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Governance Models for Creating Public Value in Open Data Initiatives



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Preface

In the edited book, *Governance Models for Creating Public Value in Open Data Initiatives*, we argue that most open government (OG) models are centered on three pillars – transparency, participation, and collaboration – being assumed or differently referred to in different OG initiatives around the world (Veljković et al. 2014). Transparency is a crucial ingredient of OG and, when applied to data openness, it means that the data should be well-known, comprehensible, easily accessible, and open to all (Veljković et al. 2014). Indeed, data have become a “strategic asset that should be shared with the public to increase accountability of government organs, deliver services more efficiently and stimulate economic growth” (Socrata 2016). This way, although transparency has often been viewed through the lens of government corruption (Veljković et al. 2014), now it has to be seen through the lens of collaboration and participation. To achieve this aim, the use of public information resources extends well beyond the government itself to include a very diverse multi-stakeholder society (Dawes and Helbig 2010). Thus, open data initiatives have been rising as Big Data strategies that may revolutionize local policy-making and program management.

Open data leads to an assumption of the readiness of public agencies for an opening process which considers interaction with their environment influences (debates, discourses, etc.) but also leads governments to give up control, demanding considerable transformations of the public sector (Janssen et al. 2012). In any case, the way data is stored, the way data is obtained, and the way data is used by a department are crucial indicators for open data release (Conradie and Choenni 2014). In addition, arguments in favor of open data are based on a rather simplistic and idealized view, and the transformative nature of open data is more elusive than might be expected (Janssen et al. 2012).

Thus, there is not always a direct link between open data and more participation and collaboration. This way, new types of governance mechanisms and policies are necessary in which the more evolutionary manner of steering at arm’s length is adopted (Janssen et al. 2012). The ultimate goal to achieve is the increase of public value, which is obtained making all the projects and initiatives addressed to the citizens (Moore 1995; Sorrentino and Niehaves 2010) and, by this way, involving

citizens in the public affairs of cities (Rodríguez Bolívar 2017). In addition, analysis of open data projects on a local level is needed to understand how the potential of open data can be realized (Kassen 2013).

Nonetheless, recent research suggests that open data portals do not possess important structural and organizational elements needed to fully support ordinary citizens engaged in public accountability efforts (Loureço 2015) and these portals do not take into account the complexity of democratic processes which results in overly simplistic approaches to open data platform design (Ruijter et al. 2017). In fact, new governance models based on different open data models have not been proposed up to now. This way, this book relies on the conceptual model of OG, focusing on transparency and, concretely, in open data initiatives at the local government context with the aim of improving participation and collaboration.

The importance of this book is further enhanced by the impact projects of smart cities have on the quality of life of citizens (Chourabi et al. 2012). In this respect, public value creation is considered as a main outcome of OG (Meijer and Rodríguez 2016). For this purpose, this book is appropriate and timely.

The content of this book is intended to contribute prior research on the discussion about governance models of open data initiatives to support open governments with the aim at creating public value in local governments. This way, the book contributes to the literature by filling the existing void and expanding knowledge in the field of open data and governance models. In this book, we focus on both the theory and practice of governance models in creating public value through open government, and we provide examples of innovations in local governments through their use of open government data (OGD).

There are two parts of this book. *Part I* examines *open government data theory and practice*. In this part, chapter “[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 examine open government data and public value. This 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 authors’ 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 results of their study support the propositions outlined by their framework. This research argues that those who wish to benefit from OGD-driven co-creation should consider putting a large emphasis on this stage.

In chapter “[Governing Open Spatial Data Infrastructures: The case of the United Kingdom](#)”, Glenn Vancauwenberghe and Bastiaan van Loenen analyze the governance of the UK open spatial data infrastructure, by examining the different governance instruments used in the past 10 years for governing the relationships and dependencies with non-government actors. The analysis demonstrates how governance of the open spatial data infrastructure in the United Kingdom is achieved by combining various traditional governance instruments. Although there is a growing body of literature that recognizes the importance of governance in open data and spatial data infrastructures, little is known about the different

governance models and instruments that could be used in governing open data infrastructures. This analysis revealed how the governance of the United Kingdom's SDI agenda has been aligned with the country's open data policy in many different manners. With this chapter, we get a better understanding of the governance of data infrastructures by introducing a "governance instruments" approach for describing and analyzing governance efforts in the context of data infrastructures.

In chapter "[Online Fiscal Transparency of U.S. State Governments: An Analysis Using Public Value Framework](#)", Ganapati, Purón Cid, and Reddick examine how US state governments differ in creating public value through their OGD portals. The research question is as follows: What are the factors of external authorizing environment and internal operational capability that influence state governments to adopt OGD portals for achieving the public value goal? These findings suggest that lag-gard states are left behind further every year, so the recovery path becomes much harder. This finding has a policy recommendation of implementing fiscal transparency through the OGD portals, which takes time. State governments should take efforts to implement online fiscal transparency measures early enough if they are serious about open government.

In chapter "[Towards the Open Government Ecosystem: Connecting e-Participation Models and Open Government to Analyze Public Policies](#)", de Magalhães Santos presents the results of the analysis of the open government initiative in the city of São Paulo, Brazil. The results indicate how initiatives vary in relation to the implementation of strategies, management of strategies, and their capacity to influence as policies. The result of the chapter reflects the imprecision of the open government label, making the approach more difficult to implement. Focusing on the use of data from the economic or operational perspective of an open government based on public needs underestimates the opportunity for feedback and co-creation of stakeholders for social perspective, for example. Openness stimulus to government participation and accountability focused on the social, political, and institutional outlook of open government is sometimes confused with simple access to information or discouraged by the lack of government feedback. The author argues in practice that much less has been accomplished than the rhetoric about open government.

Part II of this book is called *Open Government Data and Smart Cities and Government*. In chapter "[The Role of Open Data in Smart Cities: Exploring Status in Resource-Constrained Countries](#)", Dinah, Lefika, and Joseph explore the status of realization of the different types of open data in the realm of smart cities, as well as the different challenges that can be met in the implementation cycle of open data in smart city environments. This chapter looked at the fundamental concepts of open data in the realm of smart cities and has developed a conceptual framework that can be used to overcome glaring limitations and challenges of open data implementation in developing world contexts. One of the conclusions is that the challenge in wider penetration of open data in smart cities is a lack of awareness among the general populace on how to explore the different capabilities and benefits of smart cities.

In chapter “[Open Government Initiatives in Spanish Local Governments. An Examination of the State of the Art](#)”, Muñoz, Bolívar, and Arellano analyze the efforts made by the Spanish municipalities regarding the implementation of the OG initiatives with the aim at getting an overview of how these initiatives have been put into practice to increase the level of openness in these governments. Findings indicate that Spanish municipalities seem to be at the beginning of the process of OG implementation into their management processes. Also, these OG initiatives have not been addressed to promote more democratic governance models in sample municipalities. In any case, findings of this paper denote that sample Spanish municipalities are implementing bureaucratic and/or collaborative models of governance using OG initiatives embedded only in traditional or historical models of taking decisions in local governments. Spanish municipalities are using OG initiatives for supporting and enabling bureaucratic practices. Nonetheless, the introduction of new technologies into the public sector environment opens new ways of governance and interactions with stakeholders that should be implemented into municipalities for more democratic societies and for improving the citizen-centric services, which could help in achieving better outcomes and improving the quality of life.

In chapter “[Empowering Communities and Improving Public Services Through Open Data: South African Local Government Perspective](#)”, Bvuma and Joseph in an extensive literature review explored scholarly sources, policies, and strategy documents from both the public and private sectors. This chapter aims to provide a deeper understanding of the role of open data by local municipalities in South Africa. It will briefly discuss the importance of open data to local government in order to benefit its community especially in the realm of contemporary public governance models and the ways of promoting citizen participation and, most importantly, offer necessary aspects for municipal officials to consider before formalizing transparency policies. Open data plays an important role in local government and benefits communities and has potential to increase the key principles of transparency, participation, accountability, and the adoption of technology and innovation, thus promoting good governance. In order to promote participation of citizens in the decision-making processes, local government has an obligation to promote effective communication between local government department units and the citizens. Further, local government departments are mandated to promote increased participation of citizens in the decision-making processes.

In chapter “[Blockchain for Open Data – Exploring Conceptual Underpinnings and Practice](#)”, Joseph examines blockchain for open data. Blockchain has been used as a lever for enforcing accountability and responsiveness in different contemporary information and knowledge management environments. This author argues that the core principle of blockchain is that it promotes the use of technology tools and platforms to achieve anonymous vetting of integrity for different types of information. The chapter discusses formulaic definitions and concepts surrounding blockchain and open data with a special focus in the integration of the two concepts for practical application in real-world environments. Joseph’s key

argument is that exploring the formulaic underpinnings of blockchain and open data will open up avenues for consolidating their usage into the different contextual socioeconomic setups.

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References

- Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., ... & Scholl, H. J. (2012). Understanding smart cities: An integrative framework. In *System Science (HICSS), 2012 45th Hawaii International Conference on* (pp. 2289–2297). IEEE.
- Conradie, P., & Choenni, S. (2014). On the barriers for local government releasing open data. *Government Information Quarterly*, 31, S10–S17.
- Dawes, S. S., & Helbig, N. (2010). Information strategies for open government: Challenges and prospects for deriving public value from government transparency. In *International Conference on Electronic Government* (pp. 50–60). Springer: Berlin, Heidelberg.
- 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.
- 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.
- Lourenço, R. P. (2015). An analysis of open government portals: A perspective of transparency for accountability. *Government Information Quarterly*, 32(3), 323–332.
- Meijer, A., & Rodríguez Bolívar, M. P. (2016). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences*, 82(2), 392–408.
- Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard university press.
- Rodríguez Bolívar, M. P. (2017). Governance models and outcomes to foster public value creation in smart cities. In *Proceedings of the 18th Annual International Conference on Digital Government Research* (pp. 521–530). ACM.
- Ruijter, E., Grimmelikhuisen, S., & Meijer, A. (2017). Open data for democracy: Developing a theoretical framework for open data use. *Government Information Quarterly*, 34(1), 45–52.
- Socrata (2016). 2016 Socrata open data benchmark study. Retrieved 17 Dec 2017, from <https://socrata.com/webinar/2016-open-data-benchmark-report/>
- Sorrentino, M., & Niehaves, B. (2010). Intermediaries in E-inclusion: A literature review. In *System Sciences (HICSS), 2010 43rd Hawaii International Conference on* (pp. 1–10). IEEE.
- Veljković, N., Bogdanović-Dinić, S., & Stoimenov, L. (2014). Benchmarking open government: An open data perspective. *Government Information Quarterly*, 31(2), 278–290.

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Part I
Open Government Data Theory and
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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 project¹, 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).

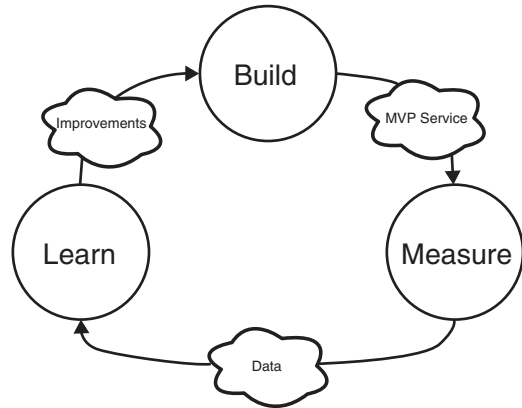
The term co-creation is tightly linked to Elinor Ostrom's concept of co-production, but also has strong roots in service management theory (Osborne et al., 2016). Recently, the up-and-coming public administration paradigm of New Public Governance has embraced co-creation as an imperative part of its 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; Ruijter 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

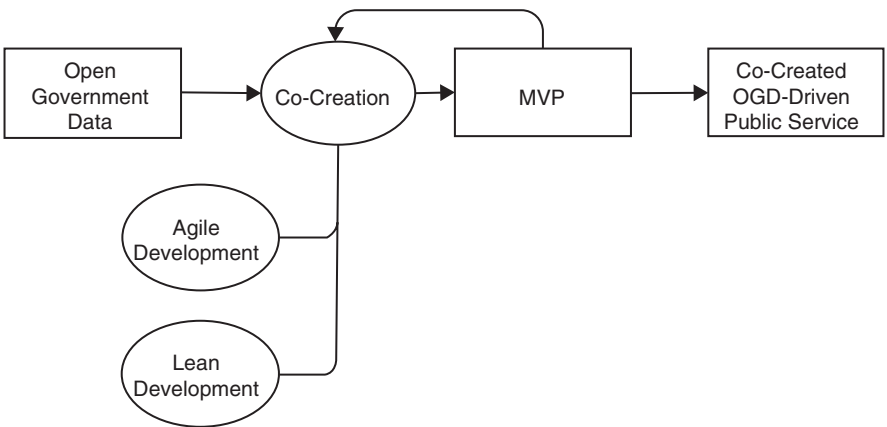


Fig. 2 Overview of framework components. (Source: authors)

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:

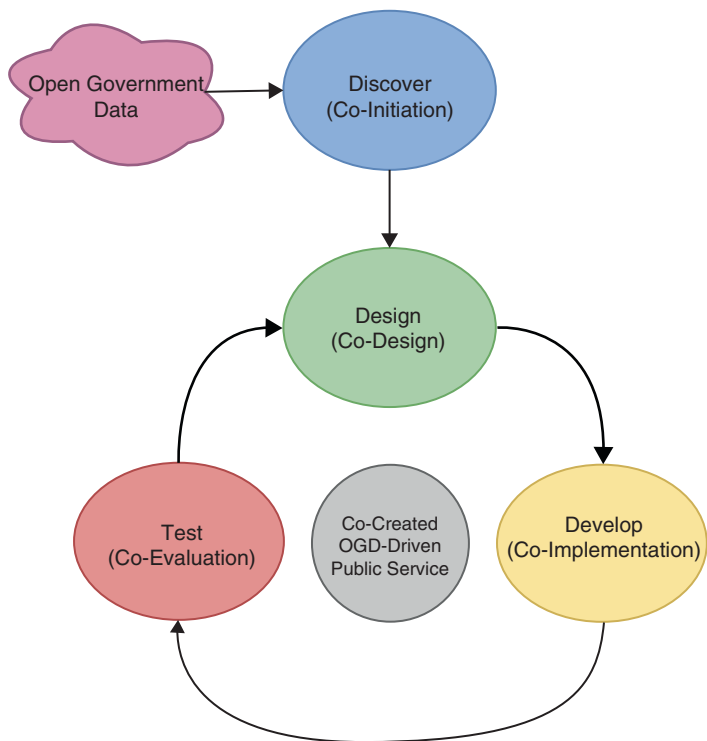


Fig. 3 Co-created OGD-driven public service cycle. (Source: authors)

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	How was the service creation process implemented? What steps did it involve?
	Proposition 4	
	Proposition 5	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?
	Proposition 6	
		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 Policy*, 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 Policy*, 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., & Androutopoulou, 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., Vidasovab, L., Parkhimovich, O., Dawesa, S., Vidasovab, L., Parkhimovich, O., Dawes, S. S., Vidasova, 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.
- Ruijter, 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.

Governing Open Spatial Data Infrastructures: The Case of the United Kingdom



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Abstract In order to facilitate and coordinate the sharing of spatial data, governments worldwide have been developing Spatial Data Infrastructures (SDIs) for many years. Recently, technological, institutional and societal developments have caused these SDIs to shift towards more open infrastructures in which non-governmental actors are embraced as key stakeholders of the infrastructure. This move towards more open SDIs created additional challenges related to the governance of the infrastructure and required the implementation of new and additional governance approaches and instruments. This chapter analyses the governance of United Kingdom's open spatial data infrastructure, by examining the different governance instruments used in the past 10 years for governing the relationships and dependencies with non-government actors. The analysis demonstrates how governance of the open spatial data infrastructure in the UK is achieved by combining various traditional governance instruments such as strategic management, joint decision-making, allocation of tasks and competencies, market-based governance and interorganizational culture and knowledge sharing.

1 Introduction

Since the 1990s, public authorities in all parts of the world have invested considerable resources in the development of spatial data infrastructures. A spatial data infrastructure (SDI) refers to the collection of technological and organizational components oriented towards facilitating and coordinating spatial data sharing (Vancauwenberghe et al. 2014). Spatial data, i.e. data that refer to a location on the earth, are of increasing importance for the execution of governmental tasks. The original focus of most SDI developments worldwide was on promoting and stimulating data sharing within the public sector. Logically, governments were the central

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actors in the development and implementation of SDIs, since they were and still are the major producers and users of spatial information (Janssen 2010). Sharing of spatial data was arranged by various types of arrangements, including individual arrangements between data providers and data users but also more overall data sharing arrangements between multiple providers and users. Besides the heterogeneity of sharing arrangements and licencing models, in many cases, also several restrictions were applied on the access and use of the data, especially for commercial purposes.

Recently, technological, institutional and societal developments have caused these SDIs to shift towards more open infrastructures in which businesses, citizens and other non-governmental actors are also considered as key stakeholders of the infrastructure (Vancauwenberghe and van Loenen 2018). In these open spatial data infrastructures, spatial data became available as open data, i.e. data anyone can freely access, use, modify and share for any purpose, and non-government actors became more actively involved in the governance and implementation of the infrastructure. While governance has always been a crucial component in the development of SDIs, open spatial data infrastructures created additional challenges related to the governance of the infrastructure, as new and additional governance approaches and instruments had to be implemented to manage the relationships and dependencies between the involved actors and organizations.

Although there is a growing body of literature that recognizes the importance of governance in open data and – spatial – data infrastructures, so far little is known about the different governance models and instruments that could be used for governing open data infrastructures (Lämmerhirt 2017). This chapter aims to contribute to the existing literature on governance of open data infrastructures, and especially to empirical advancement in the domain, by investigating the governance of the open spatial data infrastructure in the UK. Both in the development of the national SDI and in the implementation of open data policies, the UK has always been considered among the world's leading countries. According to Masser, the UK was among the 11 countries worldwide which together constituted the so-called first generation of national spatial data infrastructures (Masser 1999). This first generation of SDIs, which also included the Netherlands and Portugal as European countries, refers to the first national initiatives to coordinate the use and exchange of spatial data. Also in the development and implementation of an open data agenda, the UK has always been seen as one of the pioneers and leaders worldwide. Driven by both political and societal demands, and preceded by several policy reports and studies, the UK started with the implementation of its open data agenda around 2009, with the launch of data.gov.uk as a single online access point for public data and the creation of a government-wide licence as the first most visible realizations.

This chapter will investigate how in the past 10 years different governance instruments have been adopted and used for the governance of the open SDI in the UK. The chapter will analyse the different actions taken and initiatives implemented to actively involve non-government actors in the realization of an open SDI in the UK.

The chapter follows a governance instruments approach as introduced by public administration researchers to analyse coordination and governance in the public sector. In the next section of this chapter, a brief introduction is provided to the concept of – open – spatial data infrastructures. The third section discusses the existing literature related to the governance of SDIs and introduces the conceptual framework that will be used for the analysis of the governance of the UK open SDI. The fourth section of this chapter provides a description and analysis of the adoption of different instruments for governing open spatial data in the UK. The fifth section provides a discussion of the main results and findings of our analysis. The chapter ends with a conclusion in which we summarize the main findings.

2 Realizing Open Spatial Data Infrastructures

Spatial data, also called location data or geographic data, is a critical resource for governments to fulfill their tasks, as most activities and processes in the public sector are in one way or the other linked to a location (Dessers 2012). Compared to other types of government data, spatial data is special in that it refers to a location on the earth (Van Loenen 2006). Typical examples of spatial data that are used and managed within government are address data, topographical data, data on properties, hydrographical data, administrative boundaries and road data. A key characteristic of spatial data is its potential for applications in different domains and applications. As a result, considerable savings can be realized by sharing spatial data. Sharing spatial data also contributes to improving the quality of these data and in some cases is the only manner to get access to certain data. Since the beginning of the 1990s, countries and public authorities have been developing SDIs to promote, facilitate and coordinate the sharing of spatial data. These SDIs consist of different technological and organizational components enabling spatial data sharing. Examples of technological components are metadata, standards, access networks and spatial datasets, while funding, policies and governance are seen as the main organizational components of an SDI (Global Spatial Data Infrastructure 2012).

In Europe, the Directive establishing an infrastructure for Spatial Information in the European Community (INSPIRE) of 2007 had an important impact on the development of national SDIs (European Commission 2007). INSPIRE aims to overcome several barriers affecting the availability and accessibility of spatial data, through the development of a European SDI, which will be based on the creation, operation and maintenance of the national SDIs established and operated by the EU Member States and other European countries. The INSPIRE Directive requires public authorities to publish all spatial data related to the environment according to specific technical and non-technical specifications. For each dataset, metadata should be created and made accessible through discovery services, view and download services should be put in place making it possible to view and download the data, and data should be conform to the INSPIRE data specifications. Moreover, public authorities should adopt measures for the sharing of spatial datasets and

services, and the status of implementation and use of the infrastructure should be monitored and reported.

For a long time, the main focus of most SDI developments, not only in Europe but also in other parts of the world, was on promoting and stimulating data sharing within the public sector. Also the primary aim of INSPIRE was to create a European SDI for enabling the sharing of environmental spatial data among public sector organizations, within and between member states and especially between EU Member States and the European Commission. Whereas several authors suggested and explored the introduction of a new generation of SDIs and the need to redefine or expand the SDI concept, the concept of open spatial data infrastructures was introduced only very recently to characterize and describe ongoing developments towards making SDIs open to non-government actors (Vancauwenberghe and van Loenen 2017). The development and implementation of an open SDI is about making spatial data available to the public as open data, but also about organizing and governing the infrastructure in an open manner, enabling and stimulating the participation of non-government actors. Open spatial data infrastructures involve the application of the principles of open data to spatial data, and making available spatial data for free to all potential users. This means spatial data should be licence-free, machine processable and released in timely manner to the widest range of users in an open format (OpenGovData 2016). On the other hand, open SDIs also encourage and facilitate the participation of non-government actors in the governance and implementation of the infrastructure (Vancauwenberghe and van Loenen 2018). Open SDIs require that appropriate processes, methods and tools are put in place that stimulate and enable non-government actors to add their own datasets and other components to the infrastructure. Moreover, open SDIs also allow the participation of organizations and actors outside government in the governance of the SDI. This means the scope of traditional governance structures, mechanisms and processes has to be expanded, in order to engage different stakeholder groups, including data users and producers outside the public sector, and take into account their needs and requirements (Vancauwenberghe and van Loenen 2017).

3 Analysing Governance

Open SDIs involve and affect various stakeholders from different sectors and domains, including not only public authorities and decision-makers within government but also businesses, citizens, researchers, non-profit organizations and many other non-government actors and organizations. The effective development and implementation of these infrastructures requires governance, which includes the structures, policies, actors and institutions by which the SDIs are managed through decisions on producing, accessing, sharing, exchanging and using spatial data. Lacking of ineffective governance will lead to typical governance problems, such as gaps, duplications, contradictions and missed opportunities (Bouckaert et al. 2010). Masser was one of the first authors recognizing the emergence of more complex and

inclusive models of governance to cope with the multi-level nature of implementations of the new generations of SDI (Masser 2006). The creation of appropriate SDI governance structures that are inclusive and understood and accepted by all stakeholders should be key priority in the future implementation and success of SDIs. Governance of SDIs also requires expanding the scope of stakeholders to include the private sector, research bodies and other actors outside the public sector, to actively promote bottom-up and participatory processes and to find the appropriate mechanisms and instruments to enable the participation of these non-government actors (Georgiadou et al. 2005; De Kleijn et al. 2014). Only few studies have investigated the governance of SDIs as a whole in any systematic way, and there has been no detailed investigation of the governance of more open forms of spatial data infrastructures (Coetzee and Wolff-Piggott 2015; Box 2013; Lance et al. 2009).

In public administration research and practices, the topic of governance has received considerable attention (Meuleman 2008). Although the term governance is defined and used in many different ways, different uses and definitions of governance all refer in some way to ‘the means for achieving direction, control, and coordination of wholly or partially autonomous individuals or organizations on behalf of interests to which they jointly contribute’ (Lynn et al. 2000). Increasing interdependencies between actors or organizations, at many levels and in different directions, are the main reason why governance is needed (Kooiman 1999). New ways of governance are needed because current problems and challenges governments are facing have become complex and require the involvement of many different actors from multiple sectors. Since governance can be defined and addressed in different manners, also many different approaches for analysing governance exist (Ansell and Torfing 2016). Some authors focus on the processes of governing and the role different government, private and civil society actors play in these processes. Other researchers emphasize the interactions between actors, jurisdictions, administrative levels and institutional arenas for exchange ideas, coordinate actions and strengthen collaboration. Some governance analyses focus on the level of governance and its impact and effects on solving particular societal problems; others analyse how governance changes through time or can be different across sectors or countries. In certain cases, several of these approaches are combined.

In this chapter, the approach introduced by Verhoest et al. for describing and analysing trajectories of specialization and coordination in the public sector is followed (Verhoest et al. 2007). Verhoest et al. focus on the instruments – and underlying mechanisms – that are adopted to enhance the alignment of tasks and efforts of organizations within the public sector. Building further on existing research and literature on coordination in the public sector, a classification is made of instruments for coordinating and governing the relationships between public bodies. The typology of Verhoest et al. includes management instruments, such as strategic planning and evaluation, financial management, culture and knowledge management and mandated consultation or review systems, and structural instruments, such as reshuffling of competences and/or lines of control, establishment of coordinating functions or entities, regulated markets, systems for information exchange, negotiation bodies and advisory bodies, entities for collective decision-making, common

organizations and chain management structures. While various other approaches and methods for analysing governance exist, the instrument-based approach of Verhoest et al. has several strengths that make it a valuable approach for our investigation. The approach focuses on a broad range of instruments that can be used for managing the relationships and dependencies between different stakeholders and allows to analyse how the use of these instruments changes through times. When applying the approach on multiple countries, differences between countries can effectively be revealed and further explored. Although the approach is less suitable for analysing the underlying governance processes or more informal governance mechanisms, it is especially useful to gain insight in the overall governance approach adopted in one or multiple countries.

Since some of the instruments proposed by Verhoest et al. are related to each other, they can be categorized into several sets of coordination instruments, in order to emphasize the connections between the instruments and analyse the connected instruments jointly. In total, five main sets of governance instruments can be identified: (1) instruments for strategic management, (2) instruments for collective decision-making, (3) instruments for allocating tasks and responsibilities, (4) instruments for creating markets and (5) instruments for interorganizational culture and knowledge management. *Instruments for strategic management* aim to align the activities of involved actors through a system of different and interconnected levels of plans, objectives and targets. They consist of strategic planning instruments, in which the objectives and necessary actions are defined, and strategic evaluations, in which the implementation of these strategies and associated actions plans is monitored and evaluated. *Instruments for collective decision-making* are about involving different stakeholders in decision-making on the infrastructure. They not only include entities for collective decision-making but also advisory bodies, public consultations and other instruments through which stakeholders can participate in the decision-making process. A third set of instruments deals with *the division of tasks and responsibilities among different stakeholders*. Governance can be realized through the assignment of related tasks to one single organization or through the division of tasks among different organizations. Two main instruments to do this are the establishment of coordinating entities and the (re-)assignment of tasks and competences among stakeholders. Another way of governing data infrastructures is through the *use of market-based instruments*. This refers to the creation of a market where producers and users can meet and data can flow from producers to users without obstacles. A fifth and final set of governance instruments are *the instruments for interorganizational culture and knowledge management*, which are related to human resources as a key component of data infrastructures. The creation of shared visions, values and knowledge between actors and organizations can enhance the governance of the infrastructure. To realize this, several instruments can be adopted, including guidance and support documents, awareness raising and interorganizational communication and training and capacity building.

To analyse the governance of the open SDI in the UK, data was collected on the adoption of each of these five sets of governance instruments in the country in the past 10 years. The data collection processes consisted of two main stages. The first

stage was a document analysis of different documents on spatial data and open data in the UK. Documents were selected, screened and categorized and information was derived on the implementation of each set of governance instruments. Two main types of documents were taken into account. The first and main source of information were policy documents, including strategies, policy reports, guidance documents but also information published on the websites of government organizations in the UK. The second type of documents included in the analysis were existing studies on the UK spatial data infrastructure and on open data in the UK. In the second stage of the data collection, in-depth interviews were carried out with 12 key experts and stakeholders involved in UK's spatial data and open data policies. These included current and former employees from government organizations such as the Department for Environment, Food and Rural Affairs (3 interviewees), Cabinet Office (2), the National Archives (2) Ordnance Survey (1), the Local Government Association (1) and HM Land Registry (1) but also representatives from the private sector (1) and the spatial data user community (1). The semi-structured interviews were organized around the five sets of governance instruments: strategic management, joint decision-making, allocation of tasks and responsibilities, market-based governance and interorganizational culture and knowledge management. The interviewees provided information on the adoption of each of these instruments in the development of the open SDI in the UK, on their personal involvement in the implementation and use of these instruments and on the impact and effectiveness of these instruments. The main unit of analysis was the infrastructure as a whole, and the governance of the infrastructure was central in the analysis. Therefore, the focus of the interviews was on instruments that determined or influenced the actions of different organizations involved in the infrastructure and less on the behaviour of single actors.

4 Governance of the UK Open Spatial Data Infrastructure

The realization of an open SDI deals with aligning and reconciling the needs and interest of different stakeholders. In this section, the conceptual framework of five sets of governance instruments is used to describe the governance of the open SDI in the UK.

4.1 Strategic Management

Strategic management is a strongly adopted practice in the UK for governing the national SDI. In the past 10 years, several strategic and policy documents have been created in order to plan, design and steer the open spatial data infrastructure. In 2008, the UK Location Strategy was released, which still is the major strategic document on spatial data and information in the UK (UK Geographic Information

Panel 2008). The UK Location Strategy was prepared by the Geographic Information Panel, an advisory body delivering high-level advice on spatial information issues, which not only represented government but also other key interest groups in the private sector and the wider spatial information industry across the UK. To support the formalization of the strategy, also a consultation was organized, through which various stakeholders could contribute to the development of the strategy. The UK Location Strategy calls for a strategic approach on the collection and management of spatial data in the UK, in order to maximize the value of the use of spatial data to the public, government and industry and deliver benefits to each of these groups. In the strategy, five main areas that require further actions are identified: knowledge on what data are available, the use of common reference data, the establishment of a common infrastructure for sharing information, the availability of essential skills and knowledge and the importance of strong leadership and governance. Both in its content and in the way it was developed, the UK Location Strategy contributes to a more open SDI in the UK.

During the process of developing the UK Location Information Strategy, which took place between 2006 and 2008, the 'Power of Information Review' was commissioned in 2007 by the Minister for the Cabinet Office with the aim to explore new developments in the use of citizen- and state-generated information in the UK (Mayo and Steinberg 2007). The 'Power of Information Review' report recommended a strategy in which the UK government should make available government-held information and engage with users and innovators that could benefit from using this information. In the Review, spatial information was mentioned as among the most desirable information for people who re-use information to build new tools and services, as it allows to link and integrate disparate information. One of the recommendations made in the report particularly focusing on spatial information was to allow non-commercial experimentation with Ordnance Survey's mapping data. Recommendations were also made on the introduction of non-commercial re-use licences for government information and on the consistent application of a marginal cost pricing policy for raw information by all public bodies. Since both recommendations were included in the UK Location Strategy, there was some alignment between the Power of Information Review and the Location Information Strategy.

After the release of the Power of Information Review, the UK government established the Power of Information Task Force to further investigate and develop the agenda set out in the Review. The Task Force released its own report in March 2009, in which a call was made for actions in six areas in which significant improvements could be made in the use of digital technologies by government (Power of Information Task Force 2009). One of these six areas focused on freeing up the UK's mapping and address data for use in new services. While the report recognized the richness of geospatial datasets in the UK public sector, it was stated that especially the Ordnance Survey required urgent reform. This reform should include several elements: basic spatial data should be available for re-use and free of charge to all; there should be simple, free access to general mapping and address data for modest levels of use by any user; and licencing conditions should be simplified and

standardized and not depend on the intended use or the intended business model of the user. Also the creation of a freely available single definitive address and postcode available for the UK for (re)use was proposed in the report of the Task Force.

Also in later stages of the UK's open data agenda, the importance of spatial data was recognized in various strategic and policy documents. In December 2009, 5 months before the 2010 General Election, the UK government of Prime Minister Gordon Brown presented the 'Putting the Frontline First: Smarter Government' document, an Action Plan for improving public services while reducing public expenditure (Great Britain HM Treasury 2009). One of the key actions announced in the plan was to radically open up data and public information in order to promote transparent and effective government and social innovation. It was stated that over a thousand public datasets would be made available free for re-use and accessible through a single point of access for government-held data, also including spatial data such as mapping data from Ordnance Survey, public transport data and weather data. After the change of government in 2010, the open data agenda was picked up by the new coalition government. In 2012, the Cabinet Office published the 'Open Data White Paper: unleashing the potential' setting out a range of commitments on which the UK's open data policy was built (Cabinet Office 2012). In the White Paper, the UK Location Programme, under which the UK Location Strategy and the INSPIRE Directive were implemented, was mentioned as one of the high-profile data release initiatives in the UK. The latest policy document on open data is the 2017 'Government Transformation Strategy: better use of data' in which nine priorities were identified to enable better use of data by addressing the technical, ethical and legal issues (Cabinet Office and Government Digital Service 2017). The Government Transformation Strategy explicitly mentions spatial data as among the most important data in a modern digital economy, and states that in the UK high-quality spatial data is available for consumption in a wide range of formats.

A key element in the strategic management of policies, besides planning the policy activities, is monitoring and evaluating the level of implementation and the degree to which predefined objectives have been realized. In the UK, various actions and initiatives to monitor and evaluate the status of the – open – SDI have been executed. Similar to other European countries, the status of the UK SDI is monitored as part of the INSPIRE Monitoring and Reporting obligations, in which EU Member States have to provide information on indicators on the status of INSPIRE/SDI implication in their country as well as report on different aspects of the infrastructure. Since 2010, the UK yearly submitted its list of spatial datasets and services under the scope of INSPIRE, including information on the different indicators for monitoring the status of INSPIRE implementation and three official country reports. In addition to the monitoring and reporting as part of the INSPIRE obligations, the UK also implemented various other evaluation activities. As part of the UK Location Programme, a Benefits Realization Strategy has been developed, in which a set of indicators is defined to measure the status and success of the UK Location Programme (Jones and Wilks 2012). These not only include indicators related to the data, such as the discoverability, accessibility and usability of the data,

but also indicators related to the awareness of the programme and skills development. Particular attention is also paid to measuring and estimating the end benefits arising from the UK Location Programme, which were divided into benefits related to cost avoidance and benefits resulting from the better use of data. In addition to the Benefits Realization Strategy of the UK Location Programme, also other actors such as Ordnance Survey and the Local Government Association initiated initiatives to measure and monitor the benefits of spatial data.

4.2 Decision-Making Structures

Among the primary instruments used in the governance of the SDIs is the creation of decision-making bodies to enable joint decision-making among stakeholders on the development and implementation of the infrastructure. Since these bodies could be used to actively involve non-government actors in the decision-making process, they could contribute to the realization of a more open SDI. In the UK, several decision-making and advisory bodies have been put in place to enable joint decision-making on spatial data and open data policies. Already in the 1990s, the initiative was taken to enable the participation of non-government actors in decision-making on geospatial data and SDI in the UK, with the so-called National Geospatial Data Framework. After a few years, however, the National Geospatial Data Framework and its governance structure, consisting of the NGDF Board representing data producers from both the public and the private sector and a separate advisory council, were abandoned. Via the membership of several representatives from the private and academic sector in the Geographic Information Panel, non-government actors were strongly involved in the preparation of the UK Location Strategy. The UK Location Strategy itself highlighted the importance of clear leadership and strong, authoritative and cross-cutting governance to drive the implementation of the strategy and proposed the creation of several governance bodies.

The UK Location Council became the central body providing strategic coordination to and overseeing the implementation of the UK Location Strategy. The participation of non-government actors in the UK Location Council was very limited, since the members of the Council mainly were representatives from major government organizations involved in the production and use of spatial data. It was only through the participation of a representative from the Association for Geographic Information (AGI), the UK spatial membership body representing the interests of the UK's GI industry, that non-government actors were represented in the Council. However, to support the work of the UK Location Council, several other bodies were put in place, in which also non-government representatives could participate. In the Location Information Interoperability Board, which addressed the aspects of the technical and business interoperability of the SDI, mainly interoperability and standards experts are involved. The participation of private, academic and third sectors in the development of the spatial data infrastructure especially took

place in the UK Location User Group, an advisory group that monitored the UK Location Programme to ensure user needs were met and value is delivered to users of the SDI. Among the sectors represented in the UK Location User Group were the geo-industry, academia, media, transport, insurance, retail and various others. Through the UK Location User Group, these sectors were kept informed about the progress of the UK Location Programme. In addition, the User Group also provided advice to the Location Council on user's key strategic concerns, identified several useful case studies, and contributed to the testing of the provided services. In that way, the UK Location User Group was an important instrument for enabling the participation of non-government actors in decision-making on the UK SDI and making this SDI more open.

After review of the UK Location Programme in 2013, the governance and decision-making structure radically changed. The UK INSPIRE Compliance Board became the main decision-making body, replacing the UK Location Council. As its name suggests, the focus of this new board was on monitoring and ensuring different government organizations were meeting the INSPIRE obligations and the UK SDI was INSPIRE compliant. The UK INSPIRE Compliance Board was assisted by the Architecture and Interoperability Board (AIB), a technical expert board which oversees and drives the implementation interoperability standards and practice guidelines. Although non-government actors no longer were formally involved in the governance structure, they could participate in the working group under the Architecture and Interoperability Board and were engaged with on certain implementation issues.

