



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

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.

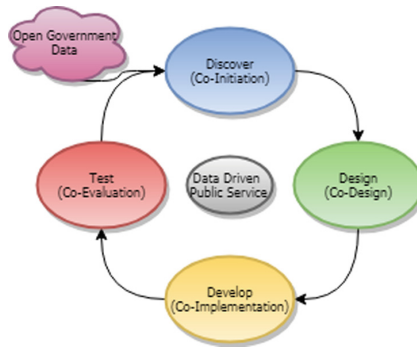


Fig. 1. OGD-driven Public Service Co-Creation Framework. Source: [6]

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 public 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 Społeczna* **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., Krmar, 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)