (2008)
25. European Commission: EU eGovernment Action Plan 2016–2020: Accelerating the Digital Transformation of Government (2016). http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=15268
26. Bovaird, T., Loeffler, E.: From engagement to co-production: the contribution of users and communities to outcomes and public value. Int. J. Volunt. Nonprofit Org. **23**(4), 1119–1138 (2012)
27. Galasso, G., Farina, G., Osimo, D., Mureddu, F., Kalvet, T., Waller, P.: Analysis of the value of new generation of eGovernment services and how can the public sector become an agent of innovation through ICT (2016)
28. A vision for public services. In: European Commission. Directorate-General for Communications Networks, Content and Technology (2013)
29. Denhardt, R.B., Denhardt, J.V.: The new public service: serving rather than steering. Public Adm. Rev. **60**(6), 549–559 (2000)
30. Together for better public services: partnering with citizens and civil society. In: OECD Public Governance Reviews. OECD (2011)
31. Nambisan, S., Nambisan, P.: Engaging citizens in co-creation in public services: lessons learned and best practices. In: Collaboration. IBM Center for The Business of Government (2013)

32. Scherer, S., Wimmer, M., Strykowski, S.: Social government: a concept supporting communities in co-creation and co-production of public services. In: dg.o 2015, New York, USA, pp. 204–209. ACM (2015)
33. Beck, K., et al.: Manifesto for Agile Software Development (2001). http://agilemanifesto.org/
34. Highsmith, J., Cockburn, A.: Agile software development: the business of innovation. Computer **34**(9), 120–127 (2001)
35. Kalvet, T.: Innovation: a factor explaining e-government success in Estonia. Electron. Gov. Int. J. **9**(2), 142–157 (2012)
36. Toots, M., McBride, K., Kalvet, T., Krimmer, R.: Open data as enabler of public service co-creation: exploring the drivers and barriers. In: Parycek, P., Edelma, N. (eds.) Proceedings of the 7th International Conference for E-Democracy and Open Government, pp. 102–112. Danube University Krems, Krems an der Donau (2017)

Curriculum vitae

Personal data

Name: Keegan McBride
Date of birth: 09 July 1993
Place of birth: United States of America
Citizenship: American

Contact data

E-mail: Keegan.mcbride@outlook.com

Education

2017–2020 Tallinn University of Technology, PhD studies in Public Administration
2015–2017 MSc, in e-Government Technologies and Services
2011–2014 Honors BA in Political Science and International Relations
2007–2011 High school

Language competence

English – Fluent (Native)
Estonian – B1/B2

Professional employment

2020–Present: **Koroonakaart.ee**, Manager
2019–Present: **GovAiLab**, Manager
2018–Present: **Estonian Open Government Data Portal,** Chief Technical Consultant
2018–2019: **DigiGovLab,** Manager
2017–Present: **Tallinn University of Technology**, Junior Research Fellow
2016–2017: **Monese**, Integration Engineer
2014–2014: **Montana State University,** Research Assistant

Project Participation

2018–2018: **Estonian Digital Governance Stakeholder Mapping (Internal University Funding)**
2018–2018: **Start-up phase of the Digital Governance Competence Centre (DGCC) (Internal University Funding)**
2018–2018: **Faroe Islands Digitalization Study (PhD School Grant)**
2016–2019: **OpenGovIntelligence (H2020)**

Supervision (Defended)

Simon de Jong, Master's Degree, 2018, (sup) Robert Krimmer; **Keegan David Braun McBride**, The transferability of morality in design: re-embedding Estonia's digital identity network in Kyrgyzstan, Tallinn University of Technology School of Business and Governance, Ragnar Nurkse Department of Innovation and Governance.

Nosakhare Osemwota, Master's Degree 2019, (sup) **Keegan David Braun McBride**., Robert Krimmer. The Impact of ICTs on Nigerian Elections, Tallinn University of Technology School of Business and Governance, Ragnar Nurkse Department of Innovation and Governance.

Nino Chinchaladze, Master's Degree 2019, (sup) **Keegan David Braun McBride**., Robert Krimmer. Understanding the Role of Cyber Crime in Global Affairs, Tallinn University of Technology School of Business and Governance, Ragnar Nurkse Department of Innovation and Governance.