Throughout the years, also several bodies have been established to involve different experts and stakeholders in the development and implementation of UK's open data policy. The Power of Information Task Force, which was established in 2008 and recommended to open the UK's mapping and address data for use in new products and services, was one of the first initiatives to allow non-government actor experts to participate in and provide advice on open data. Among the first actions on open data of Prime Minister Cameron was the establishment of the UK Public Sector Transparency Board, which was chaired by the Minister for the Cabinet Office and brought together a mix of public servants and data experts, also from outside government. In 2012, the Minister for the Cabinet Office created the Open Data User Group (ODUG), with the aim of gathering views of open data users and re-users on the release of open government data. The Open Data User Group, in which mainly representatives from the private, academic and non-profit sector participated, provided evidence-based advice to the UK Government to make the case for the release of public sector data as open data. The Open Data User Group also investigated, collected evidence on and provided recommendations on the release of several spatial datasets, including an open national address dataset, the Land Registry (HMLR) INSPIRE Index Polygons Dataset, and data from Ordnance Survey (OS). Similar to the SDI governance and decision-making structure, also some significant changes took place in the open data governance structure. After the general elections of 2015, the mandate of the Open Data User Group was not

renewed, while the Data Steering Group, a new high-level strategic board, took over the tasks of the Transparency Board. In addition, a new governance body within government was established, the Data Leaders Network, made up of the data leaders of the different government departments, and aimed to ensure a consistent approach to the use and management of data across government to enable the delivery of government policy and operational objectives.

4.3 Allocation of Tasks and Responsibilities

A third commonly adopted instrument for dealing with governance challenges is the division of tasks and competences among existing and sometimes also newly established organizations. The establishment or assignment of a coordinating institution is one of the most used governance instruments, also in the development of national – open – SDIs. With the launch of the UK Location Programme, the Department for Environment, Food and Rural Affairs (DEFRA) became in charge of coordinating the implementation of the UK spatial data infrastructure, as a UK Location Programme team was established at DEFRA to lead the programme. After the review of the UK Location Programme and the decision to focus UK's spatial policy on ensuring compliance with INSPIRE, DEFRA still remained in charge of the UK INSPIRE programme, but the size of the team working on the SDI was radically reduced. In its work as coordinator of the national SDI and INSPIRE, DEFRA was supported in the development of different – technical – components by several government organizations, such as Ordnance Survey and Cabinet Office. Cabinet Office was the central actor in the preparation, development and implementation of the open data agenda. Cabinet Office instituted several decision-making and consultation bodies and published several key strategic and policy documents on open data. The Cabinet Office also led the implementation of the open data portal, data.gov.uk, which also was used for the publication of spatial datasets. Another important actor in the first years of UK's open data policy was the National Archives, developing the UK Open Government License, which also was used for spatial data.

The identification of spatial datasets has been a central element in UK's spatial data and open data policy. In line with the requirements of INSPIRE, the UK Location Strategy stated that all public sector organizations should record and maintain up-to-date details of its spatial datasets, and make the details of its spatial data publicly available. As part of the INSPIRE Monitoring and Reporting obligations, the UK submitted its first list of datasets corresponding to the data themes of INSPIRE in 2010. The list contained 258 datasets and 25 services, from more than 30 different data providers. Data providers with the highest number of reported datasets at that time were the British Geological Survey, Ordnance Survey and the Environment Agency. The first INSPIRE Country Report, also released in 2010, contained an identification of different stakeholders, including their roles in the UK

Location Programme (UK Location Programme Team 2010). More than 50 different stakeholders and stakeholder groups were identified. Possible roles included not only users and data providers but also facilitators, funders, infrastructure providers, governance actors and political actors. After 2010, the number of reported datasets strongly increased, from around 1100 datasets in 2012, over 5643 in 2014, to almost 20,000 in 2016.

Also throughout the implementation of UK's open data agenda, several efforts have been made to identify and prioritize datasets to be released. In various strategic and policy documents, several spatial datasets, and especially Ordnance Survey's data, were acknowledged among the most valuable government data that should be made open. In 2012, the central government departments were requested to publish their own open data strategy, in which commitments had to be made on the release of data over the next 2 years. In the context of the National Information Infrastructure initiative, an attempt was made to identify and collate the data held by the government which are likely to have the broadest and most significant economic impact if made available and accessible outside of government (Cabinet Office 2013). After a collaborative process in 2013 for identifying data that should be included in the National Information Infrastructure, also several spatial datasets were recognized as data to be included in the Infrastructure. Despite efforts to relaunch the National Information Infrastructure initiative in 2015, the actual creation of such an information infrastructure never materialized.

Also the involvement of non-government actors, such as businesses, research institutions and other organization, in implementing the SDI and the assignment of particular tasks and responsibilities to these organizations is an element of the governance of an open SDI. In the UK, various non-government actors actively contributed to the development and implementation of an open SDI. Besides its participation in various governance bodies, the Association for Geographic Information organized several awareness raising events and workshops on the UK Location Programme and INSPIRE. AGI also played a major role in the development of the UK GEMINI standard for describing metadata. Since a significant amount of spatial data are collected and managed by local authorities, the UK Local Government Association encouraged and provided support to many local authorities to make their data INSPIRE compliant and release their data as open data. In the open data domain, the Open Knowledge Foundation contributed to the development of data.gov.uk, as the single access point for government data, and provided support to civic society and the third sector to use open data. Also the Open Data Institute, founded in 2012 and co-funded by the government's Technology Strategy Board, is an important non-government actor in the UK open data ecosystem. The Open Data Institute trains civil servants and businesses to work with data, provides policy and strategy advice to government and business, supports and encourages data start-ups, creates tools which enable better publishing and use of open data, and carries out research into data needs, business models and data use. Moreover, the UK is characterized by the strong presence and involvement of individual experts in the development and implementation of the open data and spatial data agenda.

4.4 *Market-Based Governance*

The fourth set of governance instruments for realizing a more open SDI on the creation of a ‘market’ where producers and users can meet and data can flow from producers to users without obstacles. Key instruments for enabling such markets where providers and users of spatial data could meet are the development of data portals, the development and adoption of national licence frameworks and the use of financial resources to steer or influence the behaviour of actors.

One of the first components implemented as part of the UK’s open data programme was data.gov.uk, the single access point for government data. In 2009, a first beta version of data.gov.uk was launched, which became publicly available in the beginning of 2010. By the end of 2010, around 5600 datasets were published on data.gov.uk, by late 2011 this number increased to 7600, and at present, data.gov.uk contains almost 40,000 published datasets, from approximately 1400 different publishers. While most countries decided to develop their national open data portal and their geoportal separately, the UK Location Council decided in 2010 to deliver all geoportal facilities through data.gov.uk, providing a one-stop shop for all government data. As a result, the scope of data.gov.uk was broadened to also include *non-open* government data. To support the discovery of and access to spatial datasets, also some additional geospatial tools had to be implemented. Ordnance Survey, Cabinet Office and the UK Location Programme team at DEFRA collaborated to implement the map-based tools allowing users to search and preview spatial datasets on data.gov.uk. While individual data providers were responsible for creating and maintaining metadata for their spatial datasets, these metadata were harvested from these publishers by data.gov.uk. The harvested metadata can be searched and previewed on data.gov.uk, and are published to the EU via a discovery service.

Another often-adopted instrument for removing the barriers in searching for and accessing data is the adoption of standard – open – licences. The development and adoption of the UK Government License (OGL) was an important element of the UK Open Data strategy. The Open Government Licence was developed in 2010 by the National Archives, and became the recommended licence for all information covered by Crown copyright and database rights published by the UK government. The introduction of the OGL was supported by a UK Government Licensing Framework, which set it within the overall context of the government’s policy on licencing and the re-use of public sector information. While the original version of the OGL was designed to work in parallel with other internationally recognized licencing models such as Creative Commons, the current version is interoperable with Creative Commons’ Attribution 4.0 licence and is Open Definition conformant. The Open Government Licence was promoted as the default licence for public sector information. The UK Government Licensing Framework was also endorsed as the licencing framework for the use of spatial datasets covered by the INSPIRE Regulations. As of 2017, the vast majority of UK government bodies publish – spatial – data under the OGL.

The creation of central of data portals and national licence frameworks both can be considered as instruments aiming to contribute to the creation of a market place

for – open – data, were providers and users could meet. Another form of market-based governance of open data is the provision of financial support and financial incentives, to data holders, for making data openly available, but also to users, for developing new products and services on top of open government data. To support government department, agencies and local authorities to publish open data, the UK government launched the Release of Data Fund and the Open Data Breakthrough Fund. The Release of Data Fund was administered by Cabinet Office, and funded the release of specific datasets prioritized by the Open Data User Group. The Open Data Breakthrough Fund, which was administered by the Department for Business, Innovation and Skills (BIS), provided funding to central government departments and local governments to overcome short-term technical barriers to the release of data. Both funds also contributed to the release of several spatial datasets, such as flood data, biodiversity data, and planning data. The Open Data Institute made use of funding provided by the Release of Data Fund to explore the creation of an open address register, to rival the national Postcode Address File, the core reference dataset containing the postcodes of all UK addresses, which was sold off with Royal Mail and still remains paid-for.

4.5 Interorganizational Culture and Knowledge Management

A fifth set of governance instruments is related to human resources as a key component of SDIs. Also the creation of shared visions, values and knowledge between actors and organizations can enhance the governance of the infrastructure. To realize this, several instruments can be adopted, including guidance and support documents, awareness raising and interorganizational communication and training and capacity building.

Between 2010 and 2012, a series of INSPIRE Guidance documents were developed to support the development of the UK Spatial Data Infrastructure and the implementation of INSPIRE (UK Location Programme Team 2017). The first set of these guidance documents is a ‘Getting Started’ guidance series, giving a simple introduction to the UK Location Information Infrastructure and INSPIRE. Guidance on the legal and data policy issues related to the sharing and re-use of spatial data is provided under the UK Location Data Sharing Operational Guidance series, consisting of three main parts: the policy context, licencing and charging and intellectual property rights. This ‘policy context’ guidance discusses the overarching policy context and highlights the major policy and legal strands that are relevant for publishing or using spatial data. Not only the UK Location Strategy and INSPIRE are addressed, but also the Freedom of Information Regulations, Environmental Information Regulations, the Re-use of Public Sector Information Regulations, Copyright and Database Right, and the Transparency and Open Data Agenda are addressed. The guidance document on licencing and charging establishes the UK Government Licensing Framework as the basis for licencing the use of spatial datasets, further explains the policy and provides practical solutions for licencing. The guidance also describes the circumstances in which charges may be made under

the INSPIRE Regulations. The guidance document on intellectual property rights gives a general overview of intellectual property rights and contractual rights, with the aim to help ensure data publishers consider rights and confidentiality when publishing location information. In addition to these guidance documents on legal and data policy issues, there are also various guidance documents on more technical aspects, such as network services, linked data and registries. Although many of these guidance documents have not been updated since 2012, they still are available on data.gov.uk to support data providers in publishing their spatial data.

Moreover, DEFRA implemented a UK Location Helpdesk, where stakeholders could contact to gain advice and support on issues related to the implementation of the UK Location Programme and INSPIRE. Also the Local Government Association created such a helpdesk, mainly to support local authorities in implementing INSPIRE. LGA also published 'A guide to INSPIRE compliance in Local Government' to assist local authorities to comply with INSPIRE requirements (Local Government Association 2014). This short guide described a set of steps to guide and help authorities to publish data that meets INSPIRE requirements. The document also contains an indicative list of local government data topics falling under the scope of INSPIRE. In addition to this support on INSPIRE, the Local Government Association also supported local authorities to release their data, through the provision of tools, guidance and services and the promotion of best practices. Another major provider of support and guidance on open data is the Open Data Institute, through its broad offer of open data training courses and its collection of tools that help with data publishing. In collaboration with the Department of Environment, Food & Rural Affairs and funded by the Release of Data Fund, the ODI also developed the Open Data Pathway, a tool organizations could use to assess their open data maturity and get practical recommendations on how to improve.

While the guidance and support provided by DEFRA and the Local Government Association strongly focused on data holders and data providers, Ordnance Survey specifically targeted the data users and developers through its awareness raising and capacity building actions under the OS Open Data project. Several tools and resources to support developers in creating new products and applications using Ordnance Survey data are made available on the OS website. To promote and support experimenting and developing new ideas using spatial data, Ordnance Survey launched the Geovation initiative, which consists of three main pillars: the Geovation Hub, the Geovation Programme and the Geovation Challenge. The Geovation Hub is a co-working space and data lab for individuals and businesses and aspiring entrepreneurs to experiment with spatial data, collaborate, exchange ideas and get support from technical experts. The Geovation Programme is an accelerator programme for start-ups that want to create a product or business using spatial data. Participants in the programme could receive access to Ordnance Survey's data and resources and financial and technical support, and could participate in different training and network events. The Geovation Challenge aims to support and fund innovative ideas that use OS data to solve real problems in the UK. While each challenge focuses on a different issue, the winners of the challenge are

invited to participate in the 3-day Geovation Camp, where they get access to the tools and support to further develop their ideas. Since the Geovation initiative also is about providing financial support to spatial data users and developers, they also consist of some market-based governance, in combination with awareness raising and knowledge management.

5 Discussion

Several authors have noted the importance of governance in the development of spatial data infrastructures. However, only few studies investigating the governance of SDIs in a systematic way exist, and especially the governance of more open forms of SDIs has hardly been investigated to date. The research presented in this chapter was designed to systematically examine the governance of open SDIs at the national level. A case study was carried out of the governance of the open spatial data infrastructure in the UK. The conceptual framework of this study was based on a governance instruments approach as introduced by public administration researchers to analyse coordination and governance in the public sector. Our analysis demonstrated that an important challenge in the implementation of the UK open SDI – and similar infrastructures in other countries – was the challenge of reconciling the needs and interests of different types of organizations and stakeholders involved in these initiatives. This means the realization of an open SDI should be considered as a governance problem. The analysis also showed how a mix of various governance instruments commonly adopted in the public sector was used in the governance of the UK open SDI. This mix consists of five main sets of governance instruments: strategic management, joint decision-making, allocation of tasks and responsibilities, market-based governance and interorganizational culture and knowledge management.

While these instruments all contribute to the main goal of aligning the needs and interests of different stakeholders, these instruments each have their own specific value. Strategic management instruments ensure that the objectives and actions to be taken in the development of open spatial data infrastructures are clearly defined and agreed upon, and the implementation of these actions is monitored and evaluated. Joint decision-making structures allow different actors and stakeholders to be directly involved in, or at least provide advice to, the decision-making process on the spatial data infrastructure. The allocation of tasks and responsibilities, also to non-government actors, ensures that all tasks necessary for the development of an effective spatial data infrastructure are executed, making the best use of the resources and expertise of different stakeholders. The adoption of market-based governance instruments in developing open SDIs contributes to the creation and regulation of a well-functioning ‘data market’ between data providers and data users. Finally, various instruments related to interorganizational culture and knowledge management, such as awareness raising and capacity building activities, lead to the creation of shared vision, norms, values and knowledge between stakeholders.

Another interesting finding of our study was the importance of both spatial data and open data policies and initiatives in the realization of open SDIs and the need for alignment between these two domains. Our analysis revealed how the governance of UK's SDI agenda has been aligned with the country's open data policy in many different manners, so that both are mutually reinforcing. From the very beginning of UK's open data agenda, spatial data have been recognized as a high-value type of government data that had to be made open for re-use by non-government actors. The UK Location Information Strategy and the implementation of the strategy have been aligned with ongoing policy actions on transparency and open government data. Although there are separate decision-making and governance structures in place for spatial data and open data, the topic of open spatial data has always been high on the agenda of all relevant decision-making bodies and advisory bodies. While different organizations were in charge of the strategic and technical coordination of the both policies, there has been intense collaboration between the different involved parties to optimally align the spatial data infrastructure with the country's open data agenda. Also in the use of market-based governance instrument, the level of alignment was high, with data.gov.uk as the single access point to all government data, spatial and non-spatial, and the adoption of the UK Open Government Licence as the default licence for spatial data. All of this indicates that although UK's open data agenda and its spatial data infrastructure should be seen as two separate policy initiatives, effort has been done to align both initiatives and the supporting governance instruments. In this perspective, the research presented in this chapter is one of the first comprehensive investigations of the alignment between spatial data and open data policies and initiatives at the national level, and contributes to our understanding of approaches for realizing alignment between these two domains.

The analysis also demonstrated that the governance of open SDIs is not a static process, as the adoption of particular instruments clearly changes over time. In the UK, especially the decision to focus the national spatial data policy on being INSPIRE compliant and to no longer consider the development of a well-performing UK spatial data infrastructure a priority had a strong impact on the governance of the spatial data infrastructure. Tasks and responsibilities of certain actors have been reduced and/or reshuffled to new actors, existing decision-making bodies or advisory bodies have been shut down or replaced by new bodies, and existing strategic documents have not been renewed or remained a dead letter, etc. In light of this, it is interesting to note that in the past 6 months (Autumn 2017–Spring 2018), some important changes in the governance of UK's spatial data policy have been announced and implemented. Ahead of the 2017 General election in June, the Conservative Party in its Conservative Manifesto called for the creation of a comprehensive spatial data body within government, by combining relevant parts of HM Land Registry, Ordnance Survey, the Valuation Office Agency, the Hydrographic Office and Geological Survey (The Conservative and Unionist Party 2017). This new body had to become the largest repository of open spatial data in the world and through the creation of the most comprehensive digital map of Britain, it should support a vibrant and innovative digital economy. The Conservative Party remained

the single largest party in the House of Commons, and in November 2017, the first plans towards the realization of their commitment were announced in the Autumn Budget, with the establishment of a new Geospatial Data Commission to provide strategic oversight to the various public bodies holding these data. It was also announced that the government would work together with the new Commission and Ordnance Survey to determine how OS MasterMap data could be opened up freely to UK-based small businesses in particular to further boost the digital economy. In the Budget £40 million a year over the next 2 years was foreseen to support this work. More recently, at the end of March 2018, Prime Minister May announced that from April 1, existing strategic spatial data policy initiatives from the Department for Business, Energy and Industrial Strategy and the Department for Environment, Food and Rural Affairs would be consolidated into the Cabinet Office to support the work of the Geospatial Commission. At the same time, the open data policy and governance functions of the Cabinet Office are transferred to the Department for Digital, Culture, Media and Sport (DCMS). These recent developments express a renewed interest in the UK spatial data infrastructure and the governance of the infrastructure. It should be noticed that these new governance efforts consist of a combination of different governance instruments: a new high-level decision-making body, with the Geospatial Data Commission; changes in the allocation of tasks and responsibilities, with Cabinet Office becoming in charge of the strategic geospatial data policies; and market-based governance, through the increased funding for making the OS MasterMap data available as open data.

6 Conclusion

The central objective of this chapter was to explore how the UK in the past 10 years has been dealing with the governance of its national spatial data infrastructure in order to make the shift towards a more open SDI. The analysis demonstrated the applicability of the ‘governance instruments’ approach for analysing governance in the context of – open – SDIs. In governing its national open SDI, the UK made use of different sets of governance instruments traditionally applied in the public sector, such as strategic management, collective decision-making, allocating of tasks and competences, the creation and regulation of markets and interorganizational culture and knowledge management. Governance of open SDIs is about creating and implementing the right combination of various instruments for managing the relationships and dependencies between different actors and aligning the needs and interests of these actors to achieve the common goal of establishing an open spatial data infrastructure. In the UK, the mix of governance instruments constantly changed in the past 10 years, with new instruments being introduced and old instruments being replaced or even eliminated. The most recent developments seem to indicate a new period in the realization of an open spatial data infrastructure, with the announcement of some major changes in the governance of the infrastructure.

With this chapter, we aimed to contribute to a better understanding of the governance of data infrastructures by introducing a ‘governance instruments’ approach for describing and analysing governance efforts in the context of data infrastructures. The focus of this chapter was on SDIs and how these infrastructures could evolve towards more open data infrastructures. Governments and public authorities worldwide have been working on the development and implementation of these infrastructures since the beginning of the 1990s. Recently, several countries and public administrations started to move towards the establishment of a more open SDI, in which government, businesses, citizens and other stakeholders commonly govern, share and use spatial data. This move created new challenges related to the governance of the infrastructure, and required the implementation of new and additional governance instruments. An important challenge in the realization of an open SDI and the governance of this infrastructure seems to be the alignment between spatial data and open data policies and related initiatives. In its analysis of the governance of the open spatial data infrastructure of the UK, this chapter showed how this alignment was achieved in the UK, through the combination and alignment of multiple governance instruments.

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References

- Ansell, C., & Torfing, J. (2016). Introduction: theories of governance. In C. Ansell & J. Torfing (Eds.), *Handbook on theories of governance* (pp. 1–17). Cheltenham: Edward Elgar Publishing.
- Bouckaert, G., Peters, B. G., & Verhoest, K. (2010). *The coordination of public sector organizations: Shifting patterns of public management*. Hampshire: Palgrave Macmillan.
- Box, P. (2013). *The governance of spatial data infrastructure: A registry based model* (p. 128). Melbourne: University of Melbourne.
- Cabinet Office. (2012). *Open data white paper: Unleashing the potential*. Norwich: The Stationary Office. <https://www.gov.uk/government/publications/open-data-white-paper-unleashing-the-potential>. Accessed 19 Jan 2018.
- Cabinet Office. (2013). *National information infrastructure*. <https://www.gov.uk/government/publications/national-information-infrastructure>. Accessed 20 Jan 2018.
- Cabinet Office and Government Digital Service. (2017). *Government transformation strategy 2017 to 2020*. <https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020>. Accessed 24 Apr 2018.
- Coetzee, S., & Wolff-Piggott, B. (2015). A review of SDI literature: searching for signs of inverse infrastructures. In C. Robbi Sluter, C. B. Madureira Cruz, & P. M. Leal de Menezes (Eds.), *Cartography-maps connecting the world* (pp. 113–127). New York: Springer International Publishing.
- De Kleijn, M., van Manen, N., Kolen, J. C. A., & Scholten, H. J. (2014). Towards a user-centric SDI framework for historical and heritage European landscape research. *International Journal of Spatial Data Infrastructures Research*, 9, 1–35.

- Dessers, E. (2012). *Spatial data infrastructures at work. A comparative case study on the spatial enablement of public sector processes*. Leuven: KU Leuven.
- European Commission. (2007). *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information in the European Community (INSPIRE)*, OJ L 108/1. <https://eur-lex.europa.eu/eli/dir/2007/2/oj>. Accessed 18 Jan 2018.
- Georgiadou, Y., Puri, S. K., & Sahay, S. (2005). The rainbow metaphor: Spatial data infrastructure organization and implementation in India. *International Studies of Management & Organization*, 35(4), 48–70.
- Global Spatial Data Infrastructure. (2012). *Spatial data infrastructure cookbook 2012 update, GSDI, 2012*. http://gsdiassociation.org/images/publications/cookbooks/SDI_Cookbook_from_Wiki_2012_update.pdf. Accessed 24 Jan 2018.
- Great Britain HM Treasury. (2009). *Putting the frontline first: smart government*. Norwich: The Stationary Office. <https://www.gov.uk/government/publications/putting-the-frontline-first-smarter-government>. Accessed 18 Jan 2018.
- Janssen, K. (2010). *The availability of spatial and environmental data in the EU at the crossroads between public and economic interests*. Dordrecht: Kluwer.
- Jones, G., & Wilks, P. (2012). *UK location programme benefits realization strategy version 2.0*. London: UK Location Programme.
- Kooiman, J. (1999). Social-political governance: Overview, reflections and design. *Public Management an International Journal of Research and Theory*, 1(1), 67–92.
- Lämmerhirt, D. (2017). *Mapping open data governance models: Who makes decisions about government data and how?* Open Knowledge International Blog, 2017. <https://blog.okfn.org/2017/02/16/mapping-open-data-governance-models-whodecides-and-how>. Accessed 28 Apr 2018.
- Lance, K. T., Georgiadou, Y., & Bregt, A. K. (2009). Cross-agency coordination in the shadow of hierarchy: ‘joining up’ government geospatial information systems. *International Journal of Geographical Information Science*, 23(2), 249–269.
- Local Government Association. (2014). *A guide to INSPIRE compliance in local government*. <https://local.gov.uk/sites/default/files/documents/guide-inspire-compliance%2D%2D6d8.pdf>. Accessed 30 Apr 2018.
- Lynn, L. E., Heinrich, C. J., & Hill, C. J. (2000). Studying governance and public management: Challenges and prospects. *Journal of Public Administration Research and Theory*, 10(2), 233–262.
- Masser, I. (1999). All shapes and sizes: the first generation of national spatial data infrastructures. *International Journal of Geographical Information Science*, 13(1), 67–84.
- Masser, I. (2006). The future of spatial data infrastructures. In *Proceedings of the ISPRS workshop on service and application of spatial data infrastructure*, Hangzhou, China, 14–16 October 2006.
- Mayo, E., & Steinberg, T. (2007). *The power of information: An independent review*. <http://opsi.gov.uk/advice/poi/power-of-information-review.pdf>. Accessed 17 Jan 2018.
- Meuleman, L. (2008). *Public management and the metagovernance of hierarchies, networks and markets: The feasibility of designing and managing governance style combinations* (p. 402). Heidelberg: Physica-Verlag.
- OpenGovData. (2016). *Eight principles of open government data*. <http://www.opengovdata.org>. Accessed 23 Apr 2018.
- Power of Information Task Force. (2009). *Power of information task force report*. <https://poweroinformation.wordpress.com/2009/03/04/final-report>. Accessed 17 Jan 2018.
- The Conservative and Unionist Party. (2017). *Forward, together: Our plan for a stronger Britain and a prosperous future. The conservative and unionist party manifesto 2017*. <https://www.conservatives.com/manifesto>. Accessed 17 Feb 2018.
- UK Geographic Information Panel. (2008). *Place matters: The location strategy for the United Kingdom*. London: Communities and Local Government.

- UK Location Programme Team. (2010). *INSPIRE member state report: United Kingdom 2010*. London: UK Location Programme.
- UK Location Programme Team. (2017). *Guidance and tools for implementation of INSPIRE in the UK*. <https://data.gov.uk/location/inspire-tools>. Accessed 30 Apr 2018.
- Van Loenen, B. (2006). *Developing geographic information infrastructures: The role of information policies*. Delft: DUP Science.
- Vancauwenberghe, G., & van Loenen, B. (2017). Governance of open spatial data infrastructures in Europe. In F. van Schalkwyk, S. G. Verhulst, G. Magalhaes, J. Pane, & J. Walker (Eds.), *The social dynamics of open data* (pp. 63–88). Cape Town: African Minds.
- Vancauwenberghe, G., & van Loenen, B. (2018). Exploring the emergence of open spatial data infrastructures: Analysis of recent developments and trends in europe. In S. Saeed, T. Ramayah, & Z. Mahmood (Eds.), *User centric e-government. Challenges and opportunities* (pp. 23–45). New York: Springer.
- Vancauwenberghe, G., Dessers, E., Cromptvoets, J., & Vandenbroucke, D. (2014). Realizing data sharing: The role of spatial data infrastructures. In M. Gascó-Hernández (Ed.), *Open government. Opportunities and challenges for public governance* (pp. 155–169). New York: Springer.
- Verhoest, K., Bouckaert, G., & Peters, B. G. (2007). Janus-faced reorganization: specialisation and coordination in four OECD countries in the period 1980–2005. *International Review of Administrative Sciences*, 73(3), 325–348.

Online Fiscal Transparency of US State Governments: An Analysis Using Public Value Framework



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Abstract Although state governments in the United States have increasingly implemented open government data (OGD) portals for fiscal transparency, they differ in the extent to which the portals provide the financial data. In this paper, we apply Moore's public value framework to analyze the factors that influence fiscal transparency through the OGD portals. Complementary methods of cluster analysis and case study provide insights into the patterns of OGD transparency and the factors with respect to the external authorizing environment and internal operational capability. We argue that enabling transparency legislation, responsive elected leadership to the constituency, and adapting to the rapidly evolving digital environment are important factors at the external level. Committed leadership, inter-agency collaboration, funding, and an organizational culture of transparency are important factors at the internal level.

1 Introduction

Open government data (OGD) portals expose government financial data to the public in machine-readable formats (Harrison and Sayogo 2014). The online sites provide fiscal information such as government budgets, expenditures, and taxes.

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Governments arguably create public value through the fiscal transparency engendered by the OGD portals. Citizens and independent watchdogs can parse the fiscal data in various ways to examine the governments' performance (Sandoval-Almazan and Gil-Garcia 2016). From the external citizens' perspective, the data transparency allows citizens to influence democratic decision-making and be meaningfully engaged in the public sphere. Fiscal transparency could result in better government accountability and performance due to reduction in unnecessary and wasteful spending. From internal government perspective, financial transparency has the potential to curb corrupt practices as all the transactions come under public scrutiny. Agencies would have less room to manipulate budget information and use fiscal gimmickry.

Although state governments in the United States have increasingly implemented the OGD portals, they differ in the extent to which they provide the budget and expenditure data for fiscal transparency. There is great degree of variation among the states, and they have made differential progress in improving online fiscal transparency over the last decade. Whereas some states are comprehensive one-stop centers for providing fiscal data in a few clicks, some provide static links to pdf files that are not entirely machine-readable. They provide differing levels of details on state spending, subsidies, and contracts for goods and services. The level of information provided is crucial for the public value created through the OGD portals. The information is useful for the public to ascertain the state government's performance in terms of fiscal efficiency. Public information on subsidies and contracts helps in ensuring that the contractors and vendors are accountable and deliver goods and services at reasonable costs. The fiscal transparency through the OGD portals adds value to the public sphere inasmuch as the public can better measure and oversee the progress of state government programs. Journalists, citizen groups, and watchdogs can be productively engaged in the budget debates in an informed way.

In the above context, we examine how states differ in creating public value through their OGD portals. The public value goal of the OGD portals is fiscal transparency, which is a principal pillar for government accountability. Moore's (1995) seminal work posited that *public value goals* are influenced by the *authorizing environment* that is external to the public agency and *operational capability* that is internal to the agency. Using Moore's framework, our main research question is: *What are the factors of external authorizing environment and internal operational capability that influence state governments to adopt OGD portals for achieving the public value goal?* Our research is exploratory in nature in order to identify the external and internal features of the state governments that influence the levels of fiscal transparency achieved through the OGD portals.

To examine the question, we first conducted cluster analysis to classify the states in terms of achieving the public value of fiscal transparency through the OGD portals. The cluster analysis provides insights into the similarities and differences in achieving the public value goal. We then conducted qualitative case studies selected from each of these groups to inform why states have enhanced or inhibited fiscal transparency through the OGD portal. The case studies identify the elements of authorizing environment and operational capabilities that influence fiscal transparency through the OGD portals.

The remainder of this paper is organized as follows. The evolution of fiscal transparency with OGD portals is outlined next. Next, the OGD's public value goal of fiscal transparency is explored. It is followed by a discussion of the theoretical framework of public value for examining online fiscal transparency. Then, the data sources and research methods of the study are presented. After this, the subsequent two sections present the results of cluster analysis and the case-study analyses. Finally, the paper concludes with a discussion of key research findings and recommendations for future research.

2 Fiscal Transparency and Open Government Data Portals

Fiscal transparency is considered as a core aspect of good governance, in order to have transparency in government decision-making and public expenditures. Fiscal transparency is the "openness toward the public at large about government structure and functions, fiscal policy intentions, public sector accounts, and budget projections" (Kopits and Craig 1998, p. 1). The citizens are stakeholders who have a right to know how and where their tax contributions are spent. The demand for fiscal openness has significantly increased over the last three decades, with international and national nonprofit agencies seeking more government transparency and accountability. The International Monetary Fund's *Fiscal Transparency Code and Evaluation* emphasizes four pillars: (1) fiscal reporting, (2) fiscal forecasting and budgeting, (3) fiscal risk analysis and management, and (4) resource revenue management. The Organization for Economic Co-operation and Development formulated the *Global Forum on Transparency for Tax* in 2000 for establishing international standards on tax transparency.

Fiscal transparency has been legally required through freedom of information legislations in most developed countries since the World War II. There are two sides to transparency: the *demand side*, which is the access and usability of information by citizens and stakeholders, and the *supply side*, which is the proactive government delivery of information (Araujo and Tejedó-Romero 2016). The demand side is often referred to as passive transparency since information is provided reactively, based upon citizen requests. The supply side is also called active transparency, since governments proactively provide this information (often to comply with a law). Empirical evidence from Brazil shows that governments frequently engage in passive transparency (Corrêa et al. 2017). The rapid evolution of computer and Internet technologies has enabled new modes of active transparency by making fiscal data publicly available online through open government data portals.

Open government policies have encouraged active fiscal transparency measures, even though they may face implementation problems (Piotrowski 2017). President Obama's Open Government Initiative aimed to take advantage of the Internet to build a more transparent, participatory, and collaborative government. The initiative resulted in several open government data efforts, including the [Data.gov](https://data.gov), USASpending.gov, and ITDashbord.gov. The 2010 Government Performance and Reporting Modernization Act (GPRAMA) enhanced the 1993 GPRA requirements

with performance planning, management, and reporting tools, including the publication of the agency reports through machine-readable formats in a centralized website (performance.gov). There are further calls for the Financial Transparency Act whereby agencies would be required to put open government data in consistent machine-readable formats online.

Open government data (OGD) for the public sector can be broadly defined as *making data and information available in formats and ways that enable free access, use, distribution, and data exploitation* (Ubaldi 2013; Wirtz et al. 2015). The fiscal goal of OGD is to increase the level of transparency with respect to government budgets and spending (Sandoval-Almazan and Gil-Garcia 2016). Although inexpensive, OGD portals do require funding to establish and maintain; issues such as data quality, usability, timeliness, and overall value are also important to resolve (Lourengo 2015). Ideally, the fiscal data should be publicly accessible through Application Programming Interfaces (APIs) that can be integrated with other demographic and geographical data to analyze government spending. Easy-to-use data visualization techniques make the financial data more facile and accessible to lay persons for informed public participation and decision-making processes. The OGDs' fiscal transparency thus adds value to the public sphere in facilitating more informed debates about budgets and programs (Benington and Moore 2011).

State governments follow Governmental Accounting Standards Board's (GASB) standards for accounting and financial reporting. Over the last decade, all state governments have established OGD portals for reporting the fiscal information online. State governments, however, differ in the nature and extent to which they provide the information. The US Public Interest Research Group (PIRG) has been evaluating the OGD portals since 2010 through the annual *Following the Money* reports. Although the evaluation has evolved over the years, it broadly grades the OGD portals in terms of *comprehensiveness* of information about government contracts, spending, subsidies, and tax expenditures, *one-stop search*, and *one-stop clickable* and *downloadable* data. In the US PIRG's 2010 report, 36 states had OGD portals; only 1 had received an A grade and 18 states got F grade. The states have shown improvement since then: in the 2016 report, all states had OGD portals, with 18 states getting an A grade and 15 states getting C or less grade. While some states have improved from a low grade to a high grade over time, others have stagnated at the low grade. In this context of differences between the state OGD portals, we examine the internal and external factors that influence the public value goal of fiscal transparency using Moore's (1995) framework.

3 Public Values and Open Government Data Portals

3.1 Public Value as an External Citizen-Centered Value

Public value, according to Moore (1995), broadly consists of the collectively desired social outcomes. Originating from a strategic management standpoint, Moore argued for public managers to not only focus on internal operations but also seek

legitimacy of public value from the external environment. Public managers must create something of value for both *clients* and *citizens*. For *clients*, managers must be able to produce something of value within their budget authority (clean parks, a military, health, and police). These are products and services consumed by clients. For *citizens*, public managers need to operate orderly and productive institutions that are required for a democratic and accountable government. In essence, Moore provided a different interpretation of the role of government that takes into account public values such as fairness, pride, care of the environment, and concern for the weak and vulnerable (Alford and Hughes 2008).

The public value framework is built on a critique of the new public management, which focused on customer-centric and market-based solutions (Cordella and Bonina 2012). From public policy and management perspective, Bozeman (2002) posited a public-failure model toward policymaking whereby public values are taken into account irrespective of market efficiency. Citizens decide the public values together through their elected representatives in the democratic process. Public sector organizations should meet three broad tests to create public value (Alford and O'Flynn 2009). First, government must aim to create substantive value to the public. Second, government must be legitimate and politically sustainable and attract sufficient support. Third, government must be operationally and administratively feasible. The public manager must be able to provide a strategy that aligns the three components.

In his extensive review of the literature, Rutgers (2015, p. 40) concludes that public values are “enduring beliefs in the organization of and activities in a society that are regarded as crucial or desirable.” The public values approach emphasizes both traditional and emerging values in having high-performance service-oriented bureaucracies—public organizations that are not only efficient and effective and achieve goals but also operate justly and fairly to benefit society (Bryson et al. 2014). Public values encompass procedural justice and socially and politically desirable outcomes (Wang and Christensen 2015). Public values approach privileges the collective preferences of the democratic electorate and the need for public officials to be accountable to citizens (Stoker 2006).