Diana Shysh, Master's Degree, 2019, (sup) **Keegan David Braun McBride**., Robert Krimmer. Open Data Ecosystem: Case Study of Estonia and Ukraine, Tallinn University of Technology School of Business and Governance, Ragnar Nurkse Department of Innovation and Governance.

Polina Medvedieva, Master's Degree 2019, (sup) **Keegan David Braun McBride**. The role of Public Private Partnerships in Estonia's Cyber Security Strategy, Tallinn University of Technology School of Business and Governance, Ragnar Nurkse Department of Innovation and Governance.

Supervision (In Progress)

Richard Michael Dreyling III, Master's student, (sup) **Keegan David Braun McBride**. The Feasibility of ICTs Mediated Relations Between Government and Citizens in Minnesota, United States, Tallinn University of Technology School of Information Technologies, Department of Software Science.

Lizaveta Miasayedava, Master's student, (sup) Jeffrey Andrew Tuhtan., **Keegan David Braun McBride**. Cyber Ecological Methods for the Automated Assessment of Environmental Flows: Estonia as a National Case Study, Tallinn University of Technology School of Information Technologies, Department of Computer Systems.

Andre Lezan Fernandes, Master's student, (sup) **Keegan David Braun McBride**. Use of public procurement data for fraud and population-specific patterns detection. Challenges and opportunities for its use in the Brazilian Public Administration, Tallinn University of Technology School of Information Technologies, Department of Software Science.

Publications

Attique Shah, S., Ben Yahia, S., **McBride, K**., Draheim, D. (2020). Twitter-based Big Data Analytics for Disaster Alerts: TAGS (Twitter Alert Generation System). Intermountain Engineering, Technology, and Computing Conference (i-ETC): Sep 2020, Utah USA. IEEE, [forthcoming].

Draheim, D., **McBride, K**., Misnikov, Y., Hartleb, F., Lauk, M., Lemke, F., Nagumo, T., Pappel, I. (2020). On the Narratives and Background Narratives of e-Government. Proceedings of the 53rd Hawaii International Conference on System Sciences 2020 (HICSS-53) : January 7-10, 2020, Grand Wailea, Maui. AIS Electronic Library (AISeL), 2114−2122.

McBride, K., Kütt, A., Ben Yahia, S., Draheim, D. (2019). On positive feedback loops in digital government architecture. Proceedings of the 11th International Conference on Management of Digital EcoSystems (MEDES'19) : November 12-14, 2019, Limassol, Cyprus. New York, NY: ACM, 174−180.10.1145/3297662.3365817.

Berryhill, J., Kok Heang, K., Clogher, R., **McBride, K**. (2019). Hello, World: Artificial intelligence and its use in the public sector. Paris: OECD.10.1787/726fd39d-en.

McBride, K. (2019). Sailing Towards Digitalization when it Doesn't Make Cents? Analysing the Faroe Islands' New Digital Governance Trajectory. Island Studies Journal, 14 (2), 193−214.10.24043/isj.93.

McBride, K., Aavik, G., Toots, M., Kalvet, T., Krimmer, R. (2019). How does open government data driven co-creation occur? Six factors and a 'perfect storm'; insights from Chicago's food inspection forecasting model. Government Information Quarterly, 36 (1), 88−97.10.1016/j.giq.2018.11.006.

Aavik, G., Mayer, A., **McBride, K.,** Krimmer, R. (2019). Is Government Welfare Able to Change? Analysing Efforts to Co-create an Improved Social Welfare System through Taking Advantage of a Collaborative Economy. Proceedings of the 51st Hawaii International Conference on System Sciences: 52nd Hawaii International Conference on System Sciences (HICSS), 8-11 January, 2019. AIS Electronic Library (AISeL), 2954−2963.

McBride, K., Toots, M., Kalvet, T., Krimmer, R. (2019). 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 (Ed.). Governance Models for Creating Public Values in Open Data Initiatives. Springer. (Public Administration and Information Technology), 3-31.

McBride, K., Aavik, G., Kalvet, T., Krimmer, R. (2018). Co-creating an Open Government Data Driven Public Service: The Case of Chicago's Food Inspection Forecasting Model. Proceedings of the 51st Hawaii International Conference on System Sciences: 51st Hawaii International Conference on System Sciences (HICSS), 3-7 January, 2018. AIS Electronic Library (AISeL), 2453−2462.10125/50197.

McBride, K., Kalvet, T., Toots, M., Krimmer, R. (2018). Open Government Data Driven Co-Creation, Moving Towards Citizen-Government Collaboration. Electronic Government: 17th IFIP WG 8.5 International Conference, EGOV 2018, Krems, Austria, September 3-5, 2018: Proceedings: 17th IFIP WG 8.5 International Conference, EGOV 2018, Krems, Austria, September 3-5, 2018. Ed. P. Parycek, O, Glassey, M. Janssen, H. J. Scholl, E. Tambouris, E. Kalampokis, S. Virkar. Springer, Cham, 184−195. (Lecture Notes in Computer Science; 11020).10.1007/978-3-319-98690-6_16.

McBride, K., Toots, M., Kalvet, T., Krimmer, R. (2018). Leader in e-Government, Laggard in Open Data: Exploring the Case of Estonia. Revue Francaise d'Administration Publique, 167, 613−625.10.3917/rfap.167.0613.

Mergel, I., Kattel, R., Lember, V., **McBride, K.** (2018). Digital Transformation in the Public Sector. Proceedings of the 19th Annual International Conference on Digital Government Research: d.go, Delft University of Technology, 2018. Ed. A. Zuiderwijk, C. Hinnant. Delft, Netherlands: ACM,.10.1145/3209281.3209294.

McBride, K., Matheus, R., Toots, M., Kalvet, T., Krimmer, R. (2018). The Role of Linked Open Statistical Data in Public Service Co-Creation. In: Ojo, A., Kankanhalli, A., Soares, D. (Ed.). Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance (679−681).11th International Conference on Theory and Practice of Electronic Governance, National University of Ireland Galway, 2018. Galway, Ireland: ACM.10.1145/3209415.3209446.

McBride, K., Aavik, G., Kalvet, T., Krimmer, R. (2017). Co-creating an Open Government Data Driven Public Service: The Case of Chicago's Food Inspection Forecasting Model. Working Papers in Technology Governance and Economic Dynamics, 76, 1−25.

Toots, M., **McBride, K.,** Kalvet, T., Krimmer, R. (2017). Open Data as Enabler of Public Service Co-creation: Exploring the Drivers and Barriers. In: Proceedings of the 2017 International Conference for E-Democracy and Open Government (CeDEM 2017) (102−112). Krems, Austria: IEEE Computer Society.10.1109/CeDEM.2017.12.

Toots, M., **McBride, K**., Kalvet, T., Krimmer, R. (2017). A Framework for Data-Driven Public Service Co-Production. IFIP EGOVEPART 2017 conference proceedings: IFIP EGOVEPART2017 conference, St. Petersburg, Russia, September 2017. Springer, 264−275. (Lecture Notes in Computer Science; 10428).10.1007/978-3-319-64677-0_22.

Hagertty, J., **McBride, K**., (2016). Does local monitoring empower fracking host communities? A case study from the gas fields of Wyoming. Journal of Rural Studies, 43 (February), 235−247.10.1016/j.jrurstud.2015.11.005.

Awards

2017: Cum Laude – MSc

2017: First Place – TTÜ ICT Thesis Contest, Information Society Category

2017: HICSS Doctoral Fellow

2017: Smart Specialization PhD Scholarship

2015: Scholarship of Estonian Government

Elulookirjeldus

Isikuandmed

Nimi: Keegan McBride
Sünniaeg: 09.07.1993
Sünnikoht: USA
Kodakondsus: USA

Kontaktandmed

E-post: keegan.mcbride@outlook.com

Hariduskäik

2017–2020 Tallinna Tehnikaülikool – PhD, avalik haldus
2015–2017 Tallinna Tehnikaülikool – MSc, e-riigi tehnoloogiad ja teenused
2011–2014 Montana State University – BA, politoloogia ja rahvusvahelised suhted
2007–2011 Keskharidus

Keelteoskus

Inglise keel – emakeel
Eesti keel – B1/B2

Teenistuskäik

2020– … **Koroonakaart.ee**
2019– … **GovAiLab**
2018– … **Eesti Riigi Avaandmed Portaal**
2018–2019 **DigiGovLab**
2017– … **Tallinna Tehnikaülikool**
2016–2017 **Monese**
2014–2014 **Montana State University**

Projektid

2018–2018: **Eesti digivalitsemise sidusrühmade kaardistamine (TTÜ arendusprojekt)**
2018–2018: **Digitaalse valitsemise kompetentsikeskuse käivitusfaas (teadus- ja arendustegevuse projektide toetamine)**
2018–2018: **Fääri saarte digivalitsemise uuring**
2016–2019: **Innovatsiooni ja loovuse edendamine Euroopas läbi avaliku halduse moderniseerimise ning lingitud statistiliste avaandmete pakkumise ja kasutamise (H2020)**

Juhendatud väitekirjad

Simon de Jong, Master's Degree, 2018, (sup) Robert Krimmer; **Keegan David Braun McBride**, The transferability of morality in design: re-embedding Estonia's digital identity network in Kyrgyzstan, Tallinna Tehnikaülikool, Majandusteaduskond, Ragnar Nurkse innovatsiooni ja valitsemise instituut.

Nosakhare Osemwota, Master's Degree 2019, (sup) **Keegan David Braun McBride**., Robert Krimmer. The Impact of ICTs on Nigerian Elections (Informatsiooni- ja kommunikatsioonitehnoloogia mõju Nigeeria demokraatia stabiilsusele), Tallinna Tehnikaülikool, Majandusteaduskond, Ragnar Nurkse innovatsiooni ja valitsemise instituut.

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Diana Shysh, Master's Degree, 2019, (sup) **Keegan David Braun McBride**., Robert Krimmer. Open Data Ecosystem: Case Study of Estonia and Ukraine (Avaandmete ökosüsteem: Eesti ja Ukraina juhtumianalüüs), Tallinna Tehnikaülikool, Majandusteaduskond, Ragnar Nurkse innovatsiooni ja valitsemise instituut.

Polina Medvedieva, Master's Degree 2019, (sup) **Keegan David Braun McBride**. The role of Public Private Partnerships in Estonia's Cyber Security Strategy (Avaliku ja erasektori partnerluse roll e-ID turvalisuse riskijuhtimises: Eesti juhtumiuuring), Tallinna Tehnikaülikool, Infotehnoloogia teaduskond, Tarkvarateaduse instituut.

Juhendamisel väitekirjad

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Publikatsioonid

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McBride, K. (2019). Sailing Towards Digitalization when it Doesn't Make Cents? Analysing the Faroe Islands' New Digital Governance Trajectory. Island Studies Journal, 14 (2), 193−214.10.24043/isj.93.

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Aavik, G., Mayer, A., **McBride, K.,** Krimmer, R. (2019). Is Government Welfare Able to Change? Analysing Efforts to Co-create an Improved Social Welfare System through Taking Advantage of a Collaborative Economy. Proceedings of the 51st Hawaii International Conference on System Sciences: 52nd Hawaii International Conference on System Sciences (HICSS), 8-11 January, 2019. AIS Electronic Library (AISeL), 2954−2963.

McBride, K., Toots, M., Kalvet, T., Krimmer, R. (2019). 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 (Ed.). Governance Models for Creating Public Values in Open Data Initiatives. Springer. (Public Administration and Information Technology), 3-31.

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Mergel, I., Kattel, R., Lember, V., **McBride, K.** (2018). Digital Transformation in the Public Sector. Proceedings of the 19th Annual International Conference on Digital Government Research: d.go, Delft University of Technology, 2018. Ed. A. Zuiderwijk, C. Hinnant. Delft, Netherlands: ACM,.10.1145/3209281.3209294.

McBride, K., Matheus, R., Toots, M., Kalvet, T., Krimmer, R. (2018). The Role of Linked Open Statistical Data in Public Service Co-Creation. In: Ojo, A., Kankanhalli, A., Soares, D. (Ed.). Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance (679−681).11th International Conference on Theory and Practice of Electronic Governance, National University of Ireland Galway, 2018. Galway, Ireland: ACM.10.1145/3209415.3209446.

McBride, K., Aavik, G., Kalvet, T., Krimmer, R. (2017). Co-creating an Open Government Data Driven Public Service: The Case of Chicago's Food Inspection Forecasting Model. Working Papers in Technology Governance and Economic Dynamics, 76, 1−25.

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