3.2 Public Value of Open Government Data Portals

Open government data portals arguably hold public value since they expose the government fiscal data to the public. OGD portals link the internal government operations with the external citizen constituents. They are mechanisms for providing fiscal transparency in the rapidly emerging digital world. OGD gains legitimacy from citizens who demand fiscal transparency for better line of sight between government decisions and government expenditures. Transparency is “the availability of information about an organization or actor allowing external actors to monitor the internal workings or performance of that organization” (Grimmelikhuisen and Meijer 2012, p. 3). The basic aspect of transparency is that the government should report the *why*, *how*, *what*, and *how much* with respect to their activities to the public

(da Cruz et al. 2016). Transparency becomes crucial when there is imperfect information in a principal agent relationship. Government agents do not necessarily follow citizens' (principals) preferences, since the agents have their own self-interests, which may go against the public interest (Bastida and Benito 2007). More information implies greater transparency (Alt et al. 2006). Higher information disclosure may reduce the information asymmetry problem, even though there is a trade-off between the value of flushing out incompetence and corruption and that of avoiding excessive politicization and surveillance (Heald 2012).

Budget and financial transparency is one of the most important facets of open and accountable government. Budget transparency refers to "the extent and ease with which citizens can access information about and provide feedback on government revenues, allocations, and expenditures" (Bank 2015). Budget transparency facilitates accountability through the disclosure of critical financial information (Tolbert and Mossberger 2006). Internally, budget transparency would improve of management aspects such as budget operation, monitoring, evaluation, accounting and acquisition systems. It should enhance the internal decision-making structures of governance, culture of transparency, and citizen engagement (Rodríguez Bolívar et al. 2015a). Externally, budget openness promotes debates about revenues, budget allocations and expenditures in the public sector (Kim and Schachter 2013). Fiscal transparency allows citizens and other external stakeholders to monitor the performance of public organizations (Hui and Hayllar 2010; Mergel 2013). As a result, policies can be expected to be aligned with citizens' needs, as budgets would be designed accordingly (Allen 2002).

Several scholars have highlighted the public values of budget and financial transparency (Wehner and Renzi 2013). The transparency improves fiscal performance (Benito and Bastida 2009; Von Hagen 1992), reduces corruption (Kim et al. 2009; Heald 2012; Santiso 2006), and limits creative accounting (Bernoth and Wolff 2008; Milesi-Ferretti 2004). At the national level, financial and budget transparency can prevent potential fiscal risks and attendant crisis (Santiso 2006). At the state and local government levels, transparency could reduce the extent of public debt and deficits (Alesina and Perotti 1996; Alt and Lassen 2006). The transparency thus allows policymakers to diagnose the fiscal context and take corrective measures in a timely way (Kopits and Craig 1998). Budget transparency leads to better fiscal performance in terms of lower budget deficits, better fiscal discipline, and more effective controls over spending (Alesina et al. 1999; Milesi-Ferretti 2004; Von Hagen 1992). Furthermore, empirical studies show that financial markets penalize those governments that are not transparent by raising the costs of borrowing capital (Bastida et al. 2017).

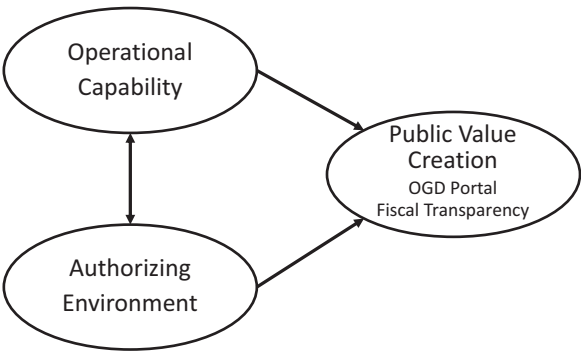
With the widespread use of the Internet, online budget transparency through OGD portals offers important public values for fortifying e-democracy and e-governance (Borins 2002; Brown 2005). They are inexpensive means of disseminating fiscal and other government data (Meijer 2015). They provide the base for data-driven innovations for governments (Susha et al. 2015a). They increase the scope for citizen engagement in public affairs by acting as drivers of citizen

self-empowerment, e-participation, and public engagement (Ubaldi 2013). Online transparency allows faster detection of corruption by allowing citizens to track information in real time (Bertot et al. 2010). Greater levels of government transparency can provide more accountability to its citizens and improve the overall quality of governance (da Cruz et al. 2016). Transparency across the budget process, through online disclosure, consultation, and participation tools, can open doors to the public decision-making process, enabling more informed citizens to engage in open discussions of revenues, allocations, and program expenditures. The OGD portals facilitate co-production and collaboration, as citizen groups can build new applications and parse the data in creative ways to examine fiscal impacts and identify scope for increasing efficiency and effectiveness (Harrison et al. 2012). Open data systems in smart cities could create public value by improving the quality of urban services and generate well-being and public satisfaction (Pereira et al. 2017).

4 Public Value Framework Work

Moore’s (1995) public value framework is ideally suited for analyzing the OGD portals because it takes into account the external citizen-centric notion of public value. Moore suggested a strategic triangle for creating the public value (Fig. 1). The first node is the *authorizing environment*, which indicates the external political, social, and economic context that delineates the role of government and public service. The elected representatives’ political mandate is required for the legitimacy for the public values. The environment includes the citizens, public, private, and third-sector stakeholders and partners, whose sustained support is required for the legitimacy of the actions. The second node is the *operational capability*, which refers to the organizational capacity to mobilize resources to achieve the outcomes. It includes the finance, personnel, skills, and technology required to achieve the public values. It recognizes the active role of public managers in orchestrating the public values in government organizations. Both the external authorizing environment and internal operational capability lead to greater public value, according to

Fig. 1 Moore’s framework adapted to open government data portal’s public value



Moore's theory. The third node is the definition of *public value* strategic goals, where public managers define the anticipated public outcomes. Public values are negotiated and legitimized within the authorizing environment and carried out by the public managers in the government agencies. As explained in the previous section, the public value of the OGD portal is the fiscal transparency that is valuable for democratic governance.

In the public value framework, the attainment of the public value goal is contingent on the external authorizing environment and the internal operational capability. Externally, several social, political, and economic factors influence the level of OGD's fiscal transparency (Harrison and Sayogo 2014). Broadly, four factors influence a government's transparency policy: the public's right to know/good governance, rights of public servants, effective public administration, and costs and risks (Bannister and Connolly 2011). Cucciniello and Nasi (2014) found that Italian municipalities published information on their websites in order to comply with legal requirements; the information had less to do with public value in terms of usefulness to citizens and other stakeholders. Essentially, with most governments, there is a push to simply provide more datasets online and there are no subsequent efforts to measure if the data meet user needs (Susha et al. 2015b). Armstrong (2011) found that it is not just the type of information that is important for online transparency; where and how the information is placed on the website is also significant to promote greater engagement with users. The portals should be comprehensive and one-stop searchable.

Internally, governments that have open administrative culture share budget information online (Rodríguez Bolívar et al. 2015b). Since government revenues and expenditures are on the top of transparency and accountability concerns, the financial data are among the foremost data released through the OGD portals. The specific data released, however, are contingent on the unique context of the jurisdiction's OGD ecosystem which encompasses the public managers, data producers, innovators, and users (Dawes et al. 2016). Providing OGD has both risks and benefits (Zuiderwijk and Janssen 2015). Governments often provide fiscal data through the portals based on political ease (Carrasco and Sobrepepe 2015). Politically controversial data may not be freely released so as not to show the government in a negative light. The data released are also contingent on the public manager's perceived risks of transparency (Nugroho et al. 2015; Wirtz et al. 2015).

5 Research Data and Methods

Data source The data for OGD portals' achievement of fiscal transparency are obtained from the US PIRG's annual "Following the Money" reports. The annual US PIRG reports assess the OGD portals using a scorecard of 13 indicators along the 2 dimensions of *comprehensiveness and one-stop search* and *one-click searchable and downloadable data*. Substantively, these dimensions are divided into three

categories: checkbook-level spending data about contracts and expenditures, economic development subsidies, and tax expenditure reports (Table 1). The final grade from the scorecard is a point score on a scale from 0 to 100 points, where more points imply more online fiscal transparency. Based on the point scores, the US PIRG also gives letter grades A to F (A grades are leading states, B for advancing states, C for middle states, D for lagging states, and F for failing states). Before publication, the reports are shared with the implementing state agencies to verify the accuracy of findings. The US PIRG evaluations of the state OGD portals are pertinent since they take into account the citizens' ease of discovering fiscal data online and use them for analysis. This aspect is important for public value creation since the data provided should be of use to citizens in public decision-making process. The US PIRG evaluations are the most robust independent and longitudinal evaluations of the OGD portals available to date. Although the reports are available since 2010, we used the reports for the period 2014–2016 since these data are consistent and comparable over the years.

With respect to the US PIRG's first dimension of *comprehensiveness and one-stop search*, the portals should provide checkbook-level data across all three substantive categories of government contracts and spending, economic development subsidies, and tax expenditures for all government entities. Ideally, citizens should get information about all major categories of government spending, including payments to private vendors and nonprofits, subsidies such as tax credits for economic development, special tax exemptions or credits, tax expenditures, revenues and expenditures of quasi-public agencies, and so on. The broad fiscal transparency holds public value for citizens, legislative groups, watchdog organizations, journalists, think tanks, academic analysts, and even public employees to engage in an informed discussion of decision-making processes. The *one-stop* search implies that the OGD portal should ideally be a single website from which anyone can search all government budget data. Although the state governments follow GASB standards for accounting and financial reporting, there are various forms of revenues, expenditures, and subsidies that are administered by different government agencies under different programs. Ordinary citizens are unlikely to navigate several websites to find such disparate fiscal information; so, one-stop transparency facilitates them to access comprehensive information from a single starting point. Standardized fiscal categories (such as XBRL) also facilitate comparing across different agencies.

In terms of the US PIRG's second dimension of *one-click searchable and downloadable data*, states should ideally offer a range of search functions for citizens to navigate complex expenditure data with a single click of the mouse. States that follow the best transparency standards allow citizens to browse information by categories such as recipients, keywords, or agencies. The data should also be downloadable for citizens and watchdogs to analyze the data off-line. The data can then be parsed in various ways to examine spending toward a particular company or agency or to examine spending trends. Ideally, the dataset should be downloadable as a single file in one click to facilitate easy access.

Table 1 Indicators, description, and point allocation for US PIRG scorecard

Dimension	Indicator name (Code)	Description	Coding	Points
<i>Checkbook-level spending (contracts and expenditures)</i>				
Comprehensiveness and one-stop	Checkbook budget	List or database of individual expenditures made to individual recipients	Presence of list or database: 24 points	24
	Excluded information	Statement about the specific types of transactions and/or government entities excluded from the checkbook, such as confidential data, payments outside the accounting system or salaries	4 points if all types of financial statements and transactions are included. 2 points when only general statements or information about agencies	4
	Quasi-public agencies	Expenditures from all quasi-public agencies are included in the checkbook	6 points if checkbook includes all quasi information. 4 points if a portion	6
One-click searchable and downloadable	Searchable by recipient	Ability to search checkbook-level expenditures by recipient (e.g., contractor or vendor's name)	Presence of search tool: 8 points	8
	Searchable by keyword	Ability to search checkbook-level expenditures by type of service, item purchased, or the paying government fund	Presence of search tool: 8 points	8
	Searchable by agency	Ability to search checkbook-level expenditures by the purchasing entity of the government	Presence of search tool: 8 points	8
	Bulk downloadable	The complete dataset can be downloaded for data analysis (via xlsx, csv, xml, etc.)	6 points are awarded if total dataset is downloadable, but 3 points only if a portion	6

(continued)

Table 1 (continued)

Dimension	Indicator name (Code)	Description	Coding	Points
<i>Economic development subsidies</i>				
Comprehensiveness and one-stop	Checkbook subsidies	List or database of individual payments made through state's five most important economic development subsidy programs listed by good jobs first	15 points if payment information is available for all 5 subsidy programs. Less information, less points	15
	Projected public benefits	Public benefits, such as the number of jobs, intended to be produced by specific private recipients of economic development subsidies (in the form of tax credits, grants, or other types of programs) are included	4 points if projected benefits information is available for all 5 subsidy programs. Less information, less points	4
	Actual public benefits	Public benefits, such as the number of jobs, actually to be produced by specific private recipients of economic development subsidies (in the form of tax credits, grants, or other types of programs) are included	4 points if actual benefits information is available for all 5 subsidy programs. Less information, less points	4
	Recouped funds (extra credit)	This extra credit in the assessment accounts for the information available of subsidies recouped (programs with clawback provisions)	4 points if recouped funds information is available for all five subsidy programs. Less information, less points	4
One-click searchable and downloadable	Downloadable	Checkbook-level subsidy information can be downloaded for data analysis	4 points if data is downloadable for all five subsidy programs. Less information, less points	4
<i>Tax expenditure reports</i>				
Comprehensiveness and one-stop	Tax expenditures from multiple years	The state's tax expenditure report is available from the transparency website	6 points if tax expenditures information is available. Portion of this information or incomplete: 6 points	9

Source: Adapted from Surka and Ridlington (2016)

Table 1 shows how the above dimensions are divided across the substantive categories of government checkbook-level spending (contracts and expenditures), economic development subsidies, and tax expenditure reports. The checkbook-level spending category carries 64 points maximum: 34 points for comprehensiveness/one-stop (checkbook budget, excluded information, and quasi-public agencies) and 30 points for one-click searchable and downloadable (searchable by recipient, keyword, and agency and bulk downloadable). The economic development subsidies category carries 27 points: 23 points for comprehensiveness/one-stop (checkbook subsidies, projected public benefits, actual public benefits, and additional 4 bonus points for recouped funds) and 4 points for downloadable datasets. The tax expenditure reports carry the remaining 9 points.

Research Methods We employed two complementary methods in this exploratory research to examine the public value of the OGD portals' fiscal transparency, as reflected by the US PIRG scores across states. In the first step, we used cluster analysis in order to classify the state OGD portals in terms of attaining the public value goal. Cluster analysis identifies the groups of state governments that are similar to each other in terms of fiscal transparency. Identification of the clusters helps with the second step of identifying states within the distinctive groups for deeper examination of the external and internal factors that influence fiscal transparency through the OGD portals. Of course, cluster analysis is criticized for being atheoretical and descriptive, with a certain degree of subjective interpretation (Mcnabb 2013). Yet, the cluster analysis is a useful heuristic tool to explore the structural patterns of fiscal transparency across state governments.

We used hierarchical clustering for delineating the patterns (Ward Jr 1963). This technique uses the minimum variance criterion of all variables (SS) to minimize the total within-cluster variance of squared Euclidean distances. The squared Euclidean distances from specified variables represent the level of dissimilarity or proximity of a selected data representing the features of OGD fiscal transparency (Ward Jr 1963). At each step, two clusters are fused which result in the least increase in the pooled within-group sum of squares. Proximity between two or more clusters is the magnitude by which the summed square in their joint cluster ($SS_{1,\dots,n}$) is greater than the combined summed square in these clusters: $SS_{1,\dots,t} - (SS_1 + \dots + SS_n)$. The US PIRG scores of the state government OGD portals are used for the dissimilarity/similarity measures.

The cluster analysis is useful to represent groups of states in a hierarchical fashion, with similar states close to each other (clustered in groups) and dissimilar states farther from each other. The results are typically depicted through a dendrogram, which is a visual representation of the clustering. The dendrogram represents clusters using all the OGD dimensions and locates each state in a bi-dimensional graph in the order of similarity/dissimilarity measures. Clusters are consecutively formed from groups of cases (states). The clustering begins with each group as an individual cluster. It displays the distance level at which there is a combination of states and clusters. The lower the level of dissimilarity, the higher the level of similarity. The clusters are then sequentially merged according to their similarity. Two most similar clusters are merged to form a new cluster at the bottom of the hierarchy. Then, another pair of clusters is merged and linked to a higher level of the hierarchy, and

so on. This is a bottom-up hierarchy of clusters. The higher the distance, the clusters become more dissimilar. Cluster analysis is thus useful for classifying the states in terms of achieving the public value of fiscal transparency.

In the second step, we conducted in-depth case studies of three selected states from each group to explore the deeper dynamics of the fiscal transparency. We chose dissimilar states for the case studies in order to identify the range of factors of authorizing environment and operational capability that enhance or inhibit the attainment of the fiscal transparency. In this process, we conducted in-depth interviews with the officials in charge of implementing the OGD portals. We also conducted documentary analysis of the annual reports and newspaper reports in order to identify key actors, events, decisions, and actions taken related to OGD portals. The cluster analysis and the case studies are thus complementary in providing insights into the authorizing environment and the operational capability that influence the fiscal transparency.

6 Cluster Analysis Results

Figure 2 shows the dendrograms of the states' OGD clusters for each year between 2014 and 2016. Each dendrogram shows two clear groups: *Group 1* is the cluster of states with high scores of fiscal transparency; *Group 2* indicates the states with low scores. Comparison of the dendrograms over the 3 years shows an interesting evolution in shift in dissimilarity distances between these groups. Overall, the dissimilarity measure between the groups reduced between 2014 and 2016. It should be noted that there is an increase in the average US PIRG scores between these years (76.3 in 2014, 81.5 in 2015, and 83.3 in 2016). States have thus generally improved fiscal transparency through the OGD portals.

Analysis within each group shows that the dissimilarity measure decreased from 2014 to 2016 for Group 1, but the dissimilarity increased within Group 2 during the period. Group 1 states have become more similar every year, with less variation between themselves as the fiscal transparency scores increased. Group 2 states have become more dissimilar over the 3 years, with more variations between them. Group 1 states with higher fiscal transparency scores have become convergent over the 3 years, and Group 2 states with lower scores have become more divergent.

The composition of the states within the groups shows interesting patterns. The number of states in Group 2 increased from 12 to 15 between 2014 and 2016. Of these, eight states remained in the group during the period; four moved to Group 1. Seven states from Group 1 moved to Group 2. In other words, there are transitions from Group 2 to Group 1 and vice versa. Laggard states which remain in Group 2 are left behind further every year as some states improve their scores and move to Group 1. At the same time, states could also fall behind and move to Group 2 as other states improve their transparency efforts.

Having a closer look into the individual states within the groups and movement between the groups also provides interesting insights. On the leading edge, seven of

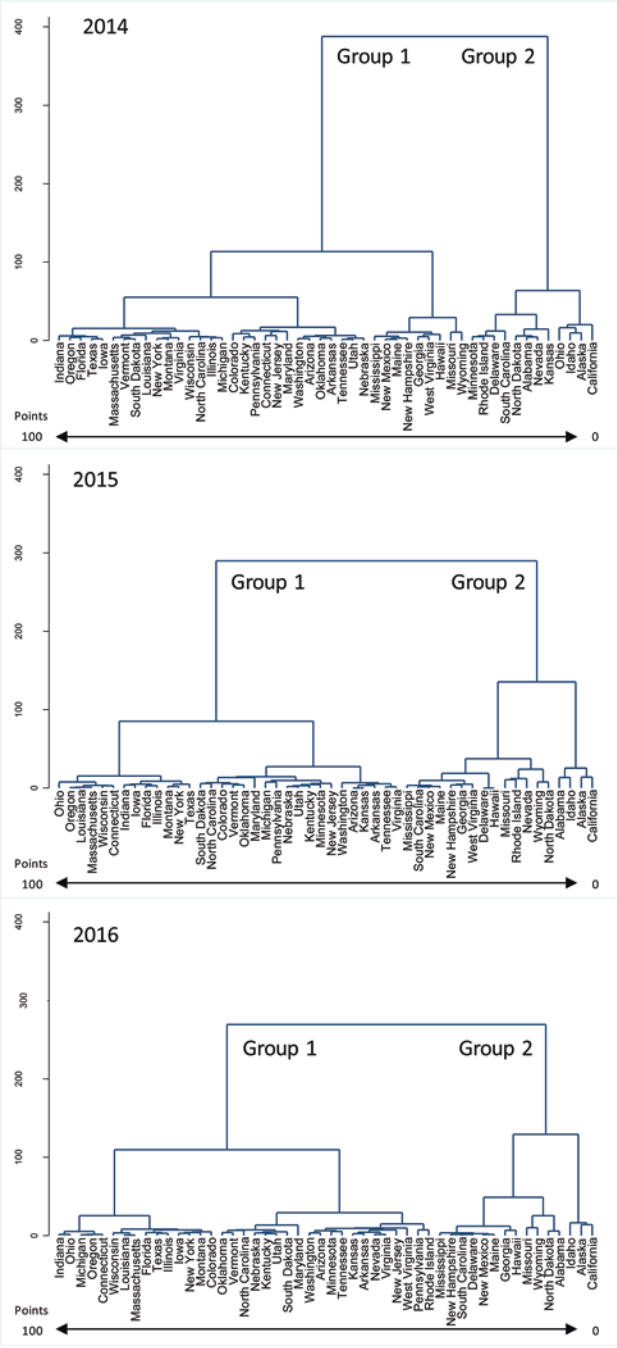


Fig. 2 Dendrograms of OGD portals’ fiscal transparency scorecard, 2014–2016

the eight states that received an A- or better grade in 2014 retained such grade levels in 2016 (they were Florida, Indiana, Iowa, Massachusetts, Oregon, Texas, and Wisconsin). On the lagging edge, three states (Alaska, California, and Idaho) consistently received F grades through the 3 years. They were laggard states that did not improve on their fiscal transparency scores. One state—Ohio—rose remarkably in the grades from D- to A+ during the 3 years. No state fell as dramatically from a high to low grade. The cluster results present important policy implications. Citizens living in the leading states clearly obtain better public value of OGD's fiscal transparency than those living in the lagging states. A Texas resident, for example, would have much better access to state government fiscal information than an Idaho resident. The differences in the access create unequal conditions for citizens in the United States to access their state government fiscal information.

To understand the specific aspects of each dimension, Fig. 3 presents a radial graph of the average attainment of the states across the 13 US PIRG indicators. A point on the radial graph represents the average value as a percent of the maximum value for the indicator. A move from small to high percentage indicates that the average has moved in the positive direction. The checkbook-level spending information is nearly 100% for all 3 years, showing that all states provide this type of information. There is scope for improving upon expenditure information about quasi-public agencies, but states have improved remarkably on providing excluded information on transactions. The OGD portals of a very large majority of the states (average over 90%) are also searchable by agency, keyword, or recipient, but the average score for bulk downloadable data is below 90%. Unlike the checkbook-level information, the information about economic development subsidies is not as advanced across all states. The average scores for checkbook-level subsidies, projected public benefits, and actual benefits reached about 60%, 50%, and 40% of the maximum value. Very few OGD portals provide information about recouped funds. The data for economic development subsidies also are not available for majority of the states (average value is below 40%). The average score for tax expenditure reports is below 90% of the maximum value, implying that a few states do not provide such information.

The cluster analysis presents interesting results about the attainment of public value of fiscal transparency. The overall scores of the OGD portals have improved over time. Within the two groups, Group 1 states have become more similar over time, achieving higher grades over time. Group 2 states have become more dissimilar over time, with divergent grades over time. Some features of fiscal transparency—such as checkbook-level transparency—have been attained across all states. The OGD portals are also largely searchable. Clearly, the external authorizing environment and the internal operational features of the states have been broadly supportive in enhancing fiscal transparency efforts through the OGD portals. However, there are variations between the two groups of states, mainly in terms of information about checkbook-level subsidies, projected public benefits, and actual benefits. There are thus distinctive patterns of factors that have influenced the differential achievement of public values between the two groups of states. We explore these differential factors through in-depth case studies.



Fig. 3 Radial graph of average OGD portals’ fiscal transparency scorecard indicators, 2014–2016

7 Case Study Results

Based on the cluster analysis, we selected three contrasting states for further in-depth case studies in order to explore the factors with respect to the authorizing environment or operational capability that enhance or inhibit the OGD portal’s public value creation. The first case was chosen from the states that scored F grade across all the years and the second case was chosen from the states that scored A range grade across all the years. Among the three states (Alaska, Idaho, California) scoring F grade, we chose Idaho. Among the leading states scoring A- or better grade, we chose Texas. In addition, we chose the special case of Ohio because it moved up dramatically from D- to A+ in the 3-year period. The contrasting case studies are useful to obtain a wide range of contextual factors at the internal and external levels that influence the OGD portal’s public value creation. We constructed the case studies based on interviews with persons in the state government offices that maintain the OGD portal and review of secondary data sources (e.g., newspapers, the department websites). For Idaho, the Deputy State Controller was interviewed (in July 2017). For Texas, group interview with three officials (director, manager, and supervisor) of the Comptroller Office’s Data Analysis and Transparency Division was

conducted (in August 2017). The Ohio Treasurer's office (which manages the portal) did not respond to our repeated interview requests, but the treasurer (Josh Mandel) has authored articles about the OGD portal.

7.1 *Idaho*

Idaho launched its transparency portal in 2013, one of the last states to do so. It is hosted by the State Controller's office, which is managed by an elected State Controller. The office oversees statewide internal pre-audit accounting controls (post-audit functions are performed by the Legislative Services Office). It is divided into three operating divisions: accounting, computer services, and payroll. Brandon Woolf, who has been the controller since 2012, came into office with an express commitment to openness and transparency of government operations, including implementation of "a strong internal control structure and requiring accurate, timely, and transparent financial reporting" (<https://www.sco.idaho.gov/>). Transparency has been one of Mr. Wolf's four priority issues politically (<http://brandonwoolf.com/issues/transparency/>). Although the Controller's office had considered establishing the transparency site for 6 years, it was not able to do so since state funding was not available (the budget for the site was even withdrawn in 2012). The Controller remarked, "It was like drawing blood out of turnip." Hence, the office used internal funds for the portal, through contract negotiations with their data warehouse software vendor. The Controller's office set up the transparency portal (<http://transparent.idaho.gov>) in cooperation with the governor's office, the Division of Financial Management, Legislative Services Office, and Office of the Chief Information Officer (CIO).

While the setting up of the transparency portal is significant by itself, it has consistently received failing grade. Figure 4 shows the scores of Idaho's OGD portal for the US PIRG scorecard's 13 indicators across the 3 substantive categories. In 2014, the website provided checkbook-level information for contracts and expenditure, and the data were available by agency; however, the site did not provide a searchable interface of the contracts and expenditure by recipient or by keyword. The data were also not fully downloadable. No data were available for quasi-public agencies. No data were available for the economic development subsidies either. The website appears to have provided tax expenditure reports in 2014, but has not done so since 2015. When the authors checked in July 2017, the site provided a link to tax expenditure reports, but the link was broken. Two features were added in 2015—search by recipient and excluded information. Available data are downloadable such as.pdf files, which are created on the fly. No further changes occurred in 2016.

Why did Idaho's transparency portal fare poorly in terms of public value of fiscal transparency through the OGD portal? In the beginning, the State Controller's Office was eager to work with US PIRG in order to understand and implement the transparency elements. Indeed, when the Controller's office launched the site in 2013, Mr. Woolf acknowledged that the report cards were "a bit of a breaking point

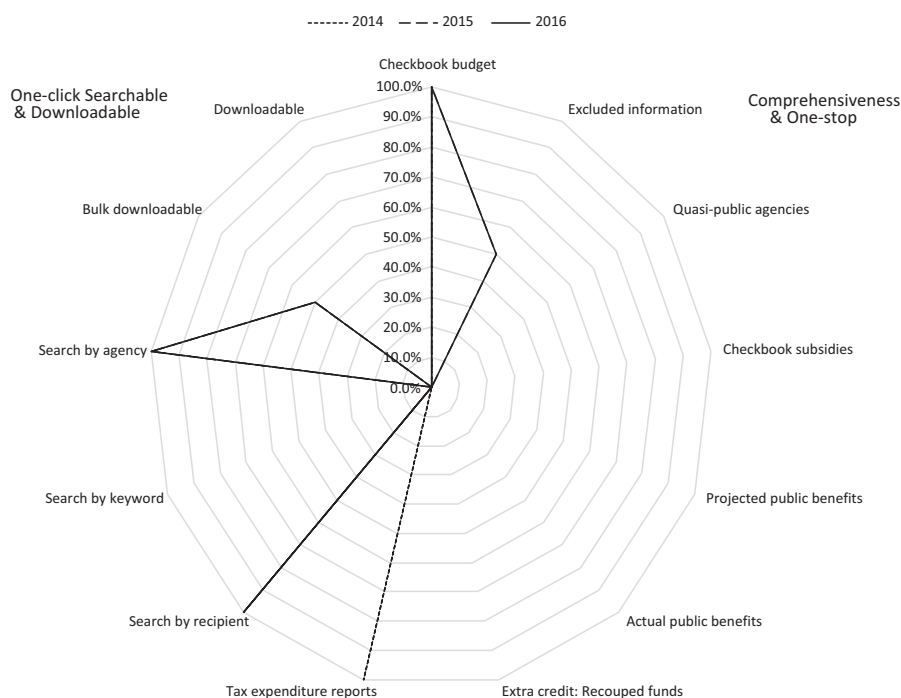


Fig. 4 Idaho OGD portal's fiscal transparency scorecard indicators, 2014–2016

in pushing for a transparency website.” The Deputy State Controller, Scott Phillips, acknowledged US PIRG as a valuable resource, saying “I can’t speak highly enough of their organization.” The US PIRG evaluation itself was thus a factor of the authorizing environment to spur the OGD portal efforts. The Idaho Controller’s Office examined other states’ transparency efforts and best practices and looked into the data that were available in-house that could be made publicly available and the range of information requests that they received. Based on their examination, the Controller’s office began to put state employees’ salary data in the portal; the data was the most frequently requested and readily available with the office.

However, by 2015, the relationship with US PIRG had soured. The Chief Deputy Controller, Dan Goicoechea, said that the “[U.S. PIRG] has no credibility with our office” (Berry 2015). Mr. Goicoechea felt that the “It [U.S. PIRG] tries to apply one template to all 50 states without looking at the laws that pertain to those states.” The Deputy State Controller also echoed Mr. Goicoechea’s sentiments in the interview. The US PIRG added new requirements for fulfilling the score, so that the criteria for the rankings become moving targets. Mr. Phillips equated them to Christmas tree decoration, where new baubles are required to be added every year as other states also add such baubles. The large investments required to attain US PIRG rankings did not have commensurate returns, especially in the context of the nature of the information requests that the office had.

The Deputy State Controller made three additional arguments in the interview that are pertinent to Idaho's low grade. On the authorizing environment side, Idaho does not have explicit enabling authorizing environment of legal framework for open government and transparency (the closest is the Law 74, called *Transparent and Ethical Government*, which is a public records law). Idaho's transparency site provides the information that confirms with Idaho's transparency laws. The US PIRG's rating for Idaho shows a level of deficiency in providing information on economic development subsidies. This deficiency reflects a limitation of Idaho's legal framework that prohibits from posting such information. On the internal operational capability front, the Controller's Office does not possess all the fiscal transparency data required for the OGD portals; some data such as the tax expenditure reports are under the purview of another office. This poses a back-end coordination issue for being a one-stop portal. Moreover, the state's information technology systems are legacy systems, which were not built with transparency disclosures in perspective. For example, the system does not allow for differentiating between checkbooks that should be legally disclosed and those that should not. The Controller's Office has plans to upgrade the information technology over the next 5 years with an enterprise system that can handle more advanced transparency requirements.

7.2 Texas

Texas's OGD portal (<https://comptroller.texas.gov/transparency/>) has been consistently rated to be on the leading edge. The Texas Comptroller's office (Data Analysis and Transparency Division) manages the portal. The Comptroller, who is elected, acts as the state's chief tax collector, accountant, revenue estimator, treasurer, and purchasing manager. The state has had over decade's history of online financial transparency. The move toward transparency began with Ms. Susan Combs, the former Comptroller (2007–2015), and has continued with the current Comptroller, Jack Hagar. In October 2007, the office launched *Where the Money Goes*, the online checkbook register for the state. It then launched the *Where the Money Comes from*, detailing the revenue sources of the state. The Texas Department of Transportation (TxDOT) teamed up with the Comptroller's office to shed more light on how taxpayer dollars are spent and grant money is awarded throughout Texas. The Comptroller's office launched the Leadership Circle program in 2009 to recognize local governments across Texas striving to meet a high standard for financial transparency online. In 2010, the transparency portal began to feature Open Data Center, where anyone can download raw datasets. The state has thus continually used online modes to keep ahead in transparency.

Figure 5 shows the scores of Texas OGD portal for the US PIRG scorecard's 13 indicators across the 3 substantive categories for 2014–2016. With respect to information on checkbook-level expenditures, the state scored 100% on checkbook budget and excluded information but scored 66% in providing information on

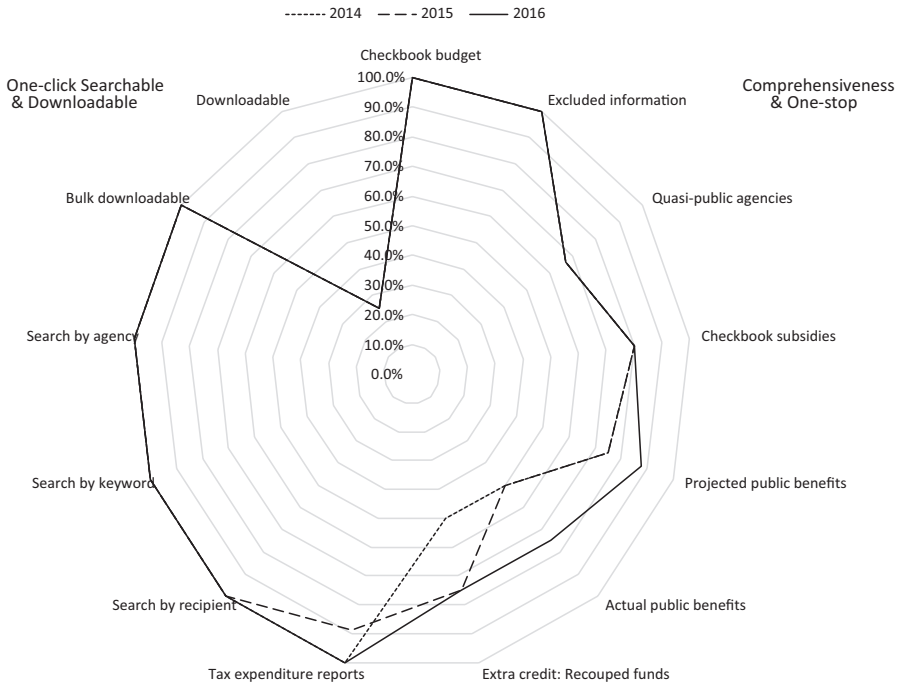


Fig. 5 Texas OGD portal's fiscal transparency scorecard indicators, 2014–2016

quasi-public agencies' expenditure. It also scored 100% on searchable and downloadable data. The portal provides information on economic development subsidies with 80% score for checkbook-level information and improved its information delivery for projected and actual benefits (88% and 75%, respectively, in 2016). The subsidy data, however, are not very downloadable (about 25% score). Finally, the state provides tax expenditure reports (100% score in 2016).

How did Texas keep its leading spot in transparency? The early start with Susan Combs spearheading the transparency efforts helped in advancing the transparency agenda. She initiated a range of transparency efforts within the Comptroller's office. She wrote in her memoir: "I was committed to government transparency. You might say I got rabid" (Combs 2017, p. 166). The transparency efforts received wide recognition (e.g., Center for Digital Government award in 2008; Government Finance Officers Association award in 2009). Legislators and citizens demanded more fiscal information with the transparency efforts. In the interview with comptroller's officials, one official said: "It snowballed into more momentum to get more and more information. They don't only want it, but also expect it." The snowball effect of transparency to get more data is quite compelling in depicting the public value of the OGD portals.

Externally, the demand for transparency began with citizens' demand for information about local government finances. One official in the interview mentioned that local property taxes are higher than the state taxes (franchise, oil & gas, sales).

Consequently, there was pressure on the state legislature to impel local governments to be more transparent with the tax expenditure (especially debts). The Texas House Bill 1378 passed in 2015 legally mandated the local governments to provide debt transparency across the state. Combs (2017) narrates the uphill task with enacting transparency legislation at the state level. According to one official we interviewed, “We did not want to ask local agencies to do something that we did not do ourselves.” So, the comptroller’s office started with putting the state government debt data online.

Internally, based on our interview, the comptroller’s office appears to have culture of transparency. The leadership of both Combs and Hegar facilitated the culture. The comptroller’s office’s experience with putting state government data helped the office to develop the Leadership Circle and other programs to assist local governments to provide financial data online. It later evolved into the STARS program currently where local governments are given recognition/ awards for providing data in each category. The comptroller’s office is thus a facilitator for local government transparency—it helps local governments with the technical as well as other procedural aspects of putting the fiscal data online. A small staff of less than five forms the core team, but is also assisted by other units (communications, information technology, web team, editorial team, etc.). The team has both technical and financial expertise to put the required financial data online.

7.3 *Ohio*

Ohio’s OGD portal is an illustration of how the state improved its grades within a short period. In 2014, the Idaho and Ohio’s portals were similar (they were apart by 7 points). While Ohio’s checkbook-level transparency was achieved, it did not have any of the other functions with respect to contracts and expenditures. With respect to economic development subsidies, the state’s portal received partial grades with respect to downloadable, projected public benefits, and actual public benefits. The state did provide tax expenditure reports. Since 2015, the strategy of the state switched to a more aggressive budget transparency, advancing in all features from both dimensions: contracts and expenses and economic development subsidies. The portal received 100% across all 13 indicators in 2015 and 2016 (Fig. 6). The results indicate that the state really tackled each of the challenges of each feature of budget transparency to provide access to government spending data. Ohio turned around to become a leader of OGD fiscal transparency.

How did Ohio advance in the transparency efforts? The Treasurer’s office oversees the implementation of the transparency measures. The office comprises state accounting, administration, debt management, information technology services, internal auditing, public affairs, and so on. The state’s Treasurer, Josh Mandel, an elected official, was taken aback by the US PIRG’s low grade it had received in 2014 (Mandel and Baxandall 2015). Elected in 2011, Mr. Mandel had launched the Treasurer’s Transparency Project with the goal of allowing taxpayers to follow their

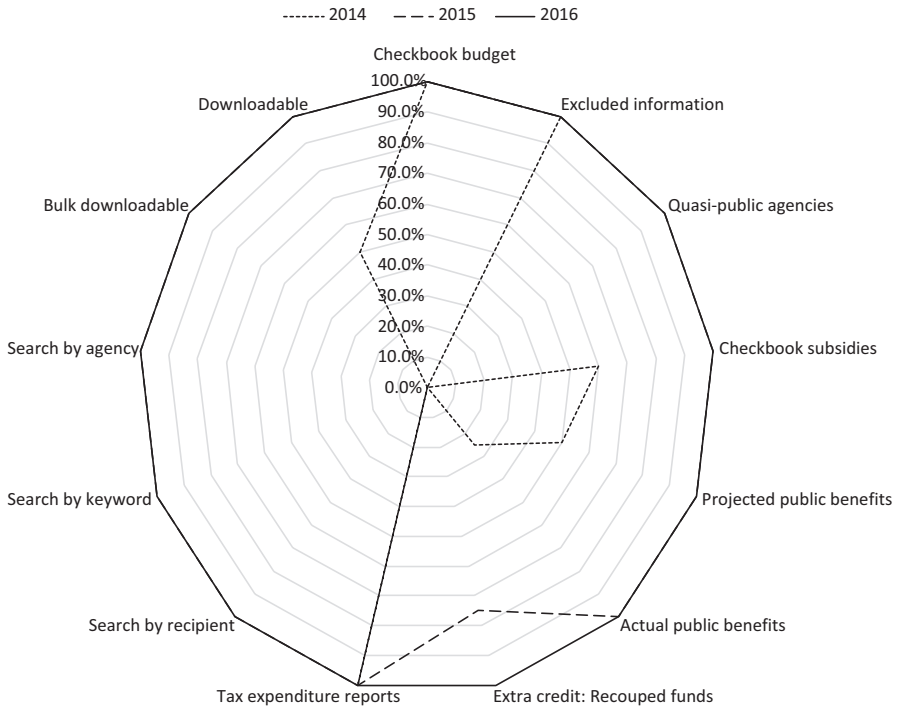


Fig. 6 Ohio OGD portal’s fiscal transparency scorecard indicators, 2014–2016

money and hold government officials accountable. The project made available state employees’ salary database publicly available. The Treasurer’s office launched the state’s transparency portal, OhioCheckbook.com in December 2014.

Externally, the role of US PIRG’s grading played a role in spurring the OGD portal. The treasurer took a leadership role in the transparency efforts following the low grades. He spearheaded the move to legislatively require state spending online (HB 175 in 2014), which did not pass muster in the state senate. The treasurer then championed a legislation (HB 46 passed in 2015) that would require future treasurers to publish and maintain the state’s online database. Besides recognition from the US PIRG, Ohio’s OGD portal has received wide acclaim from news agencies and watchdogs, including an award from the Center for Digital Government. Internally, the Treasurer’s office “set out to meet and even surpass best practices for making budgets, contracts, subsidies and ‘off-budget’ expenditures open to public scrutiny” (Mandel and Baxandall 2015). The portal was financed by using internal organizational funds. It uses a Google-style search engine that is easy to navigate, along with interactive charts. The portal began to include the local city and county government spending data in 2015 (called Local Checkbooks).

The comparison of the three cases of Idaho, Texas, and Ohio provides insights into the factors that influence fiscal transparency through the OGD portals. Table 2

Table 2 Factors enhancing or inhibiting public value creation from case studies

	Authorizing environment factors	Operational capability factors
Idaho	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">Strong relationship with the legislative branch and teamState controller is an elected official <p><i>Inhibitors:</i></p> <ul style="list-style-type: none">Change of administration and leadership of the projectConfronting relationship with US PIRGWeak state legal framework for transparency and OGDMoving standards and evaluation criteria for US PIRG in particular and financial transparency in general	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">Committed leadership from the state controller’s office at the beginningInter-agency collaboration in the start pointUS PIRG report and other watchdogs’ assessments are valuable resources <p><i>Inhibitors:</i></p> <ul style="list-style-type: none">Lack of funding to develop the projectContract’s negotiations for developing information systems and applicationsAccess to data from other agencies that are not within controller’s responsibilityInter-agency collaboration during the process of developing the project
Texas	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">The state treasurer is an elected officialTransparency and OGD legislationsStrengthening relationships with watchdogs and other external parties	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">Committed leadership from state comptrollers over timePromoting budget transparency across state and local governments (cities, counties, and towns)Support for inter-agency data sharing
Ohio	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">The state treasurer is an elected officialEnacting required transparency and OGD legislations (spearheaded legislations)Strengthening relationships with watchdogs and other external partiesPositive impact of US PIRG scorecard	<p><i>Enhancers:</i></p> <ul style="list-style-type: none">Committed leadership from the state treasurer from the start to the end of the projectSufficient internal funding for developing from the start to the end of the projectSmart use of online tools like user-friendly search engines

summarizes the enabling and inhibiting factors that affect the OGD portals. With respect to the authorizing environment, the elected leaders in all three states were sensitive to the demand for OGD fiscal transparency. The transparency laws in Texas and Ohio to require an online fiscal database that is publicly accessible further strengthened their OGD portals, and allowed them to expand the portals to host local government fiscal data as well; such laws are weak in Idaho. Texas and Ohio adapted to the changing digital environment to provide online fiscal transparency; Idaho faced funding difficulties in establishing the portal. With respect to the operational capability, all three states have committed leadership. The leaders’ roles in establishing the OGD portals cannot be underestimated; they had to find adequate resources and external support to establish the portals. At the same time, whereas agencies in charge of Texas and Ohio OGD portals developed an organizational culture of transparency, the Idaho agency was hamstrung by the legal environment.

Obtaining data beyond the transparency agency poses collaboration issues, but Texas and Ohio managed to achieve that partly by providing technical and other support and partly through legal mandates for transparency.

8 Discussion and Conclusion

The public value framework is useful in analyzing the state OGD portals that have emerged over the last decade. The OGD portals have public value in enhancing fiscal transparency by providing meaningful data online that are accessible to anyone. However, as the US PIRG scorecard shows, the states differ in the nature and extent to which the states provide the data. The cluster analysis shows the pattern of evolution of budget transparency across state governments. There are two groups of state governments: high performers (Group 1) and low performers (Group 2). In the case of high performers, the dissimilarity measures decrease overtime, meaning that budget transparency of these states reaches similar levels every year. In the case of low performers, the situation is the opposite. Low-performing states become more dissimilar every year. This is an indication that overtime the states with high performance are separating from the states with medium and low performances. These findings suggest that lag-gard states are left behind further every year, so the recovery path becomes much harder. This finding has a policy recommendation: implementing fiscal transparency through the OGD portals takes time. States should take efforts to implement online fiscal transparency measures early enough if they are serious about open government.

Cluster analysis also was useful to uncover the specific indicators that enhance the online fiscal transparency. Even leading states have scope to improve their fiscal transparency by focusing on the indicators. All states provide checkbook-level spending information, which is the basic information about government spending on contracts and other expenditures. There is much scope for improving upon information about expenditures of quasi-public agencies; states have improved remarkably on providing excluded information on transactions. The large majority of the OGD portals are searchable by agency, keyword, or recipient, and the data are downloadable for off-line analysis. States could focus on disseminating information about economic development subsidies, as many states are deficient in providing information about checkbook-level subsidies, projected public benefits, and actual benefits; the OGD portals are also deficient in providing downloadable data. Tax expenditure reports are increasingly provided by the OGD portals, but a few states could improve their portals by providing such information.

The contrasting cases of Idaho, Texas, and Ohio provide interesting insights about the authorizing environment and operational capability for fiscal transparency through the OGD portals. All three states have elected state treasurer or controller who are committed to transparency efforts and have taken the steps required for establishing a one-stop portal. They are all fiscally conservative states that demand stringent transparency. Leadership is key to achieving budget transparency. However, despite the leadership's efforts, Idaho obtained low grades, Texas has done consistently well, and

Ohio moved up considerably. The online fiscal transparency is a manifestation of the several other underlying factors. First, the states need to have the legal framework enabling transparency. In Idaho, clearly, the state laws for transparency are minimal, and even limit the data that could be released through the portal. In Ohio and Texas, the state controllers have fought for enabling legislation to put up such data. Second, there are agency coordination problems that must be overcome for providing the data. The controller’s office provides the data that are accessible to them; the office may not have control over the data that other agencies possess. Unless a broader mandate exists to provide the data, such data may be provided on voluntary basis. Third, the technological issues could shape the forms in which data are provided. Legacy systems in Idaho allow.pdf file downloads that are created on the fly. Ohio and Texas provide more interactive data that could be accessed through APIs.

Figure 7 summarizes our overall findings with respect to public value creation through the OGD portals. Fiscal transparency through the OGD portals has public value. Several aspects of the authorizing environment and the operational capability influence the achievement of the public value goal of fiscal transparency through the portals. With respect to the authorizing environment, states need to have enabling transparency legislation for setting up the OGD. Elected leaders are generally

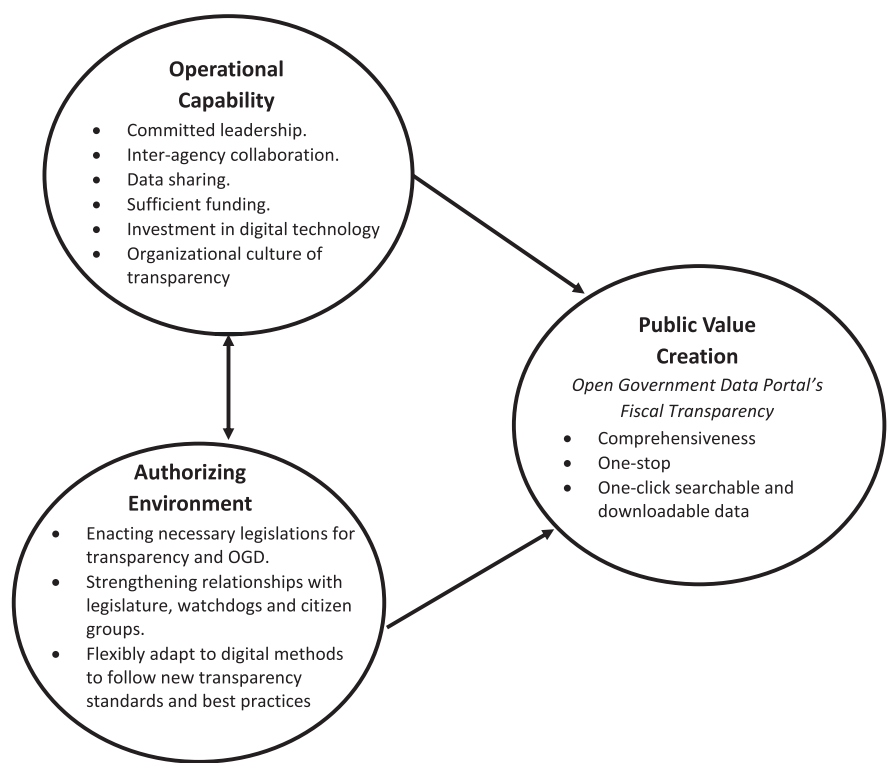


Fig. 7 Revisited public value framework for OGD portal

responsive to the constituents and have incentives to strengthen relationships with legislature, watchdogs, and citizen groups. The states should be willing to flexibly adapt to the rapidly evolving digital environment and new standards and best practices for disseminating fiscal data (e.g., adapting to mobile environment, providing machine-readable data for APIs, etc.).

With respect to operational capability, the states need to have committed leadership in the agencies implementing the OGD portals as achieving fiscal transparency takes time. The implementing agencies can facilitate inter-agency collaboration and provide a platform for data sharing, especially if the data are outside of the agency's purview. Providing such platform support enables local governments to participate in fiscal transparency through the OGD portals. Although the OGD portals are inexpensive, they do require funding support to establish and maintain them. Leaders have to be creative to find such funding support, either within their operational budgets or by establishing partnerships with other agencies. The budgetary support would also provide resources for investing in and adapting to the rapidly evolving digital technologies, rather than being stuck with legacy technologies. Last, but not the least, the state agencies need to have a culture of transparency in order to nurture and maintain the fiscal transparency through the OGD portals. Our findings clearly show that governments can innovate and create more public value. The importance has to be on creating greater public value with the fiscal transparency, not just placing "more" data online for the sake of putting data (Zuiderwijk and Janssen 2014).

There are three important recommendations for future research. First, this paper is exploratory in nature. Future research could focus on explanatory research, testing key hypotheses about the factors of the authorizing environment and operational capability identified in this paper using quantitative research designs. Second, longitudinal research designs are required to identify some of the causal factors of achieving fiscal transparency. Third, in this paper, we adopted US PIRG's evaluations as indicators of the public value of OGD's fiscal transparency. Future research could focus on the actual contents of the fiscal data and the extent to which they add public value.

References

- Alcaide Muñoz, L., Rodríguez Bolívar, M. P., & López Hernández, A. M. (2017). Transparency in governments: A meta-analytic review of incentives for digital versus hard-copy public financial disclosures. *American Review of Public Administration*, 47(5), 550–573. <https://doi.org/10.1177/0275074016629008>.
- Alesina, A., Hausmann, R., Hommes, R., & Stein, E. (1999). Budget institutions and fiscal performance in Latin America. *Journal of Development Economics*, 59(2), 253–273.
- Alesina, A., & Perotti, R. (1996). Fiscal discipline and the budget process. *The American Economic Review*, 86(2), 401–407.
- Alford, J., & Hughes, O. (2008). Public value pragmatism as the next phase of public management. *The American Review of Public Administration*, 38(2), 130–148.
- Alford, J., & O'Flynn, J. (2009). Making sense of public value: Concepts, critiques and emergent meanings. *International Journal of Public Administration*, 32(3–4), 171–191.

- Allen, T. L. (2002). Public accountability and government financial reporting. *OECD Journal on Budgeting*, 2, 11–31.
- Alt, J. E., & Lassen, D. D. (2006). Fiscal transparency, political parties, and debt in OECD countries. *European Economic Review*, 50(6), 1403–1439.
- Alt, J. E., Lassen, D. D., & Rose, S. (2006). The causes of fiscal transparency: Evidence from the US states. *IMF Staff Papers*, 30–57.
- Araujo, J. F. F. E. d., & Tejedo-Romero, F. (2016). Local government transparency index: Determinants of municipalities' rankings. *International Journal of Public Sector Management*, 29(4), 327–347.
- Armstrong, C. L. (2011). Providing a clearer view: An examination of transparency on local government websites. *Government Information Quarterly*, 28(1), 11–16. <https://doi.org/10.1016/j.giq.2010.07.006>.
- Bank, W. (2015). *Budget transparency: What, why, and how?* Retrieved from Washington, D.C.
- Bannister, F., & Connolly, R. (2011). The trouble with transparency: A critical review of openness in e-government. *Policy & Internet*, 3(1), 1–30.
- Bastida, F., & Benito, B. (2007). Central government budget practices and transparency: An international comparison. *Public Administration*, 85(3), 667–716.
- Bastida, F., Guillamón, M.-D., & Benito, B. (2017). Fiscal transparency and the cost of sovereign debt. *International Review of Administrative Sciences*, 83(1), 106–128.
- Benington, J., & Moore, M. H. (2011). Public value in complex and changing times. In J. Benington & M. H. Moore (Eds.), *Public value: Theory and practice* (pp. 1–30). New York: Palgrave Macmillan.
- Benito, B., & Bastida, F. (2009). Budget transparency, fiscal performance, and political turnout: An international approach. *Public Administration Review*, 69(3), 403–417.
- Bernoth, K., & Wolff, G. B. (2008). Fool the markets? Creative accounting, fiscal transparency and sovereign risk premia. *Scottish Journal of Political Economy*, 55(4), 465–487.
- Berry, H. (2015). Idaho State Controller's Office strikes back at U.S. PIRG report on online data transparency. Boise Weekly (March 19). Retrieved from <https://www.boiseweekly.com/CityDesk/archives/2015/03/19/idaho-state-controllers-office-strikes-back-at-us-pirg-report-on-onlinedata-transparency>.
- Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27(3), 264–271.
- Borins, S. (2002). On the frontiers of electronic governance: A report on the United States and Canada. *International Review of Administrative Sciences*, 68(2), 199–211.
- Bozeman, B. (2002). Public-value failure: When efficient markets may not do. *Public Administration Review*, 62(2), 145–161.
- Brown, D. (2005). Electronic government and public administration. *International Review of Administrative Sciences*, 71(2), 241–254.
- 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.
- Carrasco, C., & Sobreper, X. (2015). Open government data: An assessment of the Spanish municipal situation. *Social Science Computer Review*, 33(5), 631–644. <https://doi.org/10.1177/0894439314560678>.
- Combs, S. (2017). *Texas tenacity: A call for women to direct their destiny*. Austin: Greenleaf Book Group Press.
- Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, 29(4), 512–520.
- Corrêa, A. S., Corrêa, A. S., Paula, E. C. d., Paula, E. C. d., Corrêa, P. L. P., Corrêa, P. L. P., et al. (2017). Transparency and open government data: a wide national assessment of data openness in Brazilian local governments. *Transforming Government: People, Process and Policy*, 11(1), 58–78.

- Cucciniello, M., & Nasi, G. (2014). Transparency for trust in government: How effective is formal transparency? *International Journal of Public Administration*, 37(13), 911–921.
- da Cruz, N. F., Tavares, A. F., Marques, R. C., Jorge, S., & de Sousa, L. (2016). Measuring local government transparency. *Public Management Review*, 18(6), 866–893.
- Dawes, S. S., Vidiyasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, 33(1), 15–27.
- Grimmelikhuijsen, S. G., & Meijer, A. J. (2012). *The effects of transparency on the perceived trustworthiness of a government organization: Evidence from an online experiment* (p. mus048). Journal of Public Administration Research and Theory.
- Harrison, T. M., Guerrero, S., Burke, G. B., Cook, M., Cresswell, A., Helbig, N., et al. (2012). Open government and e-government: Democratic challenges from a public value perspective. *Information Polity*, 17(2), 83–97.
- Harrison, T. M., & Sayogo, D. S. (2014). Transparency, participation, and accountability practices in open government: A comparative study. *Government Information Quarterly*, 31(4), 513–525.
- Heald, D. (2012). Why is transparency about public expenditure so elusive? *International Review of Administrative Sciences*, 78(1), 30–49.
- Hui, G., & Hayllar, M. R. (2010). Creating Public Value in E-Government: A Public-Private-Citizen Collaboration Framework in Web 2.0. *Australian Journal of Public Administration*, 69, S120–S131. <https://doi.org/10.1111/j.1467-8500.2009.00662.x>.
- Kim, S., Kim, H. J., & Lee, H. (2009). An institutional analysis of an e-government system for anti-corruption: The case of OPEN. *Government Information Quarterly*, 26(1), 42–50.
- Kim, S., & Schachter, H. L. (2013). Citizen participation in the budget process and local government accountability: Case studies of organizational learning from the United States and South Korea. *Public Performance & Management Review*, 36(3), 456–471.
- Kopits, G., & Craig, J. (1998). Transparency in government operations. Retrieved from <http://www.imf.org/external/index.htm>
- Lourenço, R. P. (2015). An analysis of open government portals: A perspective of transparency for accountability. *Government Information Quarterly*, 32(3), 323–332.
- Mandel, J., & Baxandall, P. (2015). Setting off a race for fiscal transparency, Government Technology. <http://www.govtech.com/budget-finance/Setting-Off-a-Race-for-Fiscal-Transparency.html>
- McNabb, D. E. (2013). *Research methods in public administration and nonprofit management*. Armonk: M. E. Sharpe.
- Meijer, A. (2015). Government transparency in historical perspective: From the ancient regime to open data in the Netherlands. *International Journal of Public Administration*, 38(3), 189–199.
- Mergel, I. (2013). Social media adoption and resulting tactics in the US federal government. *Government Information Quarterly*, 30(2), 123–130.
- Milesi-Ferretti, G. M. (2004). Good, bad or ugly? On the effects of fiscal rules with creative accounting. *Journal of Public Economics*, 88(1), 377–394.
- Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard University press.
- Nugroho, R. P., Zuiderwijk, A., Janssen, M., & de Jong, M. (2015). A comparison of national open data policies: Lessons learned. *Transforming Government: People, Process and Policy*, 9(3), 286–308.
- 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.
- Piotrowski, S. J. (2017). The “open government reform” movement: The case of the open government partnership and US transparency policies. *The American Review of Public Administration*, 47(2), 155–171.
- Rodríguez Bolívar, M. P., Caba Pérez, M.C., & López-Hernández, A. M. (2015a). Online budget transparency in OECD member countries and administrative culture. *Administration & Society*, 47(8), 943–982.

- Rodríguez Bolívar, M. P., Navarro Galera, A., & Alcaide Muñoz, L. (2015b). Governance, transparency and accountability: An international comparison. *Journal of Policy Modeling*, 37, 136–174. <https://doi.org/10.1016/j.jpolmod.2015.01.010>
- Rutgers, M. R. (2015). As good as it gets? On the meaning of public value in the study of policy and management. *The American Review of Public Administration*, 45(1), 29–45.
- Sandoval-Almazan, R., & Gil-Garcia, J. R. (2016). Toward an integrative assessment of open government: Proposing conceptual lenses and practical components. *Journal of Organizational Computing and Electronic Commerce*, 26(1–2), 170–192.
- Santiso, C. (2006). Improving fiscal governance and curbing corruption: How relevant are autonomous audit agencies? *International Public Management Review*, 7(2).
- Stoker, G. (2006). Public value management: A new narrative for networked governance? *The American Review of Public Administration*, 36(1), 41–57.
- Surka, M., & Ridlington, E. (2016). Following the money 2016. How the 50 states rate in providing online access to government spending data. Retrieved from <http://www.uspirg.org/news/us/following-money-2016-new-report-ranks-all-fifty-states-government-spending-transparency>
- Susha, I., Grönlund, Å., & Janssen, M. (2015a). Driving factors of service innovation using open government data: An exploratory study of entrepreneurs in two countries. *Information Policy*, 20(1), 19–34.
- Susha, I., Grönlund, Å., & Janssen, M. (2015b). Organizational measures to stimulate user engagement with open data. *Transforming Government: People, Process and Policy*, 9(2), 181–206.
- Tolbert, C. J., & Mossberger, K. (2006). The effects of E-government on trust and confidence in government. *Public Administration Review*, 66(3), 354–369.
- Ubaldi, B. (2013). Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives. OECD working papers on Public Governance, No. 22, OECD Publishing, Paris. <https://doi.org/10.1787/5k46bj4f03s7-en>.
- Von Hagen, J. (1992). Budgeting procedures and fiscal performance in the European Communities. *Economic Papers*, (96), 1–79.
- Wang, B., & Christensen, T. (2015). The open public value account and comprehensive social development: An assessment of China and the United States. *Administration & Society*, 49(6), 852–881.
- Ward, J. H., Jr. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association*, 58(301), 236–244.
- Wehner, J., & de Renzi, P. (2013). Citizens, legislators, and executive disclosure: The political determinants of fiscal transparency. *World Development*, 41, 96–108. <https://doi.org/10.1016/j.worlddev.2012.06.005>.
- Wirtz, B. W., Piehler, R., Thomas, M.-J., & Daiser, P. (2015). Resistance of public personnel to open government: A cognitive theory view of implementation barriers towards open government data. *Public Management Review*, 1–30.
- Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government Information Quarterly*, 31(1), 17–29.
- Zuiderwijk, A., & Janssen, M. (2015). Towards decision support for disclosing data: Closed or open data? *Information Policy*, 20(2, 3), 103–117.

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Toward the Open Government Ecosystem: Connecting e-Participation Models and Open Government to Analyze Public Policies



Larissa Galdino de Magalhães Santos

Abstract This chapter presents the results of the analysis of the open government initiative in the city of São Paulo. The theoretical-methodological structure built in the doctoral research promoted the evolution of the debate about openness through the debate of the ecosystem of open government with several actors. We combine the theoretical discussion of e-participation and model in three-dimensional layers to address the political program, project management, and sociotechnical tools that make up the open government ecosystem. In addition, the results indicate the need for the evolution of open government strategies to an ecosystem capable of integrating several parties in the development of public policies; for this, it is necessary to invest in “collaborative data” between society, private organizations, and the government sector. We analyzed the limits and potentialities of municipal government openness in the city of São Paulo, in the management of Fernando Haddad, examining the “Programa de Metas 2013–2016,” “Plataforma do Planeja Sampa,” and “São Paulo Aberta.” The results indicate how initiatives vary in relation to the implementation of strategies, management of strategies, and their capacity to influence as policies. The opening strategy is promising only as the first steps of the policy cycle—formulation, agenda, and decision-making. For this chapter, we present the need to refine and re-elaborate the concept of open government from the ecosystem.

1 Introduction

The world of politics agrees that government with and through the Internet and the use of technologies is imperative; however, how to do it is not clear. The public sector faces challenges and opportunities for reform and adaptation in response to

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the opening stimulus based on transparency, participation, and collaboration (Freeman and Quirke 2013; Oszlak and Ester 2014).

This scenario is aggravated by the low institutionality of the initiatives, the precariousness of the regulations, the low adherence of public agents to the conversation culture, lack of feedback to stakeholders, the looping and oscillating dialogue with the public, resulting in openness strategies, consequently innovation, reduced to implementation (De Blasio and Sorice 2016; Meijer et al. 2012).

Although studies recognize this complexity, it is unclear what are the relevant perspectives for theoretical integration and analysis, since the open label labeling reflects a divergent and polarized discourse between the democratic theoretical lens and innovations related to technological content (Cruz-Rubio 2015; Chatwin and Godwin 2017; Wirtz and Birkmeyer 2015).

“Opening” was applied inheriting technological and philosophical aspects. Technically, as instrumental value, it suggests the efficient processing of information and data, linked to accessible and reusable patterns, formats and structures. Philosophically, as a relational paradigm, it suggests the theme of democratization, the effective accessibility and reuse of information to generate open public policy and benefits. The incomplete approach reflects both the production of knowledge and the political processes in which collaboration, participation, collaboration, data, software, and technology are employed (Clarke and Francoli 2014; Cruz-Rubio 2015; Chatwin and Godwin 2017; Wirtz and Birkmeyer 2015; Zuiderwijk et al. 2014a).

In line with the agenda, governments themselves have issued a variety of policies related to the political, social, administrative, technological, and economic values of open government.

The diversity of concepts related to open government also reflects in the development of the agenda and in the different currents. As a result, the literature has a limited development in openness and innovation, reflecting the analysis gap and strategic planning of public management.

Otherwise, the expectation of broadening citizen participation at all levels of decision-making with the support of technologies has redirected e-democracy studies to the emergence of e-participation and open government. Consequently, there was a gradual shift from the governmental logic of exclusivity, control, and command to new forms of management, policies, and mechanisms focused on the relationship between civil society and the state.

e-participation corresponds to participation in the policy deepened and expanded by the use of technologies capable of promoting greater interaction between citizens and state agents.

Committed to the digital governance agenda, states and subnational units began investing in the creation of open government mechanisms, programs, and plans. Thus, open government has expanded as e-government action and e-participation tools, including other voices and forms of policy-making, promoting accountability, and provision of data.

This research has advanced in a new theoretical route of the ecosystem like model Integration of the open government, e-participation, and e-democracy.

The research was structured in three phases. In the first and second phases, we analyze the literature and the intersection between e-democracy and open government. I identify and select models of analysis in the field of e-participation to close an analytical framework of open government, the ecosystem of open government (Zuiderwijk et al. 2014a; McDermott 2010; Harrison et al. 2012).

I argue that the model has the potential to project a diagnostic scope of openness initiatives related to government strategy, identifying barriers, challenges, and advances. Finally, I believe that the ecosystem model dialogues with the conceptual and methodological contribution of a new approach to open government initiatives.

2 Advancing the Debate

In the face of related concerns and motivations, I propose a new lens to address the definitions of open government through the ecosystem metaphor that combines the different areas of openness. The nuanced conception of the ecosystem, as a network of interdependent systems, provides an understanding of democratic programming as well as the intensive use of information and communication technologies, advancing the discrepancies of open government analysis and examination models.

The objective is to reflect an integrated framework for all areas, considering the concrete form of governance, including various actors, sectors, and levels of government. This framework establishes the open governance ecosystem as a way of designing and executing a new form of openness, anticipating strategic forecasting, informing alternatives and functions for modeling existing policies.

Why is this research important? And why now? A systematic investigation of these processes or governance models is still incipient. It also serves to guide an open movement of data to maturity and political participation, identifying strengths and weaknesses, appropriate technologies, what works, and what does not. Together, they identify the most effective ways of implementing strategies for using participatory and open government technologies.

The debate on open government and e-participation brings with it expectations that positively affect democracy, promoting transparency, facilitating access to the information needed for participation and the achievement of social control. An open government provides for the need to improve levels of transparency, access to information and facilitates citizen participation through collaboration. Consequently, it must do with the opening of governmental institutions for citizenship, profound change in administrative culture, and the collective construction of digital (Canto Chac 2011; Arnstein 1969; IAP2 2007).

The citizen becomes an ally in the conduct of democratic governance and in the solution of public affairs. But participation requires much more than an invitation from the government. Participation is an active agent in the transversal development that composes the public policy process. I propose a new route, the view that the

value of the nature of open government is transversal and permeates technology, innovation, information, transparency, collaboration, and participation. As such, it is the instruments or public policies that are formulated, designed, and implemented based on the principles of open government. In this way, potentially, government openness is a strategy for public policy-making. And an open government is one that allows the participation of citizens and political actors in decision-making and training in public policies but which essentially covers the whole cycle, in a broad aspect of involvement during the phases.

However, the theoretical framework indicates that participatory platforms vary greatly in the implementation of decision-making strategies and the representation of these processes and their capacity to influence policies.

This proposal was driven by the theoretical-methodological challenge of analyzing experimental initiatives, and that there is no consensus among the analysis models. Therefore, we chose to elaborate a new model, but based on e-democracy assumptions. In view of this, we adapted a complex of three-dimensional analytical dimensions, one from the studies of e-participation (Macintosh and Whyte 2008): democratic dimension and values addressed to open government; dimension of the project, in its social, economic, legal, operational, and institutional perspectives; and sociotechnical dimension in the technological perspective.

This methodological strategy allowed for a holistic approach to open government, including all labels attributed to the vain, as well as guiding in each domain that is part of a larger government image. This model restores the previous model discrepancy from a system idea of complex interactions. It allows an indication of the best “supported states” for opening and comparisons. Finally, it serves to guide an open movement with maturity, identifying strengths and weaknesses, appropriate technologies, what works, and what does not. Supported status reflects the effective path to strategies for the use of technology and open government growth.

3 Closing the Analytical Framework of Open Government

Internet presence is an initial condition before the implementation of open government, but this is not related to e-government, or the “transmission” of information to the public. Public involvement requires the efficient use of non-static communication tools. The open government model assumes a sequence of implementation stages and is not random.

According to authors (Lee and Kwak 2011), there are four steps to implementing open government and the key is incremental implementation. The first action is to increase data transparency, whose process moves and influences the improvement of participation, which improves collaboration, fostering ubiquitous engagement.

Reflecting on increasing transparency requires two lines of action, first identifying the valuable data to the public and second the improvement and quality of the data in the delivery condition. At the stakeholder stage, the government should commit to creating methods and tools for policy decision-making to accommodate

public input. This second phase is also the time to use web 2.0 and features that include dynamic and interactive tools in two-way communication. For the collaboration, however, the government strives to make it feasible between agency, the public, and the private sector, but the essential thing is that public engagement can produce or co-create values. The maximum engagement in open government to obtain benefits depends on the integrating public methods, tools and services.

In fact, simultaneous implementation causes challenges to the implementer, but this is the way to balance the public and the government, because with every evolution of implementation, value and benefits increase for both (Lee and Kwak 2011).

There are still other aggregate and subliminal values in each phase. Trust, for example, is associated with identifying relevant data and ensuring quality and timely publication. These same data provide awareness of government performance, so transparency provides the basis for the public to participate. It is important to emphasize that, to the same extent that the citizen engages with the government, the culture for openness between agencies is encouraged.

Transparency is the basis for open participation and public collaboration. But the reception of public input varies in method and tool. This is the time when government is open to ideas and public knowledge (Lee and Kwak, 2011). The tools used in this process are precisely e-participation tools, be they social networks, or other web 2.0 applications that integrate participatory processes.

Participation and collaboration differ in that open participation is the relatively simpler public engagement compared to collaboration. This is because the collaboration points to more specific tasks that are also intended to produce distinct outputs but which mainly include collaboration with other agencies, the public, and the private, using government data and public inputs. Collaboration has synergistic effects and includes innovation in services, but also policy-making (Lee and Kwak 2011).

In view of this, the open government strategy is the ideal scenario for the flourishing of electronic mechanisms of participation, including the citizen in the decision-making process. But the question is how to coordinate these practices. As an ecosystem, open government becomes an umbrella for innumerable activities and efforts to increase public participation because of a more open but developing policy while moving toward a more collaborative governance model. Initiatives, in general, encourage agencies to engage the public to generate better ideas for government and policy.

Opening initiatives that have explored the relationship of citizens to decision-making are a breakthrough for new governance in public administration, but open government is not a panacea of action to overcome the pitfalls of representative democracy. All dimensions and variables should govern the government's effort to bring political decisions under public scrutiny, but they must be considered as a joint process, not flags in dispute within a government.

At the same time, the scenario of adopting open government programs in national entities and subnational units with the expectation of economic, social, and political benefits has been reinforced by a legal framework of agencies, as mentioned

above, and this implies the implementation of the principles of open government. The issuance of the guidelines serves to guide the programs by impressing the profile of the government's strategy in the open. In the recent past, similar agencies postulated programs for e-government and were augmented using platforms for participation and social networks.

Open government programs include guidelines, rules, guidelines, and practices that apply to organizations and administrative routines within government that are different. However, in addition to the of concepts related to open government that hinders the imprecision of approaches (Dawes et al. 2016) literature is polarized.

The first hub focuses on the use of data for innovation and is more related to the economic and operational outlook of open government. On the other hand, the other center focuses on the use of data to stimulate government participation and responsibility and has more relation with the social, political, and institutional perspective of open government.

The first field that highlights the benefits of open government to solve public problems and participatory decision-making is part of the general objectives of open government with the availability of information for greater participation, collaboration, and governmental responsiveness. Participation is understood as the potential key that uses data for a better decision (Peixoto 2013), the empowerment of the citizen in the process of policy formulation implying government confidence (Janssen et al. 2012), as well as the fight against corruption disclosing the organizations' budgets, performances, and contracts (Bertot et al. 2010).

The second field dealing with the continuous dissemination of accessible data, creation of platforms with new applications, innovations, and services, points to two strategies that are adopted by governments. Governments support the use of open data through applications in the face of public needs, enabling feedback and data coordination between government and stakeholders (Sieber and Johnson 2015). This is a form of engagement as users will participate in building improved government dataset.

The current open government strategies include political, legal, institutional, social, economic, operational, and technical challenges (Zuiderwijk et al. 2014b), and this is the contribution of this analysis. I have explained the divergences in the analytical framework, the theoretical divergences, the multiple guidelines, and recommendations issued by governments and agencies, so for the next topics, we will develop an alternative based on a holistic view of open government.

I show that open government resumes the principles of governance embedded in e-democracy (Güemes and Ramírez-Alujas 2013) and that open government transparency, participation, and collaboration carry the promise of changes in decision-making processes (Höchtel et al. 2015). Next, we will deepen the debate about participation in open government, with the literature's positioning, to validate that the analytical proposal of e-participation initiatives can also capture initiatives in open government, taking due proportions of deepening, without prejudice to the theoretical basis and research methods and tools.

3.1 *E-Participation as Support for Open Government Review*

To the extent that information and transparency are preconditions for open government, they can propel e-participation initiatives. This is because participation plays a crucial role in policy-making in both e-participation and open government; the transversal use of technology is a precondition for the two movements; open government and e-participation are proposals for empowerment that scatter decision-making, democratize power, and provide an active citizen.

But participation is also problematic with respect to the open government paradigm, and sometimes confused with simple access to information, or demobilized by the lack of government feedback. Citizen participation *is a necessary consequence of the evolution of the discussion between the State and democracy, with its implications for the most rational public policy* (Canto Chac 2011; González and Juan 2015; OECD 2006).

The research focuses on the process of technology-based policy-making and solutions, in the face of explosive data growth, social networks, and opportunities to innovate. In fact, the policy-making field has been altered by the development of open data and data-processing methods, reinforced by new forms of public engagement through participatory (e-participation) tools combined with co-creation activities.

Sanchez-González (González and Juan 2015) pointed out that participation in the open government field has adopted typologies corresponding to e-participation, also distinguishing itself in stages, with each participatory process being projected on a particular level. Activities related to information, consultation, and participation have always existed in democracies, but the challenge of citizen participation in public management of open government is universal engagement. Taking participation as a formula for expanding public space in management and decision-making depends on the definition and performance of organizations and society itself.

Lastly, open government *is one who engages in a constant conversation with the citizen to listen to what they say and ask, who makes decisions based on their needs, considering their preferences* (Calderon and Lorenzo 2010: 27).

Citizen involvement in government affairs is a trend that strengthens the public space and requires the public administration to establish channels for effective citizen participation, that is, the inclination of e-participation initiatives is the same as for participation in government (González and Juan 2015).

E-participation is close to open participation, but it has a transformative dimension because it is a continuous part of the citizen's experience in the public sector (Millard 2012).

The same “democratic good” consensus around e-participation initiatives for policy-making is reflected in the incorporation of transparency, collaboration, technological innovation, and responsiveness in open government. It is a kind of new wisdom, as accountable institutions use resources constructively to provide greater transparency. Targeted information empowers the citizen of tools to exert pressure on politics. The contribution in the institutions responds better to the needs of the

citizen, interferes in the decision processes. But the links between these principles are also partial because they have a set of goals and resources that compete, so it is a risk to assume that these principles are obvious and unquestionable, so there is a need for more critical research.

Sanz (2014) stresses, as we have already argued, that the relationship between open government and e-participation is obvious, reconciling objectives and agendas. *Ideally, they can mutually fertilize and disseminate more active ways of involving citizens in governance, with citizens not only participating by providing their opinion, but also being more active in defining the agenda for discussion (...)* (Sanz 2014: 39). However, this relationship is not automatic, justifying the importance in understanding the critical factors for open governmental initiatives and contributing to participatory and collaborative e-participation.

3.2 Open Government: Integrating the e-Participation Framework and Policy Development

The literature pointed to an intrinsic relation between e-participation and the premises of open government, regarding the objectives, challenges, and potential for the elaboration of public policies. They are initiatives that follow similar trajectories. One argument is feasible: (...) *information and communication technologies affect the policy-making cycle, and this results in changes in the way policies are developed* (Janssen and Wimmer 2015:1).

To overcome the fragmented nature of open government evaluations and analyzes, our approach proposes to adapt the models used for the evaluation of e-participation. This is because the conceptual structure of the models allows to investigate the different perspectives of the phenomenon.

I opted for the holistic framework presented by Macintosh & White (2008) that is compartmentalized in three dimensions. The democratic dimension says about the phenomena related to democratic activities, which are executed and sustained by the size of the government project, and this project, in its management, leads to the creation of a sociotechnical system. The feedback of activities supported by socio-technical, that is, the results return to provide a new cycle of democratic activity (Lukasz et al. 2013).

I selected criteria in the e-participation literature that contribute to examining the potential between open government and policy-making: level of participation, stage in the elaboration of policies, actors, technologies used, rules of engagement, duration and sustainability, accessibility, resources and promotion (Macintosh 2004); the areas of participation, categories of participation and tools and technology (Tambouris et al. 2007); actors involved in the sustainability of the initiatives (Macintosh 2004; Sæbø et al. 2011); the contextual characteristics of the initiatives, the governmental sphere, degree of formality, institutionalization, duration and target group (Aichholzer and Allhutter 2011), key e-participation activities and e-participation levels (Aichholzer and Allhutter 2011; DEMO-NET 2008), and

potential technological tools for the development of new technologies, such as: for each stage of the public policy cycle.

These are criteria that help in the refinement of the framework of open government analysis; the design of these “channels” reflects the technological choices and the practice of the principles of openness. In addition, it has an impact on operability and maintenance of government initiatives. That is, the phenomenon can best be observed when transforming the structure of policy formulation itself. Moreover, the policy-making process is altered in relation to the evidence for policy decisions, as in the case of open data and social media.

I continue to use models for policy analysis, since even though a model is an abstraction, it is useful insofar as modularity facilitates the understanding of complex systems, such as the opening strategy. The layered model is a specific form of modularity in which dimensions are organized into parallel hierarchies. These are models widely used in research on cyberspace and artificial intelligence given the nature of multiple-dimensional integration (Gasser and Virgilio 2017).

I argue that the instruments explored in the project dimension, for example, the preparation of e-queries, or the availability of open data on the implementation of policies, are developed at different times. The technological support of e-consultation depends on the management of the sociotechnical system, and the availability of data depends on the legal and political framework of data access established by a government. The parallel hierarchy of the layered model assumes that several actions are performed at the same time but operating on the opening principle. Actions are combined, working together, in and between layers, as an ecosystem.

The complex system approach in dimensions, or open government ecosystem, allows the different flows and actions to be understood, integrating the limitations, barriers and potentialities.

Among the barriers and challenges, open government encompasses a number of myths, such as the belief that data openness leads concurrently to inclusive government. Other policy challenges are related to institutional willingness and competence to publish truly relevant data, or the social challenge that open programs are being designed for specialists rather than ordinary citizens. On the operational side, sometimes, complex tools and technical knowledge prevent the significant use of data. And finally, the lack of dialogue and feedback with the public empties the institutional process and the programs themselves (Reggi and Dawes 2016).

These results point to the need for a model capable of integrating all the dimensions of open government into a structure of analysis.

3.3 Research Approach: Integrated Open Government Ecosystem

The tangle of open government research has raised (...) *information security, privacy, legal framework competence, information integrity, data quality, accessibility, knowledge sharing, and open data concepts* (...) *better efficiency, unified processes,*

provision of feedback, better citizen participation, standardization of operations, improved operations and more satisfied citizen (Abu-Shanab 2015: 454).

Based on the arguments and literature review, I mapped and discussed the concepts and activities related to the pillars of open government, to describe our understanding of the possible domains in open government. The proposed model consists of three holistic dimensions: democratic, project, and sociotechnical the models serve to direct the implementation of each open government project, values the requirements, and the stakeholders, actors, legal, operational and technological panorama.

The distinction about government openness and government data is important. Government data is the information produced by public bodies, and openness is how that data can be used, reused, and distributed by all. The research approach is more about open government knowledge, than the opening movement. I explain that I will not evaluate the state of the data open, but the reasons why they are produced, the way in which they are produced and published. This connection suggests that there is an ecosystem and that different domains need to be combined for the functioning of open government (Zuiderwijk et al. 2014a).

I use the ecosystem metaphor to make sense of interdependent systems and their components, as well as social systems with intensive use of information and communication technologies (Harrison et al. 2012) according to Fig. 1.

The contributions of Zuiderwijk (2014b) on the research agenda of innovations in the public sector and open data interest us in that it points out that the activities of innovation in open data obey the order of seven perspectives: political, legal, social, economic, institutional, operational and technical.

The legal perspective deals with open legislation, which includes laws and access to information, open data policy, guidelines, and government statements. The political perspective deals with the development of politics in the context of the entity and the difference between government agendas. The social perspective is related to government projects and how the political agenda deals with data openness, its social benefits, transparency, participation, and collaboration. The economic perspective, however, emphasizes the costs and resources of creating open data, reusing data, and stimulating it. The institutional perspective examines the institutions' performance in conducting the publication, adoption, and maintenance of open data, as integrated into the daily activities and routines of the public sector. And operational dynamics focuses on the use and requirements for open data, that is, operational standards. Finally, the technical perspective says about the technology of open data, infrastructure, and resources.

I have chosen to combine these perspectives according to the dimensions of the e-participation, democratic, project, and sociotechnical models. These dimensions organized by layered modularity seem to be effective given the complexity of issues related to open government.

First, because there are many actors involved in these processes and they are also complex, with competing interests (Dawes et al. 2016; Helbig et al. 2012). Second, the open government context varies according to the legal and social institute, resulting in different types of data, content, and patterns of organization and dis-

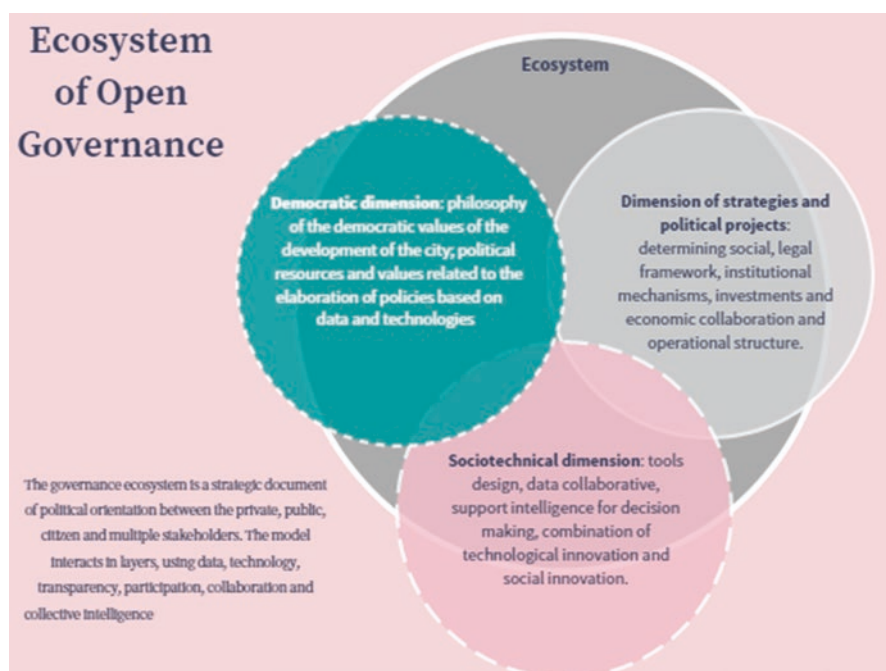


Fig. 1 Ecosystem of open governance. Author's elaboration

semination (McDermott 2010). Finally, other economic, operational, institutional, and technological aspects are part of the challenges of new public management.

I believe that when the complex nature of these processes is not considered relevant, the potential of the opening processes is impaired. According to Zuiderwijk (Zuiderwijk et al. 2014b), barriers are also of a research order, since different theories are used to incorporate the variety of perspectives the field produces. In view of this, a multidisciplinary approach can harbor the diversity of perspectives.

I argue that if these perspectives were listed (McDermott 2010; Dawes et al. 2016; Zuiderwijk et al. 2014b) as barriers or challenges, there are several criteria and conditions under which there is an evaluation. Therefore, the route we propose is to meet these criteria to consolidate the analytical framework of open government.

Each dimension is broken down by perspectives, and for each one, I will point out subcomponents corresponding to the criteria listed in the debate. For the composition of this table, I organize the definition of each perspective and the respective criteria. The work of Zuiderwijk et al. (2014b), the open data evaluation framework (Caplan et al. 2014), Open Data Institute and World Bank benchmarking (Atz et al. 2015), and the framework developed by the World Wide Web Foundation, NYU Governance Laboratory, were supporting studies to develop definitions of dimensions, perspectives, and criteria.

The research combined the intense intense debate with a literature and how different approaches of the label of open government, between the guiding and normative principles of the political, academic and non-governmental documents. This diversity reflects in different analysis tables, which sometimes prioritize one category over others.

I took the position to create a holistic framework capable of apprehending the open government strategy as an ecosystem. Thus, for the methodology, I use traditional procedures and techniques of research in the social sciences, but finally, we adapt information science and content management techniques to construct analysis tools that offer an approach both for heterogeneity and for the standard within the respective dimensions.

4 Ecosystem and Local Open Government

Government open plans include a variety of political participation activities, provision of information and transparency, and collaboration to qualify the decision-making mechanisms of accountability and anti-corruption measures, establishing all the gap, availability of standardized data, and technological innovation. The strategy applied to achieve these objectives corresponds to certain requirements that have been applied to public management, such as the modernization of the administration, the use of technological advances, the development of interactive media, government platforms, and forms of hybrid participation.

In this chapter, I present the theoretical and methodological framework that we use to analyze the limits and potentialities of the municipal government plan for open government in the City of São Paulo. This model analyzed the potential for development of public policies for three initiatives, the Programa de Metas 2013–2016, the virtual platform *Planeja Sampa*, and *São Paulo Aberta*. Therefore, I identify the potentialities and challenges of the municipalization of openness and the elaboration of public policies.

The Programa de Metas 2013–2016 was an initial activity that inaugurated a territorial participatory policy tied to the government agenda, think of management goals contained in the campaign plan and that were elaborated together with the population and decision-makers, through dynamic forms of participation online and offline and with the support of instances of control and management.

The *Plataforma Planeja Sampa* was a platform that supported the goals program and housed the monitoring system. The renegotiation of goals and conclusions planning instruments and budget formatted the virtual channel of the participatory cycle of planning and budgeting. The platform simulates the policy cycle, with information, public consultations, documents and actions of the Council of the Plannig. These resources promote transparency and social participation.

The *São Paulo Aberta* was the initiative that organized a series of management commitments to articulate, integrate, and foster open government actions. Conceived a set of practices and interventions together think organizations for transparency

through access to public information; promotion and expansion of the participation process for decision-making; developed and stimulated the accountability of public power and its agents (responsibility) and the development of technological tools. The São Paulo Aberta initiative is organized by the Intersecretarial Committee through the portal.

Each government, at different levels and at different levels of development, has established and produced guidelines and strategies on open government. This understanding matters to avoid flaws in the focus and tools of analysis. The course of action of the open government in each agency or secretariat may be slightly different, that is, there is improvement of the democratic program, with management structures, objectives, actors, institution, printing different details, or results.

So, I am explaining about “potentials and challenges based on results.” These results can be long term, that is, what is necessary for the ultimate objectives to be achieved. But also, I can focus on short-term results or intermediates, which are those with a program, policy, or project.

The open government is a long-term program, but during the opening process, progress is made, i.e., short-term results, depending on the strategy.

In the long term, the open government assumes that a culture of governance is part of the promotion of six principles. The movement of the ecosystem that promotes the practice of open government occurs when all levels of government, public institutions, citizens and private sectors recognize their respective roles, prerogatives with their legal and institutional frameworks, collaborating, sharing practices, exploring synergies, promoting solutions and lessons among themselves.

Open government initiatives are more concise actions, undertaken by the government or a single institution in the medium term, to achieve specific objectives in the open government, such as online e-queries.

The open government strategy, through an official document, defines the government's agenda, or its units, as well as a single institution or thematic area, including the open government, in the set of goals, actions, and policies, medium and long term.

In the short term, open government potentials include the degree to which rulers actually work for greater transparency, participation, and citizen involvement. For example, the laws of access to information that actually lead to greater transparency, stimulating accountability and access to important and updated information while monitoring policies.

In the medium term, the results of the open government include the extent to which the strategy intervenes or implies transparency, or participation, or collaboration. It refers to the reflection on the mode of government action, so there is a substantive change for improvement in public services and access to data, reduction of corruption, channels of ombudsman.

The municipalization of the open government in São Paulo is still crawling, the initiatives analysed point to the experimental character, designed by the opening strategy. The projected strategy indicates a long-term program, due to the set of actions and activities of transparency, social participation, technological and social innovation, and integrity of power. In the short term, because it was a set of govern-

ment initiatives entangled by a single “institution”, but with the objective of achieving more than specific objectives coordinated in a decentralized way.

The municipalization of the open government is based on the prospect that the proximity to the citizen and the delivery of services can facilitate the strategy, raise awareness of public actors and civil society organizations, and expedite the processes before the smallest Bureaucracy compared to the federal level.

At the local level, policies and citizens meet, since the government is most often responsible for basic public services and in the form of immediate relations between the government and the citizen. In the municipalities, public agents and representatives tend to carry out more frequent exchanges with the citizen and their needs, so in this position, the local government figures as an active promoter for open government strategies.

This is because I can assume that the government will print the local reality in the opening strategies, favoring the appropriate implementation to achieve goals. But although the government is the active agent for the opening of the government, a set of barriers will expose the sustainability challenge of open government strategies.

However when it comes to Sao Paulo, the largest city in Latin America, the challenges of the open government have been strengthened by the fragmented coordination for policy elaboration, overlap and legal and economic conflicts, low adherence to open government culture, low institutionality and high informality, skills gaps and investments in human resources, unclear standards and specifications, uncertainty about sustainability, directing the strategy to support international agreements to safeguard public policies of the open government.

5 Conclusions

In this chapter I seek to present what political debate agrees that governing with and over the internet and the use of technologies is imperative, however, how to do so is unclear. Consequently, the public sector faces the challenges and opportunities of reform and adaptation in response to the constant stimulus of innovation in the new lexicon of “open government.”

This inevitably leads to new tensions and criticisms about the structure and culture of government, while broadening the debate on participation, transparency, and governance, with civil society demanding a greater role in policy development. These problems is not exclusive to governmental activities, the academy itself and multi-lateral organizations each reproduce a discourse, whose open government paradigm remains based on the three basic principles enabled by technologies.

From the e-democracy debate, we clarify that “openness” denotes a democratic discourse that incorporates achievable values or is reinforced by digital media. However, the idea of “open” often reflects in theoretical competition that is unable to bring together technology, content, participation, and collaboration under the same analytical lens. The polarization of the field discourages generalizations and

highlights the incongruity between technological determinism and the combination of democratic promises.

The result reflects the imprecision of the open government label, making the approach more difficult. Focusing on the use of data from the economic or operational perspective of an open government based on public needs underestimates the opportunity for feedback and co-creation of stakeholders for social perspective, for example. Openness, however, as a stimulus to government participation and accountability focused on the social, political, and institutional outlook of open government, is sometimes confused with simple access to information or discouraged by the lack of government feedback. In practice, much less has been accomplished than the rhetoric about open government.

In addition, based on the extensive and innovative use of the internet and digital technologies such as artificial intelligence and large data, open government initiatives are expected to allow the co-production of policies between national states and multiple audiences such as citizens, data providers, government organizations, the private sector, researchers, developers, archivists, and journalists. Driven by the integration and expansion of artificial intelligence and algorithmic governance, it can support decision-making in policy contexts, generating options and evidence, whose ecosystem will significantly affect the way policies are developed.

I advanced the approach of the open government analysis framework, based on the ecosystem metaphor, whose political, legal, social, economic, institutional, operational, and technical challenges and barriers were rearticulated as guidelines for the evaluation of open government.

Considering the Programa de Metas 2013–2016 and the metal monitoring system tool, as subcomponents, the results indicate the progress in the fulfillment of the democratic requirements of openness; nevertheless, it is necessary to stimulate the strategy of evaluating the performance of the initiatives and feedback to the user. The biggest gargoyles are in project management, with high turnover of teams, from institutional activists to digital activists, high informality between agents, growing operational and sociotechnical bureaucratization. The great potential is related to the data and the technical dimension of the tool that used and maintained the standards of functionality, semantics, and organization of the content, positively reflecting on data reuse and data quality.

The Plataforma Planeja Sampa is the initiative that presented the greatest inputs for an opening. Mainly as institutional changes during the second year of Haddad's mandate, with the Division of Planning, Budget and Management Secretariat, coordination of the platform was fragmented, and some internal projects were left unattended, due to the lack of regulation in the creation the very cycle of planning and participatory budgeting that gave life to the virtual channels. The dimension of the project showed how organizational culture, democratic understanding of openness within public administration, resources, structure and technological support, as well as the legal framework influence the implementation capacities of open government.

The São Paulo Aberta states as close to the federal government, and especially the open government action plans and the partnership with the government's Open

Partnership. The São Paulo Aberta promoted advances combining strategies of social innovation and technological innovation. In addition, training cycles, open political literacy programs, and data literacy have emerged in the opening actions. The intersecretarial Committee and the São Paulo Aberta should articulate, create, and stimulate actions and activities of open government; however, we observe a distancing between initiatives that were already in progress and those that were created from the formalization of municipalization in the beginning of 2014.

As management barriers, they emphasized the challenges of openness. Fragmentation in the coordination of initiatives and policies has hampered the intersectoriality and interoperability of openness. In line, the deformed legal framework, combined with the conservative dynamics of the institutional organization, impacted on the development of the projects.

Finally, in the discussions and results, I indicate a relationship between dimensions of open government, potentials, and challenges. I emphasize the prominence of the democratic dimension with the combination of social innovation, technologies, and democratic values, but it is crucial to improve the legal framework, strengthen institutionalization, reform a closed culture of public management, and promote the adherence of partners and the citizen open government.

The open government in the city of São Paulo promoted public policies of open government; to move forward, it is necessary to give voice to the citizen, besides the vision. The management of the ecosystem must walk together, mu-giving a mindset for reform, efficiency and commitment to the results of transparency, participation and collaboration.

References

- Abu-Shanab, E.A. (2015) Reengineering the open government concept: An empirical support for a proposed model. *Government Information Quarterly* 32(4): 453–463. Google Scholar, Crossref.
- Aichholzer, G., & Allhutter, D. (2011). Online forms of political participation and their impact on democracy. In *Manuscript*. Vienna.
- Arnstein, S. R. (1969). A ladder of citizen participation. *JAIP*, 35(4), 216–224.
- Atz U., Tom H., & Jamie F. (2015). *Benchmarking open data automatically*. ODI. Disponível em: <https://theodi.org/guides/benchmarking-dataautomatically>. Acessado em: 04/08/2017.
- Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27(3), 264–271.
- Calderon, C., & Lorenzo, S. (2010). Open Government: Gobierno Abierto. <http://www.martinoli-vera.com.ar/data/gobiernoabierto.pdf>
- Canto Chac, Manuel (comp.) (2011). Participación ciudadana en las políticas públicas, México, Siglo xxi, Biblioteca Básica de la Administración Pública del D.F., No. 4.
- Caplan, R., Timothy, D., Asiya, W., Stefaan, V., Jose, A., & Hania, F. (2014). *Towards common methods for assessing open data*. Workshop Report & Draft Framework.
- Chatwin, M., & Godwin, A. (2017). Beyond ambiguity: Conceptualizing open government through a human systems framework. *JeDEM*, 9(1), 52–78.

- Clarke, A., & Francoli, M. (2014). What's in a name? A comparison of 'open government' definitions across seven open government partnership members. *eJournal of eDemocracy and Open Government*, 6(1), 248–266.
- Cruz-Rubio, C. N. What is (and what is not) open government? A conceptual discussion. *Eunomía. Journal in culture of Legality*, 2015, 8, 37–53.
- Dawes, S., Vidasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, 33, 15.
- De Blasio, E., & Sorice, M. (2016). Open government: a tool for democracy? *Media Studies*, 8(14), 14–31. (ISSN 1847-9758; doi: 20901/ms.7.14.3).
- DEMO-NET. (2008). eParticipation evaluation and impact. *DEMO-Net Project Deliverable*, (13.3).
- Freeman, J., & Quirke, S. (2013). Understanding E-democracy: Government-led initiatives for democratic reform. *eJournal of eDemocracy and Open Government*, 5(2), 141–154.
- Gasser, U., & Virgilio, A. F. A. (2017). A layered model for AI governance. *IEEE Internet Computing*, 21(6), 58–62. <https://doi.org/10.1109/mic.2017.4180835>.
- González, S., & Juan, J. (2015). La participación ciudadana como instrumento del gobierno abierto Espacios Públicos. *Universidad Autónoma del Estado de México Toluca, México*, 18(43), 51–73.
- Güemes, M. C., Ramírez-Alujas, A. (2013). Gobierno abierto, reforma del Estado y modernización de la gestión pública: Alcances, obstáculos y perspectivas en clave Latinoamericana, en A. Hofmann et al. (ed.), *La promesa del gobierno abierto* (p. 193–223). México: Creative Commons.
- Harrison, T. M., Pardo, T. A., & Cook, M. (2012). Creating open government ecosystems: A research and development agenda. *Future Internet*, 4(4), 900–928.
- Helbig, N.; A. M., Cresswell, A. M., Burke, G. B., & Luna-Reyes, L. (2012). The dynamics of opening government data. In *A white paper, Center for Technology in Government, University at Albany*. New York: State University of New York.
- Höchtel, J., Parycek, P., & Schöllhammer, R. (2015). Big data in the policy cycle: Policy decision making in the digital era. *Journal of Organizational Computing and Electronic Commerce*, 26(1–2), 147–169.
- IAP2. (2007). *IAP2 spectrum of public participation*. International Association for Public Participation.
- Janssen, M., & Wimmer, M. A. (2015). Introduction to policy-making in the digital age. In *Policy practice and digital science. Integrating complex systems, social simulation and public administration in policy research* (Vol. 10). Springer International Publishing. Public Administration and Information Technology.
- 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.
- Lee, G., & Kwak, Y. (2011). *An open government implementation model: Moving to increased public engagement*. IBM Center for The Business of Government.
- Lukasz, P., Adegboyega, O., & John, B. (2013). Structuring e-participation perspectives mapping and aligning models to core facets. In *14th annual international conference on digital government research*. Quebec City: Laval University.
- Macintosh, A. (2004). Characterizing eParticipation in Policy Making, HICSS, Proceedings of the 37th Annual Hawaii International Conference on System Sciences (HICSS '04).
- Macintosh, A., & Whyte, A. (2008). Towards an evaluation framework for eParticipation. *Transforming Government: People, Process and Policy*, 2(1), 16–30.
- McDermott, P. (2010). Building open government. *Government Information Quarterly*, 27(4), 401–413. <https://doi.org/10.1016/j.giq.2010.07.002>.
- Meijer, A., Curtin, D., & Hillebrandt, M. (2012). Open government: Connecting vision and voice. *International Review of Administrative Sciences*, 78, 10–29. <https://doi.org/10.1177/0020852311429533>.
- Millard, J. (2012). Rethinking e-participation: smash down the silos and move to “open participation”. In *E-Participation Summit*. Stockholm.

- OECD. (2006). Participación ciudadana. *Manual de la ocde sobre información, consulta y participación en la elaboración de políticas públicas*, México, ocde, Secretaría de la Función Pública.
- Ortíz de Zárate, A. (2010), Fábula introductoria: una historia de Brujas, em Calderón, CÉSAR y LORENZO, Sebastián (2010). *Open government: Gobierno Abierto*, Alcalá la Real, Algón Editores.
- Oszlak, O., & Ester, K. (2014). *Teoría y práctica del gobierno abierto: lecciones de la experiencia internacional*, Buenos Aires, idrc-crdi, red gealc, Organización de los Estados Americanos.
- Peixoto, T. (2013). *The uncertain relationship between open data and accountability: A response to Yu and Robinson's the new ambiguity of open government*.
- Reggi, L., & Dawes, S. (2016). Open government data ecosystems: Linking transparency for innovation with transparency for participation and accountability. In J. H. Scholl, O. Glassey, M. Janssen, B. Klievink, I. Lindgren, P. Parycek, E. Tambouris, A. M. Wimmer, T. Janowski, & D. S. Soares (Eds.), *Electronic government: 15th IFIP WG 8.5 international conference, EGOV 2016, Guimarães, Portugal, September 5–8, 2016, proceedings* (pp. 74–86). Cham: Springer International Publishing.
- Sæbø, Ø., Leif, F., Sein, S., & Maung, K. (2011). Understanding the dynamics in e-participation initiatives: Looking through the genre and stakeholder lenses. *Government Information Quarterly*, 28, 416.
- Sanz, E. (2014). Open governments and their cultural transitions. In M. Gascó-Hernández (Ed.), *Open government: Opportunities and challenges for public governance* (Vol. 1, p. 11).
- Sieber, R. E., & Johnson, P. A. (2015). Civic open data at a crossroads: Dominant models and current challenges. *Government Information Quarterly*, 32(3), 308–315.
- Tambouris E., & Liotas N., & Tarabanis, K. (2007). A framework for assessing eParticipation projects and tools, HICCS, *Proceedings of the 40th Annual Hawaii International Conference on System Sciences* (HICSS '07).
- Wirtz, B., & Birkmeyer, S. (2015). Open government: Origin, development, and conceptual 42. perspectives. *International Journal of Public Administration*, 38, 1–16.
- Zuiderwijk, A., Janssen, M., & Davis, C. (2014a). Innovation with open data: Essential elements of open data ecosystems. *Information Polity*, 19(1), 17–33. IOS Press.
- Zuiderwijk, A., et al. (2014b). Special issue on innovation through open data: Guest editors introduction. *Journal of Theoretical and Applied Electronic Commerce Research*, ALCA, 9(2), i–xiii. Mayo.

Part II
Open Government Data and Smart Cities
and Government

The Role of Open Data in Smart Cities: Exploring Status in Resource-Constrained Countries



Wafeequa Dinah, Pheladi Tracy Lefika, and Bwalya Kelvin Joseph

Abstract Open Data initiatives in public sector frameworks have been poised to be one of the most effective levers for stamping out corruption in public sector organisations. Developing world countries which are endowed with resource constraints are slowly jumping onto the bandwagon to ensure that the governance of information is being put in public domains for effective public scrutiny. To this end, there have been many interventions that have been propagated by resource-constrained countries, one of them being Smart Cities. Smart Cities provide logical and physical information infrastructures which are a prerequisite to the implementation of contemporary Open Data initiatives. This chapter explores the status of realization of the different types of Open Data in the realm of Smart Cities, as well the different challenges that can be met in the implementation cycle of Open Data in Smart City environments. The definitive contribution of this chapter is that it proposes a conceptual framework modelled upon the developing world contextual nuances. This chapter also proposes that the conceptualised framework can be used in different environments with similar contextual attributes of the developing world countries in the design and implementation of Open Data Smart Cities.

1 Introduction

The emergence of Open Data and Smart Cities creates avenues for exploring contemporary and future collaborative information management innovations where information can be pervasively accessed and utilised (Kourtiti et al. 2012). Open Data involves the placing of data in public domains so that stakeholders can easily have access to it in order to gain understanding of what is happening in the organisation or simply to validate its integrity. The concept of Open Data has been used in

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many different government establishments throughout the world with Africa, e.g. Kenya, Morocco and South Africa, recently jumping onto the bandwagon with implementing Open Data initiatives in public service delivery platforms (Caragliu et al. 2011).

Contemporary designs of Open Data initiatives especially in the realm of Smart Cities demand a lot of capital expenditure which is expensive for many countries around the world. Many developing world countries are resource-constrained culminating into limited innovations with regard to their information management initiatives or integration of dynamic information into the environment. The limitation on the capabilities of the developing countries enables them to miss out on key principles of management principles as those applied to information management such as those espoused in Drucker (1954). As a result, many public resources are mismanaged due to limited service compliance monitoring mechanisms and a lack of adherence to the established management principles of the different resources available to government. The use of Open Data enables government departments to demonstrate their accountability of the different national resources they are entrusted with and showcases what happens in the different public business processes. With appropriate integration of Open Data principles into the different aspects of governance, many independent stakeholders are able to track, monitor and evaluate the different happenings in the governance business processes.

Integration of Open Data in Smart City designs may culminate into overall competitive profile of the city and the different entities therein. In contemporary socio-economic environments, competition is everywhere and organisations keep reinventing themselves in order to remain relevant and competitive to their mandate. Both public and private organisations find themselves in different types of competition and as a result are working at an increased level of efficiency and effectiveness. A lot of digital disruption is created given the increased utilisation of diverse Information and Communication Technologies (ICTs) culminating into remodeling and redefining the information structures in different organisational setups. In this contemporary competitive environment, urban performance excellence is determined not only by physical capital (hard infrastructure) but also by human and social capital (Allwinkle and Cruickshank 2011; Johnston and Hansen 2011). The human and social capital depends on the overall quality of knowledge communication channels and the existence of a vibrant social infrastructure (Alonso and Lamata 2006). In contemporary competitive environments which depend mostly on information, social capital and infrastructure are cardinal ingredients to meaningful and sustainable competitiveness. Furthermore, coming in as an enabler, ICTs have positioned themselves as a kingmaker in improving the competitive profile of cities.

In this chapter, a critical review of literature regarding the trends in Open Data and Smart Cities specifically, with a bias to how the two concepts can be conceptually amalgamated in information intensive environments, is undertaken. Using extensive literature review, this chapter explores the current and novel thinking with regard to the realisation of Open Data especially in public sector environments and explores how Open Data can be realised in Smart City environments. This chapter empirically explores and analyses previous work and current discourse on Open

Data and Smart Cities. The major outcome of this work is a conceptual framework of how the concepts of Open Data can be intertwined into the logical fibre of Smart Cities to achieve meaningful development with a bias to management of both static and dynamic information in private or public organisations.

This chapter is organised as follows: the next section presents the fundamental and formulaic concepts related to Open Data and Smart Cities, next an in-depth discussion of the need for the integration of Open Data in Smart Cities is articulated, then the requirements of Open Data in Smart Cities and the different benefits of Open Data are presented. This is followed by exploring the usage of Open Data in both the developed and the developing world especially with a special focus on Africa. The chapter is concluded by the presentation of a conceptual framework that underpins which components need to be critically integrated into the design of Smart Cities.

2 Smart Cities

Making a city smart is one of the strategies that many cities around the world have employed to mitigate the many problems caused by rapid urbanisation and massive population growth (Meijer and Bolívar 2015). Some of the key problems resulting from massive population growth and/or urbanisation may include traffic congestion, increased complexity in waste management, air pollution emanating from increased motor vehicles on the roads, increased pressure on health facilities and other social infrastructure. Many cities in resource-constrained countries are being redesigned in order to include design agility and scalability with future urbanisation. The current requirement for effective Smart City design is to consider adaptability as much as possible for incorporating future changes in strategies and approaches on how to deal with evolving environment and contextual environments.

The principles of Smart Cities are cardinal in revitalising city life to a point where opportunities can easily be attained. Smart Cities are at the centre of the urban development agenda which focuses largely on being competitive and sustainable (Lynch et al. 2011). When cities grow, there is an increased complication with regard to cognisance of different resources or opportunities. In many cases, it is difficult to access resources which were easily accessed before complication. Consequently, the sociocultural and socio-economic infrastructure is re-arranged towards more complication. The increase in complication culminates into masking of opportunities for the ordinary rank-and-file which may translate into increased social exclusion and therefore negatively impact on the overall quality of life.

The beacon of Smart Cities is the ability of the city designers and planners to put in place sociocultural infrastructure that takes into consideration aspiration to have liveable and sustainable cities (Calzada and Cobo 2015). The achievement of a pure Smart City entails that the different facets of the city's sociocultural infrastructure are going to be integrated, and therefore, decisions can be made holistically in the

ambit of the city. This integration enables information to be easily shared among the different city services so that decisions are made in conformance with the expected service-level agreements or expectations (SLA/E).

The idea of Smart lies on the ability of the city to deliver cardinal and essential services to the doorsteps or the fingertips of the people. Some of these cardinal services may include health, waste management (waste disposal), water resource management, energy use optimisation, transport pathway management (traffic management systems) and education placements in public schools. These resources may be under constant pressure given increased scramble for these services given massive increase in population. Cities worldwide have realised that providing universal and equal access to these communal services can be achieved by providing as much information as possible in the public domains. The concept of Smart Cities comes in as a design paradigm where ICTs are widely and intelligently used to achieve global and/or universal access to information on different aspects of the city achieving what is called collective intelligence (Allwinkle and Cruickshank 2011; Juvara 2015). For example, using Google Maps application on mobile gadgets, motorists may know which roads are congested at a particular point in time and avoid it accordingly. It can thus be posited that delving towards universal access to information will eventually culminate into increased social inclusion of individuals into the social infrastructure.

Appropriate integration of the different technology platforms and solutions into everyday livelihood processes enables the establishment of a required sociocultural and socio-economic infrastructure commensurate to today's dynamic information needs. Further, it can be posited that the realisation of ubiquitous access to information and correspondingly to information enables a city to accommodate more inhabitants than earlier planned (Deakin 2014). Having more people living in the city in the realm of Smart Cities is possible because inhabitants can easily access diverse opportunities from the confines of their spaces anytime. It is worth mentioning that in order for the concept of Smart Cities to be enshrined into the different value chains, it is important to ensure that innovation informed by the content in which Smart Cities are deployed (Del Bo and Florio 2008).

Considering the emerging classical and neoclassical theories of urban growth, upon which Smart Cities are hinged, there are generally six broader themes that underpin Smart Cities: smart environment, smart citizens, smart economy, smart governance, smart living and smart mobility (Branchi et al. 2014). Contemporary designs of Smart Cities have focused on achieving all the aforementioned principles. One of the key principles upon which Smart Cities are hinged is continuous and sustainable innovation which insures that the emerging trends and themes are rightly integrated into the Smart City infrastructure. The innovative endeavours in any Smart City design and implementation should not negatively affect the environment in which it is implemented. Therefore, one of the key requirements for any sustainable Smart City is to ensure that a cadre of educated and informed labour force and/or general citizenry is constantly available to drive the different innovations given their contextual settings (Berry and Glaeser 2005). Sustainable innovation requires more skills as baseline requirement to be able to innovate in

dynamic environments. Fu (2007) has posited that the degree of smartness of a city is determined by the degree of the capability of generating local knowledge and applying to different contexts.

3 Open Data Integration Into Smart Cities

Since Open Data is relatively a new concept, there is no formulaic definition articulated at a global level, on what it entails. The concept of Open Data may mean different things in different contexts. Generally, it is important to note that during the execution of public business processes or mere interaction with different people or businesses, government departments (public institutions) generate a lot of data on everyday basis. A majority of this data is hidden in proprietary databases or in government databases where citizens cannot access it. There are many disadvantages of hiding public data in access-limited information/knowledge repositories. One of the key disquiets about not allowing citizens' universal access to public data by government agencies is that the government hides behind the data and therefore do not take accountability for their everyday decisions. Further, citizens cannot track the level of performance or efficiency of government agencies. In providing public data in open public domains and platforms, citizens are able to find any information they need easily and make timely informed decisions. Allowing more people to access public data will culminate into increasing the likelihood that the data will be applied to good causes which will ultimately translate into everyday human problems.

The integration of Open Data in different Smart City designs will lead into a lot of positives aspects with regard to the management of dynamic data. Open Data will ensure that the different aspects of city's life will be accessible by a majority of its citizens to make timely decisions. Open Data enables unhindered sharing of information among humans and technology agents to achieve spatial intelligence which enables the deployment of cyber-physical-systems in different contextual settings. Smart City design and applications are hinged on the capacity to integrate the Internet of Things (IoT) in different objects scattered around the city (Deakin 2014). The IoT entails that the different technology innovations are embedded with capabilities such as controllers, microprocessors and transceivers for enabling digital communication with other digital communicating agents. Given the aforementioned capabilities, dynamic information in the realm of Smart Cities can easily be realised and be made available to individuals and organisations.

Smart Cities demand for the deployment of smart devices and cyber-physical-systems in a spatial-temporal domain arrangement to constantly and intermittently obtain data from the environment (Letaifa 2015; Lee et al. 2013). Examples of smart devices can include sensors deployed in on traffic intersections to measure traffic intensity or sensors embedded in health apps. These sensors are able to automatically sense data from the environment in which they are deployed and send it to a central repository, which can be accessed by both humans and machines.

Although no substantial work has been done in the application of Open Data in different socio-economic domains, it is clear to note that a lot of innovative applications of Open Data are being pursued by the Open Data in Europe and Central Asia (ODECA) (see <http://www.odcanet.org/wp-content/uploads/2016/06/ECA-Open-Data-Results.pdf>). Of late, Open Data has been used extensively as a conceptual underpinning for designing Smart Cities where information and knowledge can easily be accessed (see <https://recap-project.eu/news/open-data-smart-cities/>). A further specific application of Open Data can be found in the following link: (see <https://hub.beesmart.city/solutions/benefits-of-open-data-for-smart-cities>).

When Open Data is embedded into Smart City designs, important information which can be used by citizens and businesses to make urgent decisions is easily accessible. The implementation of Open Data information systems begins with having open interoperable databases which allow different information agents and nodes to access information they hold anywhere and at anytime. Open interoperable databases are needed to achieve easier access to information resources scattered within the Smart City environment. Openness entails that databases in a given location can exchange information and can easily be connected in a wired or seamless mode to other database in order to form one huge information space which will to enable universal access to information resources. In Smart Cities where the management of highly dynamic information is required, interoperable databases are one of the key components. The information architecture in a highly dynamic environment is shown in Fig. 1.

The integration of different databases into one information space is made possible by having similar virtual or physical interfaces. Using one of Open Data is key principles for making data available in the public domains, a complete array of the dataset or the metadata is made available into searchable information repositories and networked databases. In Fig. 1, information is sensed by different nodes placed in the environment. These nodes continuously capture new information as soon as it becomes available and makes the information available in different repositories/databases. Using an open interface represented by a highly abstracted software and

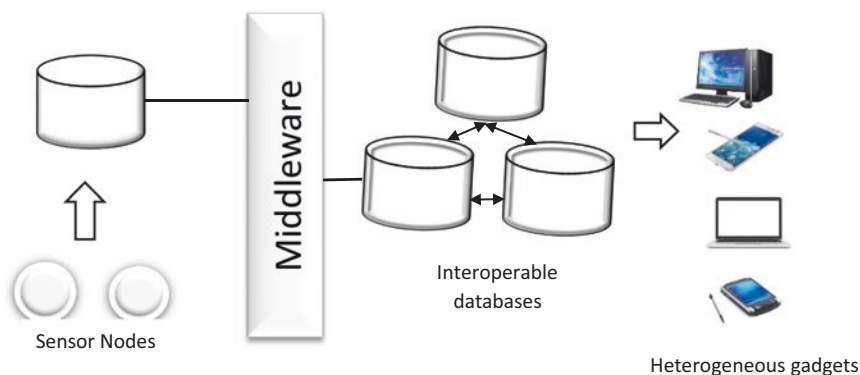


Fig. 1 Management of dynamic information in Smart Cities. (Source: Authors)

hardware platform, the middleware, interoperable databases and heterogeneous gadgets from different vendors are able to access this information. These interoperable databases store information one instance of the current version of the information and allow intermittent access of that information by different gadgets.

4 Requirements for Open Data Usage in Smart Cities

In achieving true opening data in Smart City environments, there is a need to consider some of the requirements that need to be observed. Depending on the environment in which it is implemented, the following are some of the key requirements that need to be considered when aspiring to achieve Open Data in Smart City environments:

- Putting in place requisite legal and regulatory frameworks to protect all the participants and stakeholders in the Smart City environment. One of the key legal aspects is the need for the enactment of the freedom of information (FOI) bill where government agents will be implored and mandated to provide information from their day-to-day business processes and activities as a matter of expectation and not choice.
- Effervescent technical requirements, e.g. integration of different information repositories, ensuring that there are enough nodes in the environment with adequate spatial temporal characteristics, open and dynamic middleware platforms to enable heterogeneous information gadgets to dovetail to the information spaces (repositories and databases), and strong internet connectivity (e.g. global free Wi-Fi with reasonable data handling capabilities).
- Awareness campaigns which would assist to create public awareness of the different Smart City initiatives that are currently in place.

In order to ensure that data has been made available using the Open Data initiative, it is important that each of the datasets is linked to possible set of circumstances and contexts in which it can be applied. This can be done through information tagging by creating mappings of information to specific contexts achievable by contextual exploration of metadata. The opening of the data in this regard is followed by creating an information architecture through tagging and metadata exploration. When this is achieved, it will allow people to easily navigate through the diverse information in the environment and to access only context-specific and relevant information for ready application.

When individuals access information in the realm of Smart Cities as they traverse the environment, their smart mobile devices will remember the data or information they access, and using tags and information logs, this information will be stored in personal databases as a subset of Open Data in 'MyData'. Therefore, it can be posited that 'MyData' will store information which the individual is interested in so that he or she can easily access it from personal information spaces. Further to the data obtained from the public space, 'MyData' will also house private individual information such as health records and home energy usage statistics (Fig. 2).

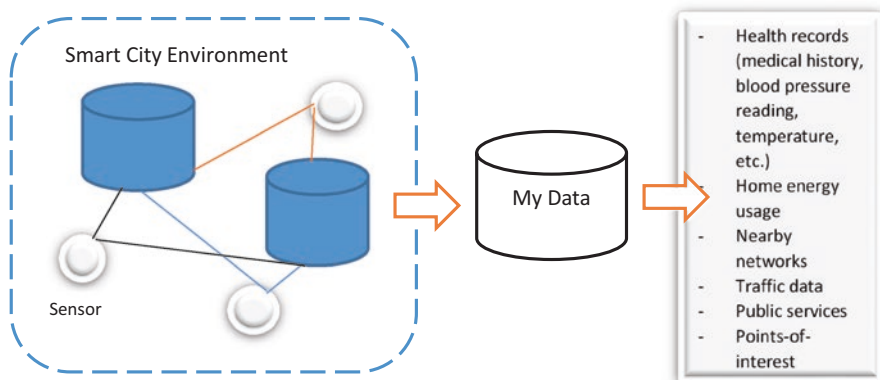


Fig. 2 Capturing of ‘MyData’. (Source: Authors)

5 Benefits of Open Data in Smart Cities

The utilisation of Open Data in Smart City environments has many benefits which can be realised depending on the context in which it is applied. Some of the generic benefits include the following:

- *Empowerment of citizens:* Empowers citizens by providing context-specific information which can be used in innovations to solve societal problems by enabling the conceptualisations of citizen-specific solutions. In the context of Smart Cities, Open Data facilitates placing public data in the hands of the citizens so that each of them adds a different perspective when they access the data given their current contextual positioning.
- *Transparency in government:* Increased transparency in the government does its business and therefore enshrining a sense of integrity in the public sector. Opening up public data so easy encapsulation into Smart City device search ranges enables citizens to track the actions of government agencies on an everyday basis so that every citizen can check how the government executes its mandate. Further, cash flows in the government departments can be monitored by the citizens and interested parties, thereby showcasing accountability on the part of the government.
- *Changing data traits:* By analysing Open Data over time, it is possible to discern certain changing traits in data over time and therefore come up with innovative ideas on how to react to or overcome the change. For example, by analysing publicly available information, it is possible to observe the historical trends, market insights and changes in political, economical, social and environmental establishments. In many circumstances, big data analytics of social media or publicly available data will enable prediction of the future happenings in the Smart City environment (Kitchin 2014).

- *Open innovation*: Facilitates open innovation and urban innovation where any individual can contribute to the innovative inventory by adding their little or defined perspectives on the innovative solutions as a social good.
- *Citizen inclusion*: Open Data facilitates civic engagement and therefore makes it possible for e-Inclusion to be achieved. By so doing, more and more citizens are included in the governance value chains at different levels of the government infrastructure.
- *Tailor-made services*: By using Open Data in public service delivery channels, local governments can provide tailor-made services which are more relevant to the needs of the population.
- *Tailor-made solutions*: Enable the design of tailored solutions which can be easily accessed and applied to different contexts.
- *Streamline business processes*: By analysing Open Data, it is possible to streamline business processes and services, thereby allowing inefficient, irresponsive or ineffective processes.
- *Economic and social benefits*: Implementation of Open Data in Smart City environments culminates into tangible economic and social benefits. Opening up public data in Smart City environments entails that more data will be readily available to feed into different apps at any given time for individuals to make smart decisions with regard to heavy congestions and locating services in any given area (Calderoni et al. 2012). For example, citizens will easily locate information as they traverse through different Smart City environments. By so doing, stress is reduced on the citizens, therefore promoting health living. The little time spent in looking for information in the public domains translates into increased person-hours on the primary job or business and therefore higher productivity. Further, individuals can make evidence-based decisions quickly and therefore avoid social catastrophes that can occur if information were not readily available in the public domains.
- *Identification of best practice in business*: In the case of a business, Open Data enables it to access information from proprietary databases which in normal circumstances will be closed off from the general public. This enables a business to understand the best practices in its domain area and tailor its goods and services according to the best practices mapped against the general consumer trends. Therefore, a business is able to adequately understand its market and design services and products according to the given market segments and trends.
- *Improve city planning*: By analysing data in public domains, a government can observe Open Data access trends and then use this data to improve city planning and modernise the different public services such as healthcare, education and transport systems. Furthermore, Big Data analysis of both structured and non-structured Open Data in the Smart City environments may enable the identification of inefficiencies in the basic and public services, therefore prompting the development of interventions that can be targeted for solving the identified problems.
- *Tracking of individuals*: At the city level, Open Data provides location or spatial intelligence which can go a long way in tracking of individuals' actions

in the environment. When appropriately linked to the environment, it can be used to provide security and monitoring dimensions to a wide array of social and economic activities. For example, a stolen car can easily be tracked by appropriately analysing Open Data.

6 Open Data Applications

There have been many instances worldwide where Open Data has been used in specific Smart City Applications. This is despite the fact that only 7% of government departments' data has been open for public access in the majority of countries worldwide. Although this is the case, in the countries where a significant degree of Open Data has been achieved, there have been tangible benefits that have been garnered (as articulated above).

The Open Data Barometer of the World Wide Web consortium (see https://open-databarometer.org/?_year=2017&indicator=ODB) collates the different Open Data innovations throughout the world, thereby providing a one-stop shop for the development of Open Data usage in different contextual settings in the world. The consortium analyses the impact of Open Data initiatives by considering how different government data is being used by citizens in smart applications. In addition, the consortium also publishes the Open Data Charter which has effectively been adopted by 30 countries worldwide. Further, the G20 anti-corruption Open Data principles have been adopted by all the G20 members, thus providing a framework for usage growth and integration of Open Data in different contextual settings (Andersen 2009).

Murray (2017) has articulated the 40 different Open Data projects being pursued by different governments and private entities throughout the world. This underscores the increasing use of Open Data in different contextual settings. This section showcases the different examples of contexts Open Data has used in the design of Smart City environments:

- The *La Base Adresse Nationale* in France, the national address database, went live in 2015 to provide accurate physical locations around France. Individuals can log onto the application and tag themselves in to locate their physical locations at that point in time. This app enables government agencies to urgently and effectively respond to emergencies.
- The USA data.gov was launched in 2009 to allow public access to over 200,000 data sets allowing the public to use the data in developing applications or service responses according to their needs.
- In Sweden, the Trafikverket was one of the first road traffic app that provided real-time traffic data making Swedish roads the first intelligent roads in the world (Komninos 2011). With on-time information, motorists could make decisions on-time decisions avoiding congestions on the road. Using the concept of Open Data, everyone could have access to the motorists' road usage

behaviour on the roads and therefore providing opportunities for the public to participate in road policy enforcement.

- The Philippines ‘Check my Barangay’ is an effort to extend Open Data and Smart City projects to the rural areas so that rural areas have an opportunity to access information opening up digital opportunities and be on the same wave length with what other citizens are doing in the socio-economic establishment.
- The EU Urban Data platform is a tool that uses the principles of open source to act as one of the major sources of context-specific (local or regional) data and acts as a data-sharing platform across the EU.
- Because of increased fake media, Open Data in Smart City framework may act as a data validating platform where anyone could access multiple authenticated data in the public domains. For example, in the USA, the Alliance for Audited Media (AAM) has acted as a reliable source of information that could shape public discourse and debate.
- Dublinked is Ireland’s Open Data platform which has been designed within the Smart City project. The Dublin City Council has implanted sensors in different strategic places around the city which aim to capture information instantly so as to monitor matters such as mobility and energy usage so as to help reduce city’s carbon footprint. By reducing the carbon footprint in the city, the quality of life is improved and there is sustainability of the different aspects of city’s design.
- One of the key aspirations of any Smart City design is that it should aim to improve the quality of life of its inhabitants regardless of their physical or mental status. In many city designs around the world, the visually impaired or mentally retarded have been left out in the different aspects of city life. The BlindSquare worldwide app gathers information from third-party apps such as Foursquare and OpenStreetMap to give visually impaired people their exact locations, announce points of interests, give street address or announce street intersections, provide audio directions, and even provide visual feedback to users on current situation in their environment. This helps the visually impaired and/or physically changed to freely navigate through the city, thereby improving their experience of the city and ultimately their quality of life.
- In Copenhagen Denmark, within the realm of Smart Cities, EnergyBlock is being implemented to use spatial-temporal sensors to give an indication of the energy production and food production in different greenhouses across the city. The captured data is straightaway shared with Copenhagen’s Open Data portal, and ordinary people can access it to monitor the different renewable energy options available in Copenhagen.
- The MIT Open Agriculture Initiative (OpenAg) uses technologies to bring together different stakeholders in the food industry starting from producers, consumers, individual citizens and stakeholders. OpenAg is an open-source eco-systems of different technologies (collaborative tools and open technology platforms) for ensuring that data about agriculture are put in the public domains so that the different stakeholders can access and use it to contribute to local food security.

The above cases of Open Data implementation are mainly in the developed world. With the many Open Data initiatives in the developing world, it is clear that such initiatives may require some financial and technical resources in order to rightly design the initiatives. The developing world, on the other hand, has limited Open Data initiatives mainly due to limitations in resources.

7 Open Data in Smart Cities in the Developing World

Africa, as a whole, has adopted the African Data Consensus (ADC) which was conceptualised in 2015 in Addis Ababa, Ethiopia. The African Data Consensus is a subset of the International Open Data charter aimed at improving data standards and interoperability which is espoused upon the following principles: open by default, timely and comprehensive, accessible and usable, comparable and interoperable, improved governance and citizen engagement, and inclusive development and innovation. Although there are fewer Open Data initiatives in the developing world especially as applied to Smart Cities, many governments in Asia and most parts of Africa have realised the need to develop projects with Open Data orientation. Of late, there has been an increased interest in monitoring Open Data initiatives in the developing world. The Open Data for Development (ODD) (see <https://webfoundation.org/our-work/projects/open-data-in-developing-countries/>) monitors the development of Open Data in the developing countries positioned in Africa and Asia.

The 2015 ODD barometer generally shows that there has been an increased development in as far as Open Data initiatives is concerned in Africa. Other than in Cameroon and Nigeria, many countries in Africa have shown significantly improved on scores measuring application of Open Data in governance platforms and different socio-economic contexts. Specifically, there are no distinct cases where Open Data has been utilised in the realm of Smart Cities. There are generally fewer cases highlighting the different initiatives of Open Data especially in government establishments. The following showcases some of the ways in which Open Data has been utilised in Africa:

- Battling Ebola in West Africa: Using a free crowdsourced mapping tool OpenStreetMap (OSM), critical information such as names of villages or roads were managed to act as input to the response to the Ebola virus by the Sierra Leone National Ebola Response Centre, Ebola GeoNode, UN Humanitarian Data Exchange so as to coordinate their responses to the disease. This app enabled ordinary community members, and interested parties can access the data and use it to respond to the disease.
- The Vihiga Municipal Council in Kenya uses Open Data to reduce corruption, thereby increasing accountability and responsibility towards public funds by allowing citizens to monitor the actions by the council (Neupane et al. 2014; Lio et al. 2011). The Panama papers articulate an example of how Open Data can be used to expose inefficiencies and dark dealings.

Of all the African countries, South Africa has a relatively developed legal and institutional framework to nurture the utilisation of Open Data. The Open Data revolution in South Africa is underpinned by the Promotion of the Access to Information (PAIA) Act No. 2 of 2000 and the South African Spatial Data Infrastructure (SASDI) Act No. 54 of 2003. Right now, South Africa is following the third Open Government Partnership Country Action Plan (2016–2018) in exploring options for Open Data innovation in the government business processes and activities.

To facilitate Open Data innovation, South Africa has a well-developed information infrastructure which has data portals housing a wide array of topical issues. The key Open Data information portal is the South African data portal (see <http://south-africa.opendataforafrica.org/>). At the city level, the South African Cities Open Data portal (see www.scoda.co.za) is the main gateway to information on different cities. Some of the more pronounced data portals include the Cape Town open data portal, Code for South Africa portal, Ekurhuleni open data portal, Statistics South Africa, Department of Education EMIS, SAPS Crime Statistics, Centre for Higher Education Transformation and the Treasury Municipal Budget Data. Although the information infrastructure is relatively developed in comparison with the rest of Africa, anecdotal evidence shows that there is underutilisation of the aforementioned data portals.

Although South Africa has achieved some significant strides in creating the Open Data information infrastructure, most of the data is static and does not automatically update itself on Web portals when new information emerges. To be useful in a Smart City environment, it is important that there is utmost need for automation at all stages of the data management cycle. This automation starts right at the data collection stage where sensors are put in strategic places in the environment to automatically collect dynamic data within the spatial-temporal domain. In the second stage, using Internet of Things (IoT) capability, integration of data from different sources is achieved and different dynamic data is stored in Open Data repositories which would then allow intermittent access to the data by different digital agents. A desired conceptual overlay for automation in the data and information management efforts is shown in Fig. 3.

Figure 3 forms the building block upon which integration is achieved in the Smart City environment. Integration desired is data and technology integration to allow ubiquitous access of different sets of data and information.

8 Integration Framework

In order to design a sustainable Smart City, there is need to understand the different challenges that sit at the centre of Smart City implementation. Some of the key challenges include:

- Achieving interoperability given the heterogeneous devices that are deployed in the Smart City environment.

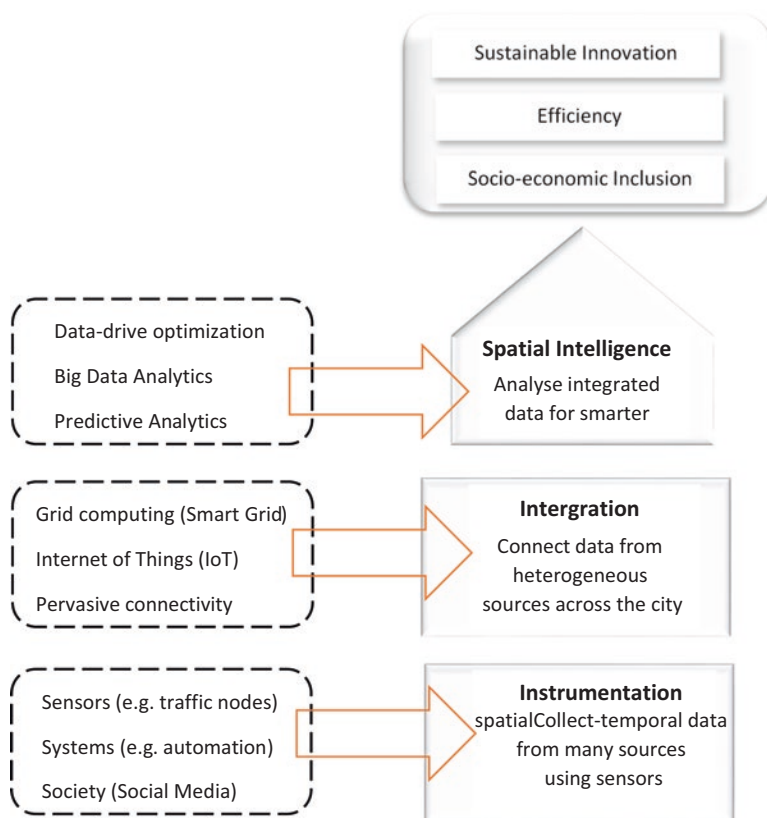


Fig. 3 Data automation in Smart Cities. (Adapted from Palmisano 2008)

- Responsibility for enforcing integrity of the data in the public domains – since using Open Data demands that the data held in a Smart City environment needs to be accessed by everyone at any given time, issues of privacy, security and integrity may come up.
- Integrating of the cultural traits in the Smart City applications for targeted universal adoption by the general citizenry.

The above challenges need to be considered in conjunction with the different key factors that have been considered as cardinal in the design of Smart Cities. Chourabi et al. (2012) identified eight factors that need to be considered in the design of any integrative framework to measure Smart City readiness in any given context. These factors are technology, management and organisation, people, policy context, governance, natural environment, built infrastructure and economy. Given the fact that it is difficult to achieve spatial intelligence and a public information space in real-life environments, it is important to design a conceptual framework for integrating Open Data principles into the design of contemporary Smart City environments (Lee et al. 2014). This framework can be used as a blueprint for guiding Smart City designs especially in the resource-constrained developing world contexts.

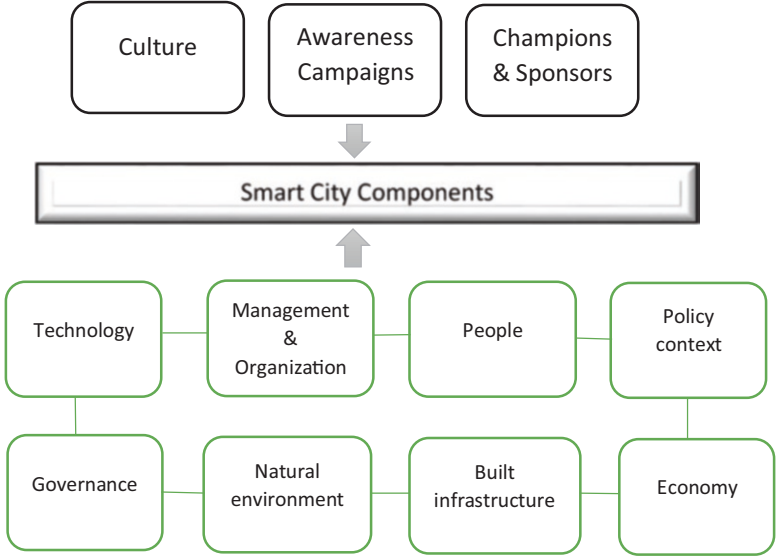


Fig. 4 Conceptual framework: Smart City infrastructure. (Source: Authors)

As espoused in Fig. 3, the starting point of the utilisation of Open Data in Smart City environments is enabling automatic capturing of data from heterogeneous sources and incorporating data and information portals that can be easily accessed by heterogeneous devices. In order to achieve that, a multi-dimensional matrix of factors need to be considered. A careful consideration of these different factors needs to be integrated into the conceptual framework used to design Smart Cities. The few cases explored in this chapter have shown that in addition to the well-known factors that influence successful design and deployment of Smart Cities, culture, awareness campaigns and availability of champions and sponsors sit at the centre for successful Smart Cities in developing world contexts (Mayne 2008). Incorporating of these additional factors into the design translate into additional costs in the design and the implementation phase (Fig. 4).

This conceptual framework can be used as a reference point for design and implementation of Smart Cities in similar contextual settings.

9 Conclusion

The world presents a situation where a majority of its inhabitants live in the city, and in the near future, more and more inhabitants will migrate to the city. The direct implication of such a move will be an increased pressure on the different resources that cities have to offer. The future demands that more and more data needs to be ubiquitous, easily accessed and applied to different contexts in real-time, ultimately culminating into improved livelihoods. Because of Open Data in Smart Cities,

individuals are afforded opportunities to openly and publicly innovate by coming up with apps to solve specific information-needs problems without having had to go through tedious red-tape in securing permits. Once individuals encounter problems disturbing their quality of life, they will be motivated to design context-specific apps to solve those problems.

This chapter looked at the fundamental concepts of Open Data in the realm of Smart Cities and has developed a conceptual framework that can be used to overcome glaring limitations and challenges of Open Data implementation in developing world contexts. It can be posited that one of the challenges in wider penetration of Open Data in Smart Cities is a lack of awareness among the general populace on how to explore the different capabilities and benefits of Smart Cities. Another pronounced problem in Smart Cities has been achieving interoperability among the different heterogeneous systems that are usually deployed to achieve a well-rounded Smart City implementation. Integrating Open Data into the DNA of Smart Cities may help achieve the desired 'spatial and functional interoperability' by utilising Open 311 where the different systems in the Smart City environment are able to communicate and exchange data which is in the open domain in the realm of Open Data.

One of the key attributes of Open Data is its transversality allowing it to be used in any aspect of city life, i.e. administration, city governance, citizens' behaviour in the Smart City environment, traffic management, etc. The design of contemporary Smart Cities will need to consider many of the principles articulated in this chapter.

References

- Allwinkle, S., & Cruickshank, P. (2011). Creating smart-er cities. *Journal of Urban Technology*, 18, 1–16. <https://doi.org/10.1080/10630732.2011.601103>.
- Alonso, J., & Lamata, M. (2006). Consistency in the analytical hierarchy process: A new approach. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, 14, 445–459. <https://doi.org/10.1142/S0218488506004114>.
- Andersen, T. B. (2009). E-government as an anti-corruption strategy. *Information Economics and Policy*, 21(3), 201–210.
- Berry, C. R., & Glaeser, E. L. (2005). The divergence of human capital levels across cities. *Papers in Regional Science*, 84, 407–444. <https://doi.org/10.1111/j.1435-5957.2005.00047.x>.
- Branchi, P., Fernández-Valdivielso, C., & Matias, I. (2014). Analysis matrix for smart cities. *Future Internet*, 6(1), 61–75.
- Calderoni, L., Maio, D., & Palmieri, P. (2012). Location-aware mobile services for a smart city: Design, implementation and deployment. *Journal of Theoretical and Applied Electronic Commerce Research*, 7(3), 15–16.
- Calzada, I., & Cobo, C. (2015). Unplugging: Deconstructing the smart city. *Journal of Urban Technology*, 22(1), 23–43.
- Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, 18(2), 65–82.
- Chourabi, H., Nam, T., Walker, R., Gil-Garcia, J.-R., Mellouli, S., Nahon, K., Pardo, T. A., Scholl, H. K. (2012). 45th Hawaii International Conference on System Science (HICSS), Issue Date: 4–7 Jan 2012.

- Deakin, M. (2014). Smart cities in Europe. In *Creating smart-er cities* (pp. 67–69). Routledge.
- Del Bo, C., & Florio, M. (2008). Infrastructure and growth in the European Union: An empirical analysis at the regional level in a spatial framework. In *Departmental working papers 2008–37* (pp. 1–23). Milan: University of Milan, Department of Economics.
- Drucker, P. F. (1954). *The practice of management*. New York: Harper & Row.
- Fu, S. (2007). Smart café cities: Testing human capital externalities in the Boston metropolitan area. *Journal of Urban Economics*, 61, 87–111. <https://doi.org/10.1016/j.jue.2006.06.002>.
- Johnston, E. W., & Hansen, D. L. (2011). Design lessons for smart governance infrastructures. In D. Ink, A. Balutis, & T. Buss (Eds.), *Rebooting the Public Square?* National Academy of Public Administration.
- Juvara, M. (2015). *Smart city: Can it lead to smart planning?* UrbanSilence. <http://www.urbansilenceltd.com/smart-planning/item/smart-city-can-it-lead-to-smart-planning.html>. Accessed 28 June 2018.
- Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, 79, 1–14. <https://doi.org/10.1007/s10708-013-9516-8>.
- Komninos, N. (2011). Intelligent cities: Variable geometries of spatial intelligence. *Intelligent Buildings International*, 3, 172–188. <https://doi.org/10.1080/17508975.2011.579339>.
- Kourtit, K., Nijkamp, P., & Arribas-Bel, D. (2012). *Smart cities perspective - a comparative European study by means of self-organizing maps* (pp. 229–246). Innovation.
- Lee, J. H., Phaal, R., & Lee, S.-H. (2013). An integrated service-device-technology roadmap for smart city development. *Technological Forecasting and Social Change*, 80(2), 286–306.
- Lee, J. H., Hancock, M. G., & Hu, M. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*, 89, 80–99.
- Letaifa, S. (2015). How to strategize SMART cities: Revealing the SMART model. *Journal of Business Research*, 68(7), 1414–1419.
- Lio, M., Liu, M., & Ou, Y. (2011). Can the internet reduce corruption? A cross-country study based on dynamic panel data models. *Government Information Quarterly*, 28(1), 47–53.
- Lynch, A., Andreason, S., Eisenman, T., Robinson, J., Steif, K., & Birch, E. (2011). *Sustainable urban development indicators for the United States*. Philadelphia: Penn Institute for Urban Research.
- Mayne, J. (2008). *Building an evaluative culture for effective evaluation and results management*. Rome: ILAC Brief 20.
- Meijer, A., & Bolívar, M. P. (2015). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences*, 1–17.
- Murray, P. (2017). *40 Brilliant Open Data Projects Preparing Smart Cities for 2018*. <https://carto.com/blog/forty-brilliant-open-data-projects-preparing-smart-cities-2018/>. Accessed 30 Sept 2018.
- Neupane, A., Soar, J., Vaidya, K., & Yong, J. (2014). Willingness to adopt e-procurement to reduce corruption. *Transforming Government: People, Process and Policy*, 8(4), 500–520.
- Palmisano, S. J. (2008). *A smarter planet: The next leadership agenda*. Speech delivered at the Council on Foreign Relations, New York, November 6. <http://www.cfr.org/technology-and-foreign-policy/smarter-planet-next-leadership-agenda/p17696>

Open Government Initiatives in Spanish Local Governments: An Examination of the State of the Art



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Abstract The implementation of OG initiatives is favoring reforms moving public administrations to more collaborative and participative spaces with stakeholders. In Spain, fostered by the issuance of legislation, governments have formulated numerous action plans with the intention of achieving the objectives included in European Digital Agenda. This paper seeks to analyze the efforts made by the Spanish municipalities regarding the implementation of the OG initiatives with the aim at getting an overview of how these initiatives have been put into practice to increase the level of openness in these governments. Findings indicate that Spanish municipalities seem to be at the beginning of the process of OG implementation into their management processes, which is not being homogeneous in all municipalities. Also, these OG initiatives have not been addressed to promote more democratic governance models in sample municipalities.

1 Introduction

Many governments around the world have implemented the Information Communication and Technologies (ICTs) which have favored reform process and innovation in the public sector (Girish et al. 2014). These technological advances have led to structural and institutional changes that, on the one hand, have favored the improvement information transparency in public administrations and the efficiency and effectiveness in the public services delivery (Lindgren and Jansson 2013). And, on the other hand, they have increased the organizational flexibility and the agility to respond to the citizens' demands of a dynamic environment in continuous change (Holgersson and Karlsson 2014).

Some key objectives of these innovative reforms include the increase of citizens' confidence in public managers and politicians and the promotion of citizen

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participation in public affairs (Harrison and Sayogo 2014). Nonetheless, according to the United Nations (UN 2013), the level of information transparency has not been enough to facilitate the participation of citizens, and the UN (2013) has demanded more transparent public administrations through the offer of new channels that favor the empowerment of citizen (UN 2013) strengthening, in this way, representative democracy and democratic decision-making processes (Kim and Lee 2012).

As a response to this situation, in the last years, public administrations, and especially municipal governments, are undertaking Open Government (OG) initiatives (Open Government Partnership 2017), mainly motivated by the improvement of information transparency, participation, and citizen collaboration (Gascó-Hernández et al. 2018). On the one hand, this kind of initiatives allows governments to offer open data that provides the basis for citizens to better monitor the use of the public resources, how decisions are made, and, in general terms, how their governments work (Nam 2012). On the other hand, these initiatives favor the creation of communication and interaction network between citizens, companies, nonprofit organizations (NGOs), and governments for participation and collaboration purposes in the design, implementation, and evaluation of public policies and services (Ruijter et al. 2017).

Some main outcomes of these initiatives include the knowledge of citizens regarding performance of government duties, reducing corruption, and poor public management (Veljkovic et al. 2014), which has had an impact on the improvement in the confidence of citizens in the political parties (Leen and Kwak 2012) and in the understanding of the framework in which public management works. Therefore, the implementation of OG projects has improved government efficiency and effectiveness, the development of sustainable innovations, and higher economic growth (Grant 2016) supporting, at the same time, collaboration patterns of all interested stakeholders in the search for answers and solutions to solve social problems (Sandoval-Almaza and Gil-García 2012).

Although the interest in establishing OG strategies has been increasing throughout the world, the European Union (EU) has been very active in this role, designing multiple actions in the so-called European Digital Agenda that seek to exploit ICTs for increasing the capacity of citizens, companies, and other organizations to adopt a more proactive role in society (European Commission 2010). Particularly in Spain, fostered by the issuance of legislation (Law 11/2007 on the Implementation of Electronic Administration or Law 10/2013 on Transparency, Access to Public Information, and Good Governance), governments have formulated numerous action plans with the intention of achieving the objectives included in European Digital Agenda (Alcaide Muñoz et al. 2016).

In this paper, we seek to analyze the efforts made by the Spanish municipalities regarding the implementation of the OG initiatives with the aim at getting an overview of how these initiatives have been put into practice to increase the level of openness in these governments. Findings seek to critically make recommendations on actions, good practices, and public policies that could favor the development of these initiatives.

This chapter is organized as follows. The next section shows a description of the legal and regulation background about OG in Spain, and we continue with the sample selection and explain the methodology used. In the fourth section, we show the empirical results of this study, and finally, we offer the findings and conclusions about this study together with the empirical implications.

2 Public Policies for Implementing Open Government in Spain

Members of the European Union have followed the European policies regarding ICTs implementation in public administrations. In fact, all European plans, initiatives, and strategies have been coordinated together with the Member states to improve access to ICT and to promote the opportunities offered by new technology (see Table 1). In this regard, the Spanish experience in OG has moved these initiatives and action plans formulated from EU into the Spanish framework. As Spain is a Napoleonic country, the issuance of Spanish regulations, laws, and initiatives about Information Society and OG has been the main way in increasing and improving the Internet connections in Europe (see Table 1).

In this context, Spanish governments have formulated public policies and legal frameworks such as *Info XXI* (2001–2004), *España.es* (2004–2005), *Plan Avanza 1* (2005–2009), and *Plan Avanza 2* (2009–2012) (Alcaide Muñoz et al. 2016). Together with these action plans, the government issued an important law to introduce ICT in the field of public sector services delivery, in order to personalize and to improve the quality of public services and access to these services (*Spanish Act 11/2007 Electronic Access for Citizens to Public Services*).

Also, in 2013, the Spanish government published the most ambitious strategy about Information Society – *A Digital Agenda for Spain* – into two stages. The first one is focused on digital inclusion for the period 2013–2015 (Government of Spain 2013), whereas the second one (2015–2020; www.agendadigital.gob.es) incorporates six main objectives for developing economy and the digital society in Spain: encourage the deployment of networks and services to ensure digital connectivity; develop the digital economy for the growth, competitiveness, and internationalization of the Spanish companies; improve e-administration and digital public services; strengthen confidence in the digital domain; promote R&D&I in the future industries; and promote inclusion and digital literacy and the training of new ICT professionals (Government of Spain 2013).

This Spanish strategy has been performed through the implementation of nine specific plans, seven of them defined and turned on in 2013 and two additional plans approved in 2015 (see Table 1). Also, the Spanish government formulated the *Law 19/2013 of Transparency, Access of the Public Information and Good Government*, which strengthens the right of citizens to access information about public activities, and the *Law 37/2007 on reuse of public sector information*, which allows to exploit

Table 1 Public policies context for implementing OG – European Commission, Government of Spain, and Regional Governments

European Union initiatives	Government of Spain initiatives
e-Europe – An Information Society for All 2000	INFO XII The Information Society for Everybody 2001–2003 <i>Law 57/2003 for the modernization of local government</i> España.ES – SPAIN.ES (2004–2005)
e-Europe 2005	ADVANCE PLAN 1 (2005–2009) <i>Law 11/2007 Electronic Access for Citizens to Public Services</i> <i>Law 37/2007 on reuse of public sector information</i>
I2010 Strategy – An European Information Society for growth and employment 2005	ADVANCE PLAN 2 (2009–2012)
Digital Agenda for Europe 2020	Digital Agenda – First Phase (2013–2015) Telecommunication plan and ultrafast networks ICT plan in SMEs and e-commerce Plan to boost the digital economy and digital content Technological companies internationalization plan Trust plan in the digital field ICT sector development and innovation plan Plan for digital inclusion and employability <i>Law 19/2012 of Transparency, Access of the Public Information and Good Government</i> Digital Agenda – Second Phase (2015–2020) National plan for smart cities Plan for promoting language technologies <i>Law 18/2015 which modified Law 37/2007 on the reuse of public sector information</i>



Regional government	OG plan actions and regulations	Regional government	OG plan actions and regulations
Andalusia	OG Action Plan (2018–2019) <i>Law 1/2014 on Public Transparency in Andalusia</i>	La Rioja	Digital Agenda 2015–2020 <i>Law 3/2014 on Transparency and Good Government</i>
Aragon	Annual Citizen Participation Program <i>Law 8/2015 on Transparency of Public Activity and Citizen Participation of Aragon</i>	Community of Madrid	Government Action Plan (2015–2019) <i>Law 19/2013 on Transparency, Access to Public Information and Good Governance</i>

(continued)

Table 1 (continued)

Asturias	Strategic Transparency Plan (2017–2020) White paper on citizen participation Draft Law 2016 of the Principality of Asturias on Transparency and Good Governance	Navarre	Plan to boost citizen participation (2017–2019) Annual Normative Plan 2018 Regional Law 11/2012 on Transparency and Open Government
Catalonia	OG Action Plan (2017–2018) Law 19/2014 on Transparency, Access to Public Information and Good Governance	Murcia	OG Action Plan (2018–2019) Law 12/2014 on Transparency and Citizen Participation
Valencian Community	Strategic Plan of Open Government (2016–2019) Law 2/2015 on Transparency, Good Government and Citizen Participation	Canary Islands	Strategic of OG 2017–2019 Law 12/2014 on Transparency and Access to Public Information
Basque Country	Euskadi.eus Ireka Open data Euskadi Draft Law 2016 of the Basque Country on Transparency and Good Governance	Cantabria	Law 1/2018 on Transparency of the Public Environment
Extremadura	Technological Literacy Plan (2015–2019) Law 4/2013 of Open Government of Extremadura	Castile La Mancha	Project of Open Data (2017–2019) Draft Law 2018 of Participation Law 4/2016 on Transparency and Good Governance
Galicia	Democratic Boost Program 2015–2016 Law 1/2016 on Transparency and Good Governance	Castile and León	Agreement 17/2012 about OG Model Law 3/2015 on Transparency and Citizen Participation
Balearic Islands	Annual Normative Plan 2018 Law 4/2011 on Good Administration and Good Governance		

Source: Own elaboration

the information potential of public sector's information and overcome the barriers of a fragmented European market for the treatment of information that can be reused by citizens and firms. The law obliges public administrations to actively publish relevant and current information about public affairs, like public contracts, financial information, and so on, in a proactive way without the citizenship requesting it. Also, it requires the creation of public website (www.transparencia.gob.es) to publish the mandatory information by law that must be provided by the General State Administration, as well as the one requested most frequently by citizens.

Nowadays, the *National Plan for Smart Cities* (2017–2020) (Government of Spain 2017a) was born with the aim at improving efficiency of local governments in online public services delivery (in platforms 4.0), at responding to the needs of the most disadvantage territories (rural territories), at advancing in the governance of the Smart Cities system, and at generating new business models that boost the economy and Smart Tourism. Also, parallelly, it was turned on an *alliance plan for the Open Government* (Government of Spain 2017b) that seeks to strengthen the mechanism of participation and dialogue with civil society, to ensure inter-administration cooperation between the different levels of administration, to strengthen open government initiatives undertaken, and to reinforce transparency.

These actions at the state level have been moved to Spanish Regional Governments (RGs) implementing strategic plans and actions in order to achieve the success in the state government's action plans (Alcaide Muñoz et al. 2016) (see Table 1). However, this process has not been homogeneous among the different RGs, due in part to the current economic situation and weak financial health (De la Fuente 2015) that has made it impossible to face the necessary financial effort for the development of ICTs through the necessary infrastructure. In this regard, some of these RGs have carried out their own *Digital Agendas Strategies* (Alcaide Muñoz et al. 2016), facilitating social inclusion and strengthening business environment, supporting e-commerce and citizen formation and inclusion.

Bearing in mind previous comments, OG strategies carried out by the Catalanian, Murcia, Navarre, and Basque Country's RGs are the most ambitious OG strategies in Spanish RGs. In the particular case of Catalanian, this RG is implementing its *OG Plan Action* (2017–2018) (Government of Catalonia 2015), which tries to consolidate, improve, and strength OG through the performance of five areas of action: transparency, open data, good governance, citizen participation, and cultural change. It seeks to empower citizen through access to public information, facilitating the understanding and analysis of public information, promoting the generation of social value through the use of open data using tools and processes that ensure the quality of public services with the aim at increasing citizen participation in public policies, and empowering civil society to have influence on the dissemination of knowledge about OG.

Murcia is undertaking the *OG Plan Action* (2018–2019) (Government of Murcia 2017), which generates greater credibility in the citizenship of the Murcia RG's institutions, as well as in their public managers and politicians; improves the mechanism of accountability and transparency through the implementation of instruments to evaluate public policies; guarantees access to public information;

encourages citizen participation; promotes multilevel governance in OG policies; generates public value through the use of open data; and encourages cultural change.

Navarre has an *OG Action Plan* (www.gobiernoabierto.navarra.es) that seeks to improve the commitment acquired from active publicity and access to public information, stimulating the culture of citizen participation and collaboration, and contributing to the economic and social development of new applications, products, and services that arise from the reuse of public information, as well as favor the inclusion of the sectors of the most disadvantaged citizens.

Finally, in January 2018, Basque Country published its *Government Action Plan* (2018–2020) (<http://www.euskadi.eus/gobierno-vasco/-/plan-accion-ogp/>) which promotes an axes about transparency and participation where the following strategic objectives are included: approach of the municipal administration to citizenship and personalized public services delivery; improvement in the quality and innovation in the provision of services and management systems; new communication model that offers citizens all the municipal information in real time; and transparency, open government, data opening, and reuse.

3 Empirical Analysis

3.1 Sample Selection

In the last years, Spanish governments are undertaking numerous initiatives to improve the e-administration and to adopt digital solutions for efficient delivery of public services by transforming the administration through the use of ICTs (Alcaide Muñoz et al. 2016). Also, Spanish Central Government participates in the OG Alliance (Open Government Partnership) since 2011, which highlights the strong commitment of this country with the values that this organization defends. Spanish action plans have sought both to make governments more transparent and accountable and to improve the capacity to respond to citizens' demands, with the objective of improving the quality of government, as well as the quality of services provided (Government of Spain 2017b).

Under this framework, Spanish local governments have made greater efforts to respond the new social demands and to provide high-quality and citizen-centric public services (Rodríguez Bolívar 2017a). These local governments are those with a closest relationship with citizens (Cegarra-Navarro et al. 2012), manage large budgets, and provide a wide variety of services, with lead to the municipalities to undertake major reforms in public sector (Smith and Fridkin 2008).

Also, Spanish local governments provide different services (public lighting, waste collection, public parks, social services, cultural services, and protection of the environment, for example, Law 7/1985, Regulation of Bases of Local Regimes). In this research, we focus our efforts in those municipalities with a population over 50,000 inhabitants – the so-called large municipalities – because they have opted

the most for introducing OG initiatives into their management purposes (Law 57/2003 for the modernization of local government). Also, municipalities with relatively large populations are examined in this paper because they are usually among the first to adopt new technologies (Bonsón et al. 2012) with the aim of providing efficient services to the public (Cegarra-Navarro et al. 2012) and their delivery of services is more complex (Torres et al. 2005) and comparable. Taking into accounting these considerations, our sample is composed by 148 municipalities with more than 50,000 inhabitants, which represent more than 50% of the Spanish population (National Institute of Statistics 2017).

3.2 *Methodology of Research*

To analyze the efforts made by the Spanish sample municipalities regarding the implementation of the OG initiatives, we visited their official websites during March–June 2018 to analyze whether they have an OG section. Taking into account that OG projects put emphasis on information transparency and on citizen participation, we collected information about general aspects of OG projects, citizens' access to the information, transparency, and different actions taken by sample municipalities for citizens' participation (see Table 2).

Regarding the general aspects' section, we analyze whether municipalities have a specific OG section in their official websites (WS) using a different page from that of the WS (1 point), using a OG tab but inside in their official WS (0.5 points), using an independent WS without providing a link in their official WS (0.25 points), or no OG section is provided (0 points). Also, we checked whether the WS allow an advanced search of OG databases, whether the municipality offers information on the OG Action plan, and whether there is a news section (YES = 1 point, NO = 0 point) assigning a weighting of 0.25 points to each of these items (see Table 2). Therefore, the maximum punctuation of the general aspects' section is 1 point.

As for different actions taken by sample municipalities for citizens' participation, we checked different ways for promoting citizen participation. In this regard, we checked whether recommendations and initiatives proposed by citizens are accepted, whether local government allows the citizens' participation in municipal plenary sessions (in person and/or online), whether the municipality allows the citizen participation in the consultations, or finally, whether there are online discussions (YES = 1 point, NO = 0 point) with a weighting of 0.25 points each of these items (see Table 2). This way, the maximum punctuation of this section is 1 point.

Finally, regarding the information transparency section, we checked the degree of information disclosure and transparency, dividing this section into two different parts: (a) content of the information disclosed (with a weight of 0.5 points) and (b) format used to disclose the information provided (with a weight of 0.5 points). As for the content of the information disclosed, we checked the disclosure of Spanish municipalities about information on municipal services (Law 7/1985, of April 2, regulating the Bases of the Local Regime) (YES = 1 point, NO = 0 point) with a

Table 2 Items of General Aspects, Transparency, and Accountability

Questions	Score	Weighting
On the Local Government website, is there a specific section of Open Government?	$\sum a$ to d	0.25
(a) There is a section which links a different page of Open Government.	1	
(b) There is an Open Government tab, but it is inside the official Local Government website	0.5	
(c) There is an independent website without a link in the official website of the Local Government	0.25	
(d) There is no Open Government page/section	0	
Does the web page allow an advanced search of Open Government databases?	0/1	0.25
Does the Local Government offer information on the Open Government action plan?	0/1	0.25
Is there a news section?	0/1	0.25
<i>Total general aspects (max. punctuation)</i>		1
Are accepted recommendation and initiatives proposed by citizens (apply form)?	0/1	0.25
Does Local Government allow the participation of citizen in municipal plenary sessions?	$\sum a + b$	0.25
(a) In person.	0/1	
(b) Online (using different tools).	0/1	
Does it allow the participation of citizen in the consultations?	0/1	0.25
Are there online discussions?	0/1	0.25
<i>Total participation (max. punctuation)</i>		1
Disseminate information on	$\sum a$ to n	0.50
(a) Map of the city – typography network	0/1	
(b) Security in public places	0/1	
(c) Environment	0/1	
(d) Urban planning	0/1	
(e) Rural environment and fishing (conservation of roads and rural coats)	0/1	
(f) Culture and leisure (historical-artistic heritage)	0/1	
(g) Commerce – Industry	0/1	
(h) Supplies	0/1	
(i) Social services – Employment	0/1	
(j) Public transport	0/1	
(k) Sport	0/1	
(i) Energy (public lighting)	0/1	
(m) Economy (budget and public accounts)	0/1	
(n) Payment and municipal taxes	0/1	
(o) Education	0/1	
(p) Legislation and justice	0/1	

(continued)

Table 2 (continued)

Questions	Score	Weighting
(q) Demography	0/1	
(r) Health (participation in the management of primary health care)		$(\sum 1 + 2 + 3) / 0.50$
Format in which information is disclosed:	$\sum a$ to l	0.60
1. Transferable	0/1	
(a) CSV	0/1	
(b) XLS	0/1	
(c) XML	0/1	
(d) XLSX	0/1	
(e) WMX	0/1	
(f) RDF	0/1	
(g) PRJ	0/1	
(h) SHP	0/1	
(i) SHX	0/1	
(j) JSON	0/1	
(k) CPG	0/1	
(l) GEOJSON	0/1	
2. Less transferable	$\sum a$ to h	0.30
(a) ZIP	0/1	
(b) DBASE	0/1	
(c) WMTS	0/1	
(d) DBF	0/1	
(e) DAT	0/1	
(f) KML	0/1	
(g) KMZ	0/1	
(h) SBN	0/1	
3. No transferable		0.10
(a) PDF	0/1	
<i>Total transparency (max. punctuation)</i>		<i>1</i>

Source: Own elaboration

total weighting of 0.5 points. Also, we analyzed the different formats offered to disclose information: transferable format (YES = 1 point, NO = 0 point, with a weighting of 0.6 points), less transferable format (YES = 1 point, NO = 0 point, with a weighting of 0.3 points), and no transferable format (YES = 1 point, NO = 0 point, with a weighting of 0.1 points). As noted previously, these two subsections – information disclosure and format of information to be disclosed – have a total weighting of 0.5 points each of them (see Table 2). This way, the maximum punctuation of the information transparency section is 1 point.

4 Analysis of Results

As we can observe in Table 3, the development of general aspects shows a heterogeneous behavior. There are municipalities of five RGs, Lleida in Catalonia, Cartagena in Murcia, Pamplona in Navarre, Gijon in Asturias, and Bilbao, San Sebastian, and Vitoria in Basque Country, which are the best in accomplishing OG aspects, and they show in our research a score over the average score. However, all of them show a high standard deviation, highlighting the heterogeneity in the development of OG section in their official WS, making available advanced search tools to citizens, and offering information about OG action plan and news. These low scores are due to the low level of the information disclosed on the OG programs by the municipalities, given that they usually offer a brief and short description of the programs as well as their main objectives. Also, the most of municipalities offer advanced search tools of OG databases and allow the citizenry to search in a whole of WS.

Similarly, there are four communities whose municipalities show a similar behavior (Castile and Leon, Extremadura, Andalusia, and Cantabria) although, in general, the development of the general aspects in OG is very low (the average is below 0.23). Only a few municipalities are taking OG strategies and obtain higher

Table 3 Descriptive Results of General Aspects

Autonomous community	Frequency	Mean value	Median	Standard deviation
Andalusia	29	0.19	0.25	0.19
Aragon	3	0.25	0.00	0.35
Asturias	4	0.34	0.19	0.41
Balearic Islands	1	0.00	0.00	0.00
Canary Islands	8	0.16	0.00	0.21
Cantabria	2	0.19	0.19	0.19
Castile and León	10	0.05	0.00	0.11
Castile La Mancha	6	0.17	0.00	0.25
Catalonia	23	0.47	0.50	0.29
Valencian community	16	0.16	0.00	0.31
Extremadura	3	0.08	0.00	0.12
Galicia	7	0.18	0.00	0.27
Madrid	22	0.19	0.00	0.32
Murcia	4	0.41	0.50	0.24
Navarre	1	0.38	0.38	0.00
Basque country	6	0.38	0.50	0.28
La Rioja	1	0.00	0.00	0.00
Ceuta	1	0.00	0.00	0.00
Melilla	1	0.00	0.00	0.00
<i>Total</i>	<i>148</i>	<i>0.23</i>	<i>0.00</i>	<i>0.29</i>

Source: Own elaboration

scores in our research: Valladolid in Castile and Leon, Caceres in Extremadura, El Puerto de Santa Maria in Andalusia, and Santander in Cantabria.

In the case of channel and tools offered by the municipalities to favor citizenry's participation (see Table 4), we can observe that the results are very similar than the previous item, i.e., there is a heterogeneous behavior because the standard deviation is very low (0.30). There are municipalities of four RGs which achieve the higher score – Navarre, La Rioja, Aragon, and Catalonia – especially Pamplona (Navarre), Logroño (La Rioja), Zaragoza and Huesca (Aragon), and Rubi and Vilanova i La Geltru (Catalonia). These high scores are obtained because sample municipalities are offering channels and media tools that favor citizen participation in public issues.

Also, the results show that there are common strategies and initiatives, which flow from the RGs to the municipalities. This is the case of Catalonia where results show that the standard deviation is low among municipalities located in this RG. This type of strategic formulation is efficient since the RG plays a leader role in the OG development and the financial resources can be managed effectively. On the opposite side, we can find municipalities of Galicia, Cantabria, Ceuta, and Melilla, which show a low average. In these cases, there are similar behaviors and results which seem to indicate that there is no agreed strategy among these municipalities.

Table 4 Descriptive results of e-participation

Autonomous community	Frequency	Mean value	Median	Standard deviation
Andalusia	29	0.37	0.17	0.40
Aragon	3	0.66	0.83	0.24
Asturias	4	0.50	0.50	0.26
Balearic Islands	1	0.33	0.33	0.00
Canary Islands	8	0.44	0.33	0.26
Cantabria	2	0.17	0.17	0.17
Castile and León	10	0.40	0.42	0.25
Castile La Mancha	6	0.42	0.42	0.16
Catalonia	23	0.63	0.50	0.16
Valencian Community	16	0.43	0.42	0.20
Extremadura	3	0.33	0.33	0.00
Galicia	7	0.26	0.33	0.17
Madrid	22	0.44	0.50	0.34
Murcia	4	0.46	0.33	0.22
Navarre	1	0.83	0.83	0.00
Basque Country	6	0.59	0.66	0.16
La rioja	1	0.66	0.66	0.00
Ceuta	1	0.00	0.00	0.00
Melilla	1	0.00	0.00	0.00
<i>Total</i>	<i>148</i>	<i>0.49</i>	<i>0.50</i>	<i>0.30</i>

Source: Own elaboration

Finally, with respect to the information provided and the formats offered (see Table 5), we can affirm that there is a homogeneous behavior and strategy (low standard deviation). This is a consequence of the implementation of *Law 19/2013 of Transparency, Access of the Public Information and Good Government*. In this case, there are municipalities of seven RGs that have a score above of the average (Catalonia, Navarre, Basque Country, Madrid, Murcia, Balearic Islands, and Castile-La Mancha), and they show a homogeneity in the informative transparency strategy. There are municipalities that show higher scores, such as Barcelona and Sabadell (Catalonia), Pamplona (Navarre), Getxo and Bilbao (Basque Country), Rivas-Vaciamadrid and Madrid (Madrid), Molina de Segura (Murcia), Palma de Mallorca (Balearic Islands), and Cuenca and Albacete (Castile-La Mancha).

In this case, there are municipalities of two RGs that show lower score in transparency – Cantabria and Castile and Leon – although there are municipalities in these regions which are making efforts and offering information in transferable format, such as Santander (Cantabria), Valladolid, and Ponferrada (Castile and Leon). These differences in the scores are usually due to the fact that some municipalities only offer the minimum information of those established by the transparency law, whereas others disclose higher volume of information in transferable format. Nonetheless, all of them are far from offering tools and formats that favor citizens to prepare their own reports, disclosing information from different departments,

Table 5 Descriptive results of transparency

Autonomous community	Frequency	Mean value	Median	Standard deviation
Andalusia	29	0.48	0.47	0.07
Aragon	3	0.51	0.49	0.02
Asturias	4	0.51	0.48	0.06
Balearic Islands	1	0.47	0.47	0.00
Canary Islands	8	0.56	0.54	0.07
Cantabria	2	0.40	0.40	0.18
Castile and León	10	0.46	0.46	0.03
Castile La Mancha	6	0.55	0.55	0.06
Catalonia	23	0.60	0.58	0.09
Valencian Community	16	0.53	0.52	0.06
Extremadura	3	0.50	0.47	0.08
Galicia	7	0.52	0.49	0.05
Madrid	22	0.57	0.55	0.04
Murcia	4	0.57	0.56	0.03
Navarre	1	0.60	0.60	0.00
Basque Country	6	0.58	0.58	0.05
La rioja	1	0.52	0.52	0.00
Ceuta	1	0.49	0.49	0.00
Melilla	1	0.49	0.49	0.00
<i>Total</i>	<i>148</i>	<i>0.53</i>	<i>0.54</i>	<i>0.08</i>

Source: Own elaboration

which can be manipulated to make their own graphics and, by this way, to have a clear idea of the resource allocation of public funding, to know the real cost of delivered public services and the execution of public policies of municipalities, and so on.

In short, municipalities of Catalonia, Navarre, Murcia, and Basque Country are the most innovative public entities related to OG initiatives, because they achieved the higher scores in the three aspects. But except Pamplona (Navarre), the rest of municipalities show differences, and there is none that offer the higher score in all aspects (general, participation, and transparency).

5 Conclusions and Discussions

This paper makes an overview of the OG development in greater Spanish municipalities with the aim at getting an overview of how these initiatives have been put into practice to increase the level of openness in these governments. In this regard, this paper examines their official websites to analyze whether they have an OG section and the OG projects that they are running for improving information transparency and citizen participation (see Table 2).

Findings indicate that there is a great heterogeneity among Spanish RGs and Spanish municipalities regarding the OG development. To begin with, OG development seems to be higher in the RGs located in the north of Spain (except for Murcia) than in the RGs located in the center-south of Spain. This situation can be clearly shown in the Autonomous Cities of Melilla and Ceuta, where local governments only offer some information transparency but no participation tools are offered for citizen participation. In addition, this is true not only for the general aspects of OG initiatives including the identification of the OG sections into WS or information about OG plans and news but also for the promotion of citizen involvement in public decisions through rooms for citizen participation in plenary sessions, discussions, or consultations. In this regard, public policies should be taken to promote a more homogeneous development of OG initiatives in all Spanish municipalities in order to offer the same opportunities for citizen participation. So, future research questions are as follows: (a) are there different levels of OG implementation in Spanish municipalities? If so, what incentives and risk factors could explain this different level of OG implementation?

On the other hand, findings indicate that municipalities located in RGs in the northeast of Spain usually obtain higher scores in participation items than in information transparency (see Navarre, Catalonia, La Rioja, and Aragon in Tables 4 and 5). Does it mean that these RGs are more prone to citizen participation? Has it effect on citizen participation in these Spanish municipalities? As their information transparency is not high (the highest are sample municipalities in Navarre and Catalonia; see Tables 4 and 5), what information are they disclosing as more relevant for citizen participation? Are they only fostering citizen participation in some

aspects of the city life? Which one? These research questions could be relevant to be answered by future research.

In any case, findings of this paper denote that sample Spanish municipalities are implementing bureaucratic and/or collaborative models of governance using OG initiatives embedded only in traditional or historical models of taking decisions in local governments. Sample local governments are taking the role of lead organizations for taking decisions about city affairs and, only in very few cases, they promote the involvement of the stakeholders in this task through the use of e-participation tools (consultations, petitions, and discussions). Therefore, instead of taking advantage of new technologies for more democratic institutions, sample Spanish municipalities are using OG initiatives for supporting and enabling bureaucratic practices. Nonetheless, the introduction of new technologies into the public sector environment opens new ways of governance and interactions with stakeholders that should be implemented into municipalities for more democratic societies and for improving the citizen-centric services, which could help to achieving better outcomes (Rodríguez Bolívar 2017b) and improving the quality of life (Rodríguez Bolívar 2018).

This way, public policies should be undertaken to advance in Spanish municipalities to a more collaborative and participative spaces with citizens. Some questions for future research include the following: Are citizens prepared for their participation in public affairs? Are the technological instruments used by sample municipalities appropriated for citizen participation? Must local governments play the leading role in taking decisions about strategic planning of the city, or should citizens play a more relevant role in this issue?

In conclusion, although central and regional governments in Spain have given steps for more collaborative spaces with citizens through the issuance of legislations and public policies, Spanish municipalities seem to be at the beginning of the process of OG implementation into their management processes. This implementation of OG initiatives is not being homogeneous in all municipalities and differences exist. Therefore, future research could also analyze if different speed in OG implementations is taking place and whether early adopters are more prone to get higher citizen participation rates.

References

- Alcaide Muñoz, L., Rodríguez Bolívar, M. P., & Alcaraz Quilez, F. J. (2016). Policies and strategies for digital inclusion: Regional governments in Spain. In J. Prescott (Ed.), *Handbook of research on race, gender, and the fight for equality* (pp. 1–29). IGI Global.
- Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, 29(2), 123–132.
- Cegarra-Navarro, J. G., Pachón, J. R. C., & Cegarra, J. L. M. (2012). E-government and citizen's engagement with local affairs through e-websites: The case of Spanish municipalities. *International Journal of Information Management*, 32(5), 469–478.

- De la Fuente, A. (2015). ESTUDIOS SOBRE LA ECONOMÍA ESPAÑOLA - 2015/10 Las finanzas autonómicas en 2014 y entre 2003 y 2014. Fundación de Estudios Económicos Aplicados. Instituto de Análisis Económico.
- European Commission. (2010). *A Digital Agenda for Europe*. European Union Commission, Brussels, 2010. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0245R(01)&from=EN)
- Gascó-Hernández, M., Martín, E. G., Reggi, L., Pyo, S., & Luna-Reyes, L. F. (2018). Promoting the use of open government data: Cases of training and engagement. *Government Information Quarterly*, 35, 233–242.
- Girish, J. G., Williams, C. R., & Yates, D. J. (2014). Predictors of on-line services and e-participation: A cross-national comparison. *Government Information Quarterly*, 31(4), 526–533.
- Government of Catalonia. (2015). Plan de Gobierno Abierto 2017–2018. Available at: http://governobert.gencat.cat/web/.content/01_Que_es/06_Pla_de_Govern_Obert/Plan-de-Gobierno-Abierto_es.pdf
- Government of Murcia. (2017). *Plan de Gobierno Abierto de la Comunidad Autónoma de la Región de Murcia*. Available at: https://transparencia.carm.es/documents/184026/7322308/PlanGobiernoAbierto_def.
- Government of Spain. (2013). *Plan Avanza 2*. Available at: <http://www.agendadigital.gob.es/agenda-digital/planes-antiores/DescargasPlan%20Avanza2Estrategia/Detalle%20del%20Plan%20Avanza%202%20Estrategia%202011-2015/Estrategia-2011-2015-PA2.pdf>
- Government of Spain. (2017a). *Plan Nacional de Territorios Inteligentes*. Available at: <http://www.agendadigital.gob.es/agenda-digital/noticias/Documents/PNTI/plan-nacional-territorios-inteligentes.pdf>
- Government of Spain. (2017b). *III Plan de Acción de España 2017–2019 de la alianza para el Gobierno Abierto*. Available at: http://transparencia.gob.es/transparencia/dam/jcr:74d66aee-760c-4962-983e-0b250fb583b8/2017_Junio_Spain_III_Plan_GA_OGP_vf.pdf
- Grant, C. (2016). Supporting a passion for new ideas through open APIs. *Information Services & Use*, 36(1/2), 65–72.
- Harrison, T. M., & Sayogo, D. S. (2014). Transparency, participation and accountability practices in open government: A comparative study. *Government Information Quarterly*, 31(4), 513–525.
- Holgerson, J., & Karlsson, F. (2014). Public e-service development: Understanding citizens' conditions for participation. *Government Information Quarterly*, 31(3), 396–410.
- Kim, S., & Lee, J. (2012). E-Participation, transparency, and trust in local government. *Public Administration Review*, 72(6), 819–828.
- Leen, G., & Kwak, Y. H. (2012). An Open Government maturity model for social media-based public engagement. *Government Information Quarterly*, 29(4), 492–503.
- Lindgren, I., & Jansson, G. (2013). Electronic services in the public sector: A conceptual framework. *Government Information Quarterly*, 30(2), 163–172.
- Nam, T. (2012). Suggesting frameworks of citizen-sourcing via Government 2.0. *Government Information Quarterly*, 29, 12.
- National Institute of Statistics (2017). Available at: <https://www.ine.es/>
- Open Government Partnership (OGP). (2017). Manual para puntos de contacto de Gobierno, Disponible en: https://www.opengovpartnership.org/sites/default/files/OGP_POC-Manual_2017_ES.pdf
- Rodríguez Bolívar, M. P. (2017a). Governance model for the delivery of public services through the Web 2.0 Technologies: A political view in large Spanish Municipalities. *Social Science Computer Review*, 35(2), 203–225.
- Rodríguez Bolívar, M. P. (2017b). Governance models and outcomes to foster public value creation in smart cities. In *Proceedings of the 18th Annual International Conference on Digital Government Research* (pp. 521–530). ACM.
- Rodríguez Bolívar, M. P. (2018). Governance models and outcomes to foster public value creation in smart cities. In *Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age* (pp. 24–37). ACM.

- Ruijter, E., Grimmelikhuijsen, S., & Meijer, A. (2017). Open data for democracy: Developing a theoretical framework for open data use. *Government Information Quarterly*, 34(1), 45–52.
- Sandoval-Almaza, R., & Gil-García, J. R. (2012). Are government internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-Government among municipalities. *Government Information Quarterly*, 29(1), S72–S81.
- Smith, D. A., & Fridkin, D. (2008). Delegating direct democracy: Interparty legislative competition and the adoption of the initiative in the American States. *American Political Science Review*, 102(3), 333–350.
- Torres, L., Pina, V., & Acerete, B. (2005). Gauging e-government evolution in EU municipalities. *Journal of Systemics, Cybernetics and Informatics*, 3(6), 43–54.
- United Nations. (2013). *Guideline on Open Government Data for Citizen Engagement*. Department of Economic and Social Affairs. División for Public Administration and Development Management. New York. Available at: <http://workspace.unpan.org/sites/Internet/Documents/Guidelines%20on%20OGDCE%20May17%202013.pdf>
- Veljkovic, N., Bogdanovic-Dinic, S., & Stoimenov, L. (2014). Benchmarking open government: An open data perspective. *Government Information Quarterly*, 31(2), 278–290.

Empowering Communities and Improving Public Services Through Open Data: South African Local Government Perspective



Stella Bvuma and Bwalya Kelvin Joseph

Abstract The concept of open data has rapidly permeated the design and implementation of local government systems. Coupled with appropriate requisite and appropriate Information and Communication Technologies (ICTs), public services are delivered on open platforms and domains further opening up transparency and accountability. Embedded on Open Government Data and e-government, South Africa is pushing to mitigate corruption and inefficiency in its public delivery platforms, especially at the local government levels. Using extensive literature review exploring both scholarly sources, policy and strategy documents from both the public and private sector, this chapter aims to provide a deeper understanding of the role of open data by local municipalities in South Africa. It will briefly discuss the importance of open data to local government in order to benefit its community especially in the realm of contemporary public governance models, discuss ways of promoting citizen participation, and, most importantly, offer necessary aspects for municipal officials to consider before formalising transparency policies. It is intended to help local government officials take first steps in creating municipal transparency and openness policies.

1 Introduction

Open government refers to the opening up of government processes, proceedings, documents, and data for public scrutiny and involvement; it is now considered as a fundamental element of a progressive democratic society. Transparency and public participation may lead to better policies and services and promote public sector integrity, which is essential to regain the trust of citizens in the neutrality and

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reliability of local government officials. The concept of Open Government Data is hinged on creating data and information systems hinged on open platforms where public business processes are executed on open domains.

Open data enables citizens to be more involved with different governmental decisions and initiative programmes aimed at society, at the same time increasing accountability and transparency (Bertot et al. 2014). It is the transforming agent of change, creating a whole new approach on the ways of communication between the citizens and their governments.

Making information accessible to the public can improve public good governance. In countries where corruption is pervasive, services intended for citizens often do not reach them or they do not effectively comply with legislation. Open data will play a significant role in municipalities by speeding access to data and identifying information that require speedy responses, thus assisting in managing poor service delivery.

In this chapter, transparency, participation, and accountability are linked together in order to create successful openness. The author's views are geared towards factors that promote citizen participation and create transparency in local government. The factors that influence the demands of open data can be achieved when local government applies the principles of good governance including the level in which citizens have access to information.

This chapter aims to provide an overview of the role of local government in South Africa (SA) and the challenges they face; the chapter will further explore the benefits and the role of Information and Communication Technologies (ICTs) that can facilitate open data initiatives and allow transparency, accountability, and access to information which in turn may result in competent service delivery to communities and address socio-economic challenges that SA currently is faced with. SA local government needs to take into consideration the ICT infrastructure and issues such as skills and perceptions towards ICT when formulating policies on open data. Since 1994 when SA became a democratic country, the policies of the ruling government have perpetuated the importance of an inclusive country of all citizens in order to improve people's lives by promoting openness; however, SA seems to be experiencing challenges of corruption, poor service delivery, and multiple citizen strikes. Netswera and Kgalane (2014) agree that South Africa faces challenges when it comes to the interaction between citizens and government with regard to openness and service delivery. The ongoing service delivery protest in SA attests to these challenges, and it is currently making its rounds on media platforms in SA.

This chapter is conceptualised upon an extensive literature search targeting both scholarly and non-scholarly sources to understand how openness is being encouraged in the South African policy from both a policy and operational perspective. Principally, the following databases were used: Emerald, Elsevier, and other Scopus database and government publications found on www.data.gov.za. Both quantitative and qualitative data informed the positions presented in this chapter. The results of the study were in line with the expectations of the study as informed by the experience of the authors of this chapter and the anecdotal evidence obtained with regard to open data in the South African public service.

This chapter is arranged as follows: The first section will present definitions and aspects of open government and open data and how they relate. Next, the chapter will provide a brief historical background of local government/municipalities in SA and how they are categorised followed by role and challenges they are facing.

The second section explores the importance of ICT and how ICTs such as e-government can harness the possibilities of openness in local government; this section will further explore the factors to consider when formulating ICT infrastructure for local government with the intention to create openness. Lastly, the chapter will discuss the factors that influence the demands for local government to open their data through transparency, accountability, participation, technology, and innovation. Finally, concluding statements are presented.

2 Open Government and Open Data

According to Clarke and Francoli (2014), open government has now shifted from just been seen as access to information laws and accountability measures to many functionalities such as inclusiveness of the public participation, open data, and better improved governance. The study by Dawes et al. (2016) clarifies the definition of open government formulated from the policy implementation perspective and policy content perspective, which are in relation to transparency, participation, collaboration, and technologies.

Open Government Data is generally defined as government-owned data “that is freely available, easily discoverable, and accessible and published in ways and under licences that allow reuse”.

The Open Government Partnership (OGP) was founded in 2011 by eight countries (the United States, Brazil, Indonesia, Mexico, Norway, the Philippines, the United Kingdom, and South Africa). The OGP aims to promote open government, empower citizens, fight corruption, and harness new technologies to strengthen governance (Open Government Partnership 2018).

SA government has undertaken the initiative and commitment with the Open Government Partnership (OGP) since 2011 to create open data and make data easily accessible to its citizens; however, the government seems to be lacking behind on its commitment to openness. Local municipalities in SA continually face protest by citizens with regard to poor service delivery and lack of accountability and participation.

South Africa believes that by opening their data and becoming transparent, local government will benefit towards good governance principle and ensure that communities are knowledgeable about the services intended for their benefit as supported by the inclusion of “Access to Information (ATI) in the Constitution of the Republic of South Africa (Act No. 108 of 1996)” (Republic of South Africa 2000). This will encourage citizens to understand what local government’s role is and the better engagement and collaboration (Ubaldi 2013). The act promotes transparency with the influence of strengthening collaboration and openness of information

amongst all relevant stakeholders; however, what South Africa is lacking in their policy formulation is how they address the issues of corruption through accountability and implement strategies that are seen to be transparent. Thus, the promises tabulated by the South African government policy contradict the clarification of the definition of open government which is set out to provide information that can be accessible, data that are transparent, and citizens who are knowledgeable about service delivery. Whilst different authors may view the concept of open government from a digital technology perspective, not all local municipalities in SA are ready for the digital technology due to challenges such as poor ICT infrastructure, cost to access the Internet, and poor basic needs such as water and electricity. Many of these municipalities are still relying on the traditional caucus or conversations normally in the form of feedback by officials appointed as councils, who in turn do not seem to be accountable and are labelled corrupt. However, there seem to be no policies or guidelines for public officials organising these caucus processes regarding how the feedback or discussions should be managed, what form these records need to take, and how they should be stored and accessed.

Another contradiction in SA is the fact that the Department of Provincial and Local Government 2007 outlined the national policy framework for public participation which also details the guidelines for local government/municipalities to promote a culture of inclusiveness by all members of communities. “The Promotion of Access to Information Act (PAIA)” No 2 of 2000 of SA grounds for refusing requests to access information about public consultation seems to contradict the values of citizen participation supported in the constitution and legislation. Perhaps, this is because the citizens are not clearly defined when articulating public participation (Florin and Dixon 2004), or perhaps it is because the definitions of and rationale behind citizen participation are not clearly articulated (Conklin et al. 2012).

3 The Role of Local Government/Municipalities in South Africa

3.1 Definition of Local Government/Municipalities in SA

The democratisation of South Africa (SA) in 1994 has seen many amendments into the constitution and structures of the country’s governance (Madumo 2012). Since 1994 when SA became a democratic country, municipalities are structured to address the needs and improve the lives of the communities. Municipalities in SA (also called local government) are made up of elected councillors, the council administration, and the people who live in the municipality. Before 1994, South Africa had over 2000 municipalities, but today, with a population of approximately 52 million people, South Africa has 283 municipalities with an average of 172,000 people per municipality. South African municipalities are mandated to create an environment that is efficient and effective in delivery of services to communities

within a specific jurisdiction. In South Africa, municipalities play an important role in delivering basic services including (amongst others) water, sanitation, sustainable electricity provision, and waste removal as supported by Section 152(1) of the Constitution of 1996 (Republic of South Africa 1996). Local government has the powers to make and enforce its own laws; however, local government is still supervised by national and provincial governments. Local government plays a critical role to facilitate and engage communities of their role. The national government seems to have lost control of the many local governments, and this is clearly seen by the level of corruption and poor service delivery by many SA local municipalities.

3.2 *Categories of Municipalities*

The following categories in Table 1 are municipalities based on the categorisation undertaken by the National Treasury and used by the Municipal Demarcation Board (MDB) and the number of each category as of 2011:

Local municipalities are classified as per Table 1. This classification indicates that they are not operating on the same localities and have different characteristics and needs. There is a need to formulate policies that will significantly differentiate municipalities and also ensure clarity so that services are effectively designed to suit each municipality. Clearly, Table 1 distinguishes municipalities as per categorisation and description. The SA government on the national level needs to engage accurately with municipalities in order to address specific challenges faced by individual municipality.

Van der Waldt (2015) states “On its most fundamental level, the role of local government in society can be categorised as follows”:

- Allocative, e.g. resources, maximise efficiency, service delivery
- Distributive, e.g. equity, social security, services

Table 1 Local municipality’s categories in SA

Category	Description	Number
A	Metropolitan municipalities	6
B1	Local municipalities with secondary cities	21
B2	Local municipalities with large towns and substantial urban populations, although the variation in population size is large	29
B3	Local municipalities with small towns and significant urban population but no urban core; rural areas have commercial farming	111
B4	Local municipalities that are mainly rural, but have villages and communal land tenure and are typically located in former homeland areas	70
C1	District municipalities that are not a water services authority	25
C2	District municipalities that are a water services authority	21

Sources: National Treasury (2011, p. 193); Municipal Demarcation Board (2012, p. iii); South Africa (1998)

- Regulatory, e.g. enforce law, protection, justice
- Stabilisation, e.g. fiscal, monetary, and economic policies to pursue objectives for control of inflation, unemployment (Van der Waldt 2015)

Section 152 of the Constitution of SA (Republic of South Africa 1996) sets out the five basic objectives of municipalities:

- To provide democratic and accountable government for local communities
- To promote social and economic development of their communities
- To promote a healthy and safe environment
- To encourage the involvement of communities and community organisations in the matters of local government by consulting with the community and letting the community participate in the decision-making process
- To provide basic services to communities in a sustainable manner – services such as water and sanitation, electricity, refuse removal, health and fire-fighting services, public transport, and roads and parks

3.3 Challenges Faced by Local Government

Like many other countries, corruption is clearly one of the major societal challenges that governments need to address. Corruption is regarded as the biggest challenge and it serves to lock populations in cycles of misery (Thornhill 1995). Corruption seems to creep into the running of municipalities and in turn threatens the objectives set out by Section 152 of the Constitution of SA. The role that should be played by local government interrupts the delivery of services aimed at communities and thus leading to dissatisfaction and protests. These protests have accumulated a higher cost for local government because they often resulted in destroying or demolishing of building as a result of citizens or community frustrations.

Thornhill (South Africa 2011) states that local government is confronted with the following challenges, amongst others:

- The inability of municipalities to financially sustain themselves
- The lack of capacity to deliver constant and regular services
- The failure of officials to comply with regulations

The issue of governance cannot be ruled out; municipalities are governed by municipal councils, which are made up of councillors elected by members of the community. Councillors make decisions on behalf of the municipality and at times oversee the administration of the municipality. The SA 2030 Agenda for Sustainable Development focuses on global priorities to eradicate extreme poverty and shift all countries towards inclusive, sustainable development. The priorities set out to eradicate poverty are supported by the SA's National Development Plan (NDP) as a vision of SA by 2030 (Yu and Robinson 2012).

However, local governments are faced with challenges of councils who are not effectively consulting and engaging with communities. Various authors (Yu and

Robinson 2012; Veljković et al. 2014; Verhulst and Young 2016) agree that it is therefore necessary for local government to encourage effective openness, and accountability and ensure that communities interact with government officials regarding service delivery in the community.

According to Millar (OECD, ISOC and UNESCO 2013) and OECD (South African), open government can accelerate Gross Domestic Product (GDP) growth and reduce corruption which will also improve and better standards in management of service delivery. These are true because when citizens are informed of services towards them, they will have access to data and also participate in questioning any information at hand.

According to the “Local Government Report (2009)” (Bertot et al. 2012), a total number of 283 municipalities were assessed and coined the various unique challenges that local municipalities encounter within the socio-economic challenges; these challenges are noted as poor leadership and governance, accountability, and poor service delivery to communities. In order to eliminate challenges faced by local municipalities, the government needs to ensure that policies and strategies are set out and implemented effectively. This will result in good governance which entails that there are efficient and accountable systems in place that will promote transparency and ensure that community members receive services required. Good governance must entail that community members are free to participate and their voices are heard, and this is the democracy that SA aims to be. However, in SA, it seems citizens believe they can only be heard through the voice of protest and demolishing of buildings; citizens turn to protest as the only way to hold officials accountable. For democracy to materialise at the municipal level, citizens have to be given some role in all processes that are set out. Thus, promoting accountability and responsiveness will therefore improve the level of democracy.

In summary, the local government must ensure that there is an inclusive participation by its community and openness and transparency are promoted. For local government to live up to its potential, it depends not only on the availability of skilled personnel and financial resources but also on the role played by communities within the structures of local government. Finally, the other challenge faced by local municipalities is the availability and shortage of the required skills. The State of Local Government in South Africa Report 2009 points out that skills deficit within municipalities remains a major challenge. A significant number of municipalities do not have the managerial, administrative, financial, and institutional capacity to meet the rising needs of local people. Without the required skills, the challenges will continue because it will lead to poor service delivery.

4 The Role and Benefit of ICT Towards Open Government

Information and Communication Technology (ICT) plays a major role in all aspects of national life such as in government, in economic life, as well as in social and cultural development. It is rapidly transforming lives, the way we do business,

access information and services, communicate with each other, and share information; the major shift of access to data also raised expectations on how communities interact with local government. ICTs such as social media have made their entrants as tools for enabling government to increase participation and inclusiveness of citizens, thus promoting transparency and accountability (Alexopoulos et al. 2014). Charalampos (Bertot et al. 2010) posited that governments are also seen to acknowledge and have intentions of the possibilities that technologies such as the Web 2.0 can provide such benefits. These technologies can facilitate open data initiatives and allow transparency, accountability, and access to information which in turn may result in competent service delivery to communities and address socio-economic challenges that SA is currently facing.

Some authors (Bélanger and Carter 2012) ascertain that the use of ICT such as e-government can help to achieve the principles of open government. The adoption and utilisation of ICT by local government can enhance access to data and improve service delivery and operations to benefit the communities and all stakeholders; this is also defined as e-government (Dwivedi et al. 2012; Srivastava 2011; Srivastava and Teo 2007; Teo et al. 2009). E-government fosters transparency in executive transactions, thereby mitigating corruption (Andersen 2009; Criado et al. 2013). Davis and Mintz (2009) presented the main capabilities of technologies such as Web 2.0 social media as the key to enable users to collaborate on information at hand in online platform where users can participate in shared content with everyone in connected. Sandoval-Almazan and Gil-Garcia (2016) attest to the power of social media as the enabler for promoting participation amongst citizens and encouraging collective information and also promoting government transparency and accountability.

Recent activities in SA such as the “feel must Fall” protest organised by university students on platforms such as social media (Twitter), which initially started in 2015 in one province and rapidly spread across other universities in other provinces, have provided evidence of the power of utilising social media platform. Bertot et al. (2010) agree that these platforms can provide government opportunities which can increase citizens’ participation and privileges to be heard by those in authority in policy making amongst other benefits.

SA has an ICT skill shortage which translates into a negative impact on service delivery and specifically on government departments, especially when embarking on the adoption of ICT. ICT on its own cannot achieve anything unless it is facilitated by skilled people. It is on this basis that SA government must consider investing in skilled individuals where policies are supported by capable people and all new processes must be tested to ensure that they provide services in which the public can have confidence. However, the recent auditor general report on local municipalities showed that only 33 of the country’s 257 municipalities had received a clean audit in 2016–17, down from 48 in the previous year. Thirty-one per cent of municipalities were found to be dysfunctional. The declines were a result of many factors such as irregularities in financial management, lack of accountability, and poor governance pointing to the appointment of unskilled and inexperienced individuals in critical positions.

5 Factors to Consider When Formulating an ICT Infrastructure for OG:

- Formulating a clear vision and strategy: the vision and strategy must be formulated in such a way that they are clear and attainable. In their strategy, government should encourage ICT access and utilisation of ICT tools within government.
- Open Data Policy: an Open Data Policy needs to be formulated and support the open data principles.
- Government Support: government officials should be “skilled” to participate fully and take on changes that accompany an ICT structure and new roles.
- E-readiness: this is vital and should be analysed and clear on how local municipality is ready to utilise ICT tools, especially because they are evolving timeously. This should include the identification of the right ICT to be adopted.
- ICT Education: when ICT infrastructure is in place, it is important to ensure the skills management of municipal official must be capacitated to take advantage of the ICTs in place. The government needs to ensure that their officials are developed and professionally capacitated to establish adequate support.
- ICT Support: it is important to ensure that the ICT in use is operational and maintained; if there is dis-connectivity, the challenge will lead again to communication breakdown, thus leading to poor service delivery. ICTs can enhance and encourage good service delivery.
- Involve all stakeholders: include all stakeholders at different levels including citizens, especially local government officials directly working with community members. This is specifically important, especially when introducing innovative technologies. The complexity of new technologies can lead to resistance to change, thus affecting day-to-day operations.

In summary, the concept of OG or opening data can benefit community members and the government, thus leading to transparency, accountability, participation, and better technology and innovation. When local government collaborates and allows participation with its community members, they will reap the benefits of good governance. However, the government must ensure that the community members are encouraged to use and benefit from open government. The government has a responsibility to ensure that their officials and all relevant stakeholders are ready to participate and engage fully in the processes of open government. It is important to promote these benefits in a way that can be universally appealing, so that anyone can share ideas, spread information, and participate in a more transparent and collaborative way. Information that is available at hand can eliminate the frustrations that citizens experience.

In SA, it is worth noting that the locations of municipalities are mostly in towns or cities that are far from communities, especially those in rural areas. It is also worth noting that the adoption of ICT may not be a solution to all municipalities to deliver open data; it is not a one-size-fits-all. It is therefore important for the national

government to consider the uniqueness of each municipality and its members. For example, a municipality located in Johannesburg City will have good ICT infrastructure and the level of ICT knowledge may be stronger when compared to a municipality located in the rural of Limpopo such as Mopani municipality. There is a need to address the challenges faced by individual municipalities which must be fully understood and addressed. With the ever-increasing and changing technological innovations, indeed ICT can provide and create new paradigm shift for the future of public delivery service; however, some rural areas are facing challenges such as access to water and electricity and access to the Internet. It is in this context that the national government must set up priorities clearly and formulate collaboration with citizens to pin the solutions required.

Indeed, open access is often viewed as access to the Internet or utilisation of ICT. It is for this reason that careful attention is given to ensure equal access of open data is attainable by all citizens and those who have challenges or limitations to Internet access are also considered and not neglected. Perhaps government must find ways to address the issue of cost in relation to accessing the data. The government portal can be subsidised or given free access to community members. This notion must be challenged at the national level and plans are to be put in place to manage cost. The challenge with access to the Internet is a reality in SA, mainly due to high cost of connectivity and the poor state of ICT infrastructure. Additionally, in SA, you have the interruption of electric power supply or in the case of rural areas where there is no electric supply at all. Taking into account the challenges of access to the Internet or connectivity, it brings to the attention the economic reality of municipalities which makes it even more difficult to adopt ICT or apply innovative technologies.

It can never be denied that the digital divide exists amongst municipalities in SA and has a negative impact on service delivery. Government must consider ways to leverage this when opening access to their data. For the fact that open data is available via the Internet, access may only be limited to other municipalities with ICT infrastructure or access to the Internet issues, amongst others. Therefore, government must ensure that Internet infrastructure is available and accessible in rural localities if the benefits of open access are to be maximised. Furthermore, it is worth noting that the adoption of ICT will not automatically introduce trust amongst government officials and citizens; providing access to the Internet is no means to gain trust; thus, if government is not trustworthy and citizens do not have trust towards their policies and strategies, it is highly likely that they will not gain reasonable level of trust with ICT adoption.

According to Sandoval-Almazan and Gil-Garcia (2016), there are several challenges with regard to initiating open government, which include lack of resources and communication barriers, amongst others. Communication is seen as the important force between citizens and government officials, and if effectively carried out, it can benefit both government and citizens. The driving force for community development and service delivery is communication. Communications can be carried out using any form of ICT and human communication. These forms of communication (ICT enabled or human communication) must be developed and carried out

effectively between citizens and local government officials. Local government can benefit by adopting ICT to deliver services which will in turn minimise the paper work or manual filling system such as managing the land and ownership in rural areas. Good planning and good policy structures of ICT can benefit stakeholders such as farmers to access data whenever they need, thus eliminating the frustration of poor communication. Therefore, the SA government should consider more efforts to address the issues related to ICT infrastructure especially in rural settings in order to bridge the digital divide.

Communities are thirsting for transparency, accountability, access to information, and competent service delivery from their government. They also expect policies and services to be tailored to their needs and address their concerns. In this case, the adopted definition of open government will be one that aims to facilitate the possibility of documents and data available to the society and also allows the society to be involved and empowers the democratic society that SA is. In turn, the government may reap the benefits of trust and integrity from the community. Openness should be emphasised in the management of local government. Municipalities are set to benefit from the principles of accountability and transparency and have an inclusive culture with all community members.

Various authors have posited that the factors influencing the demands for government to open up their data are transparency and accountability, participatory governance, innovation, economic growth, and internal value for the public sector. Several authors (Veljković et al. 2014; Zuiderwijk and Janssen 2014; Davies 2010) also point out that these factors are the main drivers of open government and are explained below:

- **Transparency:** This includes publication of all government-held information (as opposed to only information on government activities); proactive or reactive releases of information; mechanisms to strengthen the right to information; and open access to government information.
- **Accountability:** There are rules, regulations, and mechanisms in place that call upon government officials to justify their actions, act upon criticisms or requirements made of them, and accept responsibility for failure to perform with respect to laws or commitments. Commitments on accountability should typically include an answerability element, i.e., that they are not purely internal systems of accountability but involve the public.
- **Participation:** Governments seek to mobilise citizens to engage in dialogue on government policies or programs, provide input or feedback, and make contributions that lead to more responsive, innovative, and effective governance.
- **Technology and Innovation:** Governments embrace the importance of providing citizens with open access to technology, the role of new technologies in driving innovation, and the importance of increasing the capacity of citizens to use technology. E-government initiatives are welcome, but in order to be relevant to OGP, action plans should explain how these initiatives advance government transparency, accountability, and/or public participation.

According to Davies (Braunschwei et al. 2012), open government can facilitate effective economic opportunities and promote transparency and accountability. For local municipalities to benefit from transparency, accountability, participation, and technology innovation, they may reap benefits from ICT tools such as open data portals (OPD). In order to become more transparent and to work closer with communities, local governments must create effective open data portals (ODP), which are repositories providing structured access to the opened-up data.

The South African government has initiated a data portal team. This data team was established to develop the OGP Portal that serves as an extension for increased participation from civil society and citizens. The aim of the OGP Portal is to encourage access to government data and pioneer principles of OGP and improve transparency, accountability, and participation. Furthermore, the SA Treasury initiated its first portal named “Municipal Money Portal” with an attempt to provide access to data such as the accurate financial performance of local municipalities. The “Municipal Money Portal” aims to promote transparency and citizen participation through the visualisation and “demystification” of information about financial spending of municipalities. The challenge with the initiated government data portal is that data published from the portal seem to be not satisfactory and have been alluded as a data dump. Braunschweig (Bradshaw 2014) posits that “The way people access and use Open Data is greatly influenced by the way the data is published”. The local government in SA must acknowledge and take into account the challenge that not all citizens in municipalities have the skill to understand the data published and moreover have access to the data portal they created. Braunschweig (Bradshaw 2014) agrees that indeed the data processing tools are not available to all users because of the expertise required to utilise them.

Jansen (Davies 2010) mentions that true transparency is not only about the availability of data but to be in a position to use, combine, and disseminate the data without any restriction. Bradshaw (Shkabatur 2013) concurs that “It is thus assumed that open data is typically, readable by computers (such as mobile devices) makes it easy for people to combine and interrogate information in the public interest”. Such openness will enhance accountability and, therefore, trust in local government. In summary, the various initiatives towards transparency through open data will strengthen the accountability of government officials and ensure “that persons with public responsibilities [are] answerable to ‘the people’ for the performance of their duties” (Thurston 2013). This is supported by evidence in developing countries, where there is poor transparency and accountability (Bonsón et al. 2012). However, it is worth noting that the current status quo in SA local municipalities with regard to openness does not stimulate the citizens and adds no value to them. Various authors agree (Chun and Luna Reyes 2012; Margo 2012) that taking initiative to drive the opening of government data does not conclude that the citizens will automatically benefit from social and economic value, but there must be measures taken into account.

The SA’s Department of Public Service and Administration (DPSA), in collaboration with a corporate business partner, formed a partnership which encouraged participants to develop ICT solutions using already available government data in an

effort to address service delivery challenges and improve service delivery to the communities. Collaboration between the OGP, DPSA, and Business and Civil Society resulted in the development of the web address (www.data.gov.za), which is currently being piloted. The aim of the website (www.data.gov.za) (www.gov.za) is to provide central access point for public government data and to promote applications and events related to open data in South Africa. With all the efforts made from the SA government, the initiative to drive open government which in turn will foster transparency in local government seems to be suggesting access to data without accountability, and by publishing data on the portal, SA government still needs to account to many burning issues that the country still faces such as the “state capture” whereby government is accused of being influenced by private individuals and organisations in Africa, with President Jacob Zuma and the Gupta family stirring up great concern in this regard. Jonas (Birkinshaw 2006) alluded to the fact that the government has the responsibility of owning the administration control and consistently providing citizens with public service. The ongoing initiatives to investigate the state capture in SA are supported by the fact that there are challenging issues of corruption that need to be transparent enough to improve accountability. Zuiderwijk (Meijer et al. 2012) ascertains that published data is a powerful tool against corruption and can encourage and improve transparency and openness.

5.1 Promoting Transparency

Local government must welcome and encourage transparency from members of the community and all stakeholders involved. It is indeed true that opening data or becoming a transparent government may open a door of criticism towards local government officials. This must not be a hindrance to opening data but an opportunity to empower communities and to hold government accountable. Informed communities are better able to contribute to democratic processes, better able to understand and accept the basis of decisions affecting them, and better able to shape the situations in which they live (Harrison and Sayogo 2014; Verhulst and Young 2016), and thus, informed communities can spur greater community engagement as a result of transparent government.

5.2 Promoting Accountability

It is indeed necessary for local governments to open their data to communities and not be afraid to be held accountable if and when goals are not met. Rules and regulations set out by the national government towards local government point out the importance of engagement with the community so that there can be a principle of accountability. The community has a mandate to hold local government officials accountable if they do not provide effective service delivery.

Local government designed to benefit from openness and concerns raised by communities is an example of good governance. SA being a democratic country should reap the benefits of good governance through effective strategies of holding officials accountable; it can never be acceptable that communities are not receiving sufficient services and no one is held accountable. Issues related to corruption must be dealt at all levels and not only internally but also outside the offices of government, and those found guilty of offense must be held accountable.

Historically, accountability has been categorised in the area of accounting in the financial sense; this has however shifted, and accountability is now viewed as an indication of good governance and an indication of how government promotes effective service delivery. Accountability goes hand in hand with democratic governance because democracy remains hinged to those in power and responsible to deliver public service and to hold accountable all stakeholders that are assigned with responsibilities.

When members of the community have a better understanding of the role that local government plays and the services to be delivered to communities, not only will this lead to transparency but also gain trust and accountability within local government officials. The community should therefore feel free to hold their government officials accountable for not effectively playing their role as set by the constituency. In turn, government officials must account if there is any maladministration within their various departments that affect communities negatively.

5.3 Promoting Participation

The most key factor for promoting community participation is to allow access to accurate information and openness (Janssen et al. 2012). Members of the communities can only form part of the local municipalities if they are informed and have access to information. These initiatives will better position community members to participate because they hold information and understand the policies affecting them (Harrison and Sayogo 2014; Verhulst and Young 2016). Like any other country, municipalities in SA have a mandate of delivering better services and improving lives of communities by stimulating economic growth delivery (Huijboom and Van den Broek 2011; Meijer 2012; Noveck 2009).

The SA local government needs to focus on opinion formation which in turn can be seen as the central mechanism for political decision-making (Habermas 1989); this process is referred to as deliberation. According to Habermas (1989), when communities are in a deliberative democracy, they benefit from open debates that allow collective solutions to public challenges. It is therefore necessary to ensure that deliberations are not only held internally or in “closed doors”, communities should be given the opportunity to deliberate on matters affecting them. Deliberation, therefore, is not informing and then you leave communities behind with question marks; it must be an inclusive process no matter how excellent and painful it is. Deliberation amongst communities and government officials can bring liberation on matters of concern.

Local government needs to have a strategy of getting communities involved and interested in being part of the solutions. Solutions must not be as a result of protest due to poor service delivery or as a result of poor communication by government officials, as this may harbour the trust by communities. Participation has shifted from focusing on “participation in projects and programmes” but rather on policy processes (Fung et al. 2007; Wijnhoven et al. 2015). Municipalities must foster ways to move away from “hearing by protest”; they need to be proactive and listen to the concerns ahead. If these are applied, it may reduce the number of protest that SA has experienced in the past.

To increase participation with members of the community, local government must have strategies to engage and have an inclusive strategy that will encourage members of the community to present and implement their ideas with care and caution (Strömbäck 2005). Furthermore, communities need to be interested and engaged from the viewpoint of the processes (Van den Hoven 2005). If members of the community have poor interest or shows poor engagement, it is necessary to find ways to motivate because there are different motivational factors for members to participate (Schuler and Namioka 1993). Van den Hoven (Emery 1993) pointed out that this process requires commitment and can be time consuming because the average citizen might not always be willing to participate. Communities have lost trust of the government, and thus it needs patience and strategies that will bring the momentum of trust back into the communities.

As alluded that municipalities in SA are governed by municipal councillors who are responsible to make decisions and oversee administration of the municipality, it is vital to note that participation must be democratic and thus not limit members of the community to deliberate on matters affecting them. This principle is argued by Schuler and Namioka (Bagui et al. 2011) where they indicate that the key element of participation is democracy or the key element of democracy is participation. Emery (Chigona et al. 2009) agrees that individual participation or representative to participation democracy must shift to accommodate all. The issues of protest in SA are mainly due to poor service delivery; the service delivery protests have damaged the relationship not only with local officials but also with national government. The national government thus has a mandate to fully understand the main causes of these persistent protests and then find ways to provide solutions. Participation is crucial from all stakeholders involved, and it can be achieved through effective communication and making data accessible or open. When local government fails to communicate effectively the good and the bad with regard to service delivery, it then leads to chaos and collapses the trust between community members and their government. Councillors responsible to ensure effective communication is implemented thoroughly must be trained on how to deliver effective communication to the community. They need to note that communication is not only informing but a two-way process that involves full participation of community members. It must never be about the number of meetings held, but it must be active participation. It should be coupled with effective monitoring and evaluation that will be able to come up with solutions.

5.4 *Promoting Technology and Innovation*

The adoption of ICTs such as e-government can benefit local government and its communities. E-government refers to the use by government agencies of information technologies (such as wide area networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies could serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The adoption of ICTs contributes positively towards levels of corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions.

Promoting technology and innovation at local government is not strange in SA; stakeholders and community members know the experience of having to move from pillar to post with multiple government entities for everyday services, for example, service payments that can only be processed when an applicant is physically in the offices of the municipality. Noting that SA has infrastructure challenges, this can be costly and time-consuming.

A technology platform named “Pocket Maspala” was developed by Mxolisi Kwambakobi which allows communities to connect with their local municipality. Pocket Maspala creates a platform for community members to access their municipalities whilst offering value-added benefits such as monitoring of solutions, response time to resolution of problems, satisfaction surveys, and strategic data for rollout programmes. However, this technology application has received attention and interest from only the City of Johannesburg local government. Various studies have alluded to the fact that technology applications such as mobile apps are not widely utilised; however, they have a potential to facilitate the interaction between government and communities (Benyon 2018; Sandoval-Almazan and Ramon Gil-Garcia 2016).

It is necessary for SA’s local government to consider that each municipality is different when formulating strategies and adoption of ICT tools. There is no one model for e-government and no universal standard for e-government readiness. Each community and its local government’s readiness for e-government would depend upon which objectives and needs are to be priorities, as well as the resources available at a given point in time.

Local government should consider and note that there are challenges with regard to ICT adoption, such as ICT infrastructure and lack of ICT policies and skills, amongst others, which may be hindrances for local government to submit to open data. Many local municipalities are still relying on poor or weak systems. Many municipalities have poor capacity of ICT development. They do not have the capacity to design and manage the ICT technologies that are evolving rapidly.

6 Conclusions

Opening up government data is perceived as a critical step towards providing responsive, accountable, and transparent government. Opening up government data entails that any government data and information is opened up to the public, so every citizen is in cahoots with how government decisions are made. With aggressive ongoing decentralisation agendas in the African government systems, it is important that the concept of Open Government data is replicated even at the local level. This chapter has discussed the role that open data can play in local government. Firstly, the chapter discussed the background of municipalities in SA and illustrated the different localities and characteristics of these municipalities. Open data plays an important role in local government and benefits communities and has potential to increase the key principles of transparency, participation, accountability, and the adoption of technology and innovation, thus promoting good governance. In order to promote participation of citizens in the decision-making processes, local government has an obligation to promote effective communication between local government department units and the citizens. Furthermore, local government departments are mandated to promote increased participation of citizens in the decision-making processes.

In the realisation of Open Government Data, it has been posited that ICTs play a critical role as technology provides one of the key platforms for opening up government data. Furthermore, technology opens up a channel for citizens' participation in the governance value chains, thereby increasing e-participation. The adoption of ICTs in the governance business processes is important in enhancing the way services are delivered to communities, thereby facilitating improved, efficient, and effective public service delivery within municipalities. However, ICT adoption must not be seen as a one-size-fits-all; National government needs to provide strategies and policies that address individual municipalities and attend to their individual specific needs. This chapter has highlighted the importance of open data and its benefits including the factors that should be considered when formulating open data initiatives such as ICT infrastructure, skills, policies, and strategies, amongst others. In summary, local government should ensure that the key principles of open data such as transparency, accountability, transparency, and technology and innovation are adhered to.

References

- Alexopoulos, C., Zuiderwijk, A., Charapabidis, Y., Loukis, E., & Janssen, M. (2014). Designing a second generation of open data platforms: Integrating open data and social media. In M. Janssen, H. J. Scholl, M. A. Wimmer, & F. Bannister (Eds.), *13th international conference on electronic government (EGOV), Sep 2014, Dublin, Ireland* (Lecture Notes in Computer Science, LNCS-8653) (pp. 230–241). Berlin Heidelberg: Springer. Electronic Government. https://doi.org/10.1007/978-3-662-44426-9_19. hal-01401747.

- Andersen, T. B. (2009). E-government as an anti-corruption strategy. *Information Economics and Policy*, 21(3), 201–210.
- Bagui, L., Sigwejo, A., & Bytheway, A. (2011). Public participation in government: Assessing m-participation in South Africa and Tanzania. In A. Koch & P. A. van Brakel (Eds.), *Proceedings of the 13th annual conference on world wide web applications* (pp. 5–26). Johannesburg: Cape Peninsula University of Technology.
- Bélanger, F., & Carter, L. (2012). Digitizing government interactions with constituents: An historical review of E-government research in information systems. *Journal of the Association for Information Systems*, 13(5), 363–394.
- Benyon, S. Sam Qaqamba Beynon on Twitter. *Twitter*. Accessed 30 June 2018.
- Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27, 264–271.
- Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2012). Promoting transparency and accountability through ICTs, social media, and collaborative e-government. *Transforming Government: People, Process and Policy*, 6(1), 78–91.
- Bertot, J. C., Gorham, U., Jaeger, P., Sarin, L., & Choi, H. (2014). Big data, open government and e-government: Issues, policies and recommendations. *Information Polity*, 19(1/2), 5–16.
- Birkinshaw, P. (2006). Transparency as a human right. In C. Hood & D. Heald (Eds.), *Transparency: The key to better governance*. Oxford: Oxford University Press.
- Bonsón, E., Torres, L., Royo, S., & Flores, F. (2012). Local e-government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly*, 29, 123–132.
- Bradshaw, P. (2014). Transparency opportunity: Holding power to account – or making power accountable? In N. Bowles, J. T. Hamilton, & D. Levy (Eds.), *Transparency in politics and the media: Accountability and open government*. London: I.B. Tauris.
- Braunschwei, K., Eberius, J., Thiele, M., & Lehner, W. (2012). *The state of open data: Limits of current open data platforms*. <https://pdfs.semanticscholar.org/f567/00355734c88ecb04005b84eb80362e35803f.pdf> (Accessed 18 March 2019).
- Chigona, W., Beukes, D., Vally, J., & Tanner, M. (2009). Can mobile internet help prevent social exclusion in developing countries? *The Electronic Journal on Information Systems in Developing Countries*, 36(7), 1–16.
- Chun, S. A., & Luna Reyes, L. F. (2012). Editorial – social media in government. *Government Information Quarterly*, 29, 441–445.
- Clarke, A., & Francoli, M. (2014). What's in a name? A comparison of “open government” definitions across Seven Open Government Partnership members. *eJournal of eDemocracy and Open Government*, 6(1), 248–266.
- Conklin, A., Morris, Z., & Nolte, E. (2012). What is the evidence base for public involvement in health-care policy?: Results of a systematic scoping review. *Health Expectations*, 18, 153–165.
- Criado, J. I., Sandoval-Almazan, R., & Gil-Garcia, J. R. (2013). Government innovation through social media. *Government Information Quarterly*, 30, 319–326.
- Davies, T. (2010). *Open data, democracy and public sector reform*. A look at open government data use from data.gov.uk, from <http://www.opendataimpacts.net/report/>. Accessed 30 June 2018.
- Davis, T., & Mintz, M. (2009). Design features for the social web: The architecture of Deme. In *Proceedings of 8th international workshop on web-oriented software technologies-IWWOST*.
- Dawes, S., Vidasova, L., & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, 33(1), 15–27.
- Dwivedi, Y. K., Weerakkody, V., & Janssen, M. (2012). Moving towards maturity: Challenges to successful e-government implementation and diffusion. *ACM SIGMIS Database*, 42(4), 11–22.
- Emery, F. (1993). The agenda for the next wave. In M. Emery (Ed.), *Participative design for participative democracy* (pp. 30–39). Canberra: Centre for Continuing Education, The Australian National University.
- Florin, D., & Dixon, J. (2004). Public involvement in health care. *British Medical Journal*, 328, 159–161.

- Fung, A., Graham, M., & Weil, D. (2007). *Full disclosure: The perils and promise of transparency*. Cambridge: Cambridge University Press.
- Habermas, J. (1989). *The structural transformation of the public sphere*. Cambridge: Polity Press.
- Harrison, T., & Sayogo, D. (2014). Transparency, participation and accountability practices in open government: A comparative study. *Government Information Quarterly*, 31, 513–525.
- Huijboom, N., & Van den Broek, T. (2011). Open data: An international comparison of strategies. *European Journal of ePractice*, 12(1), 1–13.
- 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.
- Madumo, O. S. (2012). The promotion of developmental local government to facilitate a developmental state. *Administratio Publica*, 20(3), 40–54.
- Margo, M. J. (2012). A review of social media use in E-government. *Administrative Sciences*, 2(2), 148–161.
- Meijer, A. J. (2012). The do it yourself state. The future of participatory democracy. *Information Polity*, 17(3–4), 303–314.
- Meijer, A., Curtin, D., & Hillebrandt, M. (2012). Open government: Connecting vision and voice. *International Review of Administrative Sciences*, 78(1), 10–29.
- Netswera, F. G., & Kgalane, T. S. (2014). The underlying factors behind violent municipal service delivery protests in South Africa. *Journal of Public Administration*, 49, 261–273.
- Noveck, B. S. (2009). *Wiki Government: How technology can make government better, democracy stronger, and citizens more powerful*. Washington, DC: Brookings Institution Press.
- OECD, ISOC and UNESCO. (2013). *The relationship between local content, internet development and access prices* (OECD digital economy papers, no. 217). Paris: OECD Publishing.
- Open Government Partnership. <http://www.opengovpartnership.org>. Accessed 24 June 2018.
- Republic of South Africa. (1996). *Constitution of the Republic of South Africa. As adopted on 8 May 1996 and amended on 11 October 1996 by the Constitutional Assembly*. Pretoria: Parliament of South Africa Republic of South Africa. <http://www.justice.gov.za/legislation/constitution/SAConstitutionweb-eng.pdf>. Accessed 12 July 2018.
- Republic of South Africa. (2000). *Promotion of access to information act 2 of 2000*. Pretoria: Parliament of South Africa, Republic of South Africa. http://www.dfa.gov.za/departement/accessinfo_act.pdf. Accessed 10 July 2018.
- Sandoval-Almazan, R., & Ramon Gil-Garcia, J. (2016). Toward an integrative assessment of open government: Proposing conceptual lenses and practical components. *Journal of Organizational Computing and Electronic Commerce*, 26(1–2), 170–192. <https://doi.org/10.1080/10919392.2015.1125190>.
- Schuler, D., & Namioka, A. (Eds.). (1993). *Participatory design: Principles and practices*. Hillsdale, NJ: LEA.
- Shkabatur, J. (2013). Transparency with (out) accountability: Open government in the United States. *Yale Law and Policy Review*, 31(1), 79–140.
- South Africa. (1998). *The Local Government Municipal Systems Act 117 of 1998*. Pretoria: Government Printer.
- South Africa. (2011). *The South African National Development Plan (NDP), (2030)*. Cape Town: Planning Commission.
- South Africa. Local Development Plan 2030. <https://www.gov.za/issues/national-development-plan-2030>. Accessed 18 March 2019.
- Srivastava, S. C. (2011). Is e-government providing the promised returns?: A value framework for assessing e-government impact. *Transforming Government: People, Process and Policy*, 5(2), 107–113.
- Srivastava, S. C., & Teo, T. S. H. (2007). What facilitates e-government development? A cross-country analysis. *Electronic Government*, 4(4), 365–378.
- Strömbäck, J. (2005). In search of a standard: Four models of democracy and their normative implications for journalism. *Journalism Studies*, 6(3), 331–345.
- Teo, T. S. H., Srivastava, S. C., & Jiang, L. (2009). Trust and electronic government success: An empirical study. *Journal of Management Information Systems*, 25(3), 99–132.

- Thornhill, C. (1995). *Local government: Government closest to the people*. Pretoria: HSRC Publishers.
- Thurston, A. (2013). Transparency can “break cycle of poor governance” in developing world. *Guardian Professional*. Retrieved at 19 December. Available at: <http://www.theguardian.com/public-leaders-network/2013/mar/12/transparency-break-cycle-poor-governance>.
- Ubaldi, B. (2013). *Open government data: Towards empirical analysis of open government data initiatives*. OECD Working Papers on Public Governance, No. 22.
- Van den Hoven, J. (2005). E-democracy, e-contestation and the monitorial citizen. *Ethics and Information Technology*, 7, 51–59.
- Van der Waldt, G. (2015). *Unpublished draft UJ internal handbook. Local governance: Leading sustainable communities*. Johannesburg: University of Johannesburg.
- Veljković, N., Bogdanović-Dinić, S., & Stoimenov, L. (2014). Benchmarking open government: An open data perspective. *Government Information Quarterly*, 31, 278–290. <https://doi.org/10.1016/j.giq.2013.10.011>.
- Verhulst, S., & Young, A. (2016). *Open data impact, when demand and supply meet*. Key findings of the open data impact case studies. Available at: <http://odimpact.org/static/files/open-data-impact-key-findings.pdf>. Accessed 1 July 2018.
- Wijnhoven, F., Ehrenhard, M., & Kuhn, J. (2015). Open government objectives and participation motivations. *Government Information Quarterly*, 32, 30–42.
- Yu, H., & Robinson, D. (2012). *The new ambiguity of “open government”*. Princeton CITP/Yale ISP Working Paper. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2012489. Accessed 2 July 2018.
- Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government Information Quarterly*, 31, 17–29.

Blockchain for Open Data – Exploring Conceptual Underpinnings and Practice



Bwalya Kelvin Joseph

Abstract There has been a sustainable development of the concept of blockchain as one of the key technology innovations changing the business landscapes. Blockchain has been used as a lever for enforcing accountability and responsiveness in different contemporary information and knowledge management environments. The core principle of blockchain is that it promotes the use of technology tools and platforms to achieve anonymous vetting of integrity for different types of information. Together with relatively new concepts such as Open Data, blockchain stands a chance to be practically utilised in different socio-economic establishments. The synthesis of blockchain and Open Data presently opens up requisite implementation of Freedom of Information (FoI) bills which many countries around the world have enacted into laws. A lot of researchers are jumping onto the bandwagon of exploring ways of how blockchain can be used in solving contemporary complex human problems. As a result, a lot of conceptual designs and underpinnings are coming up everyday from both practitioners and researchers. Anchoring the philosophical underpinning on descriptive informetrics, this chapter employs a focused and detailed bibliometric analysis of work that has been published in applied scholarly and practical outlets such as in Scopus, Emerald, Elsevier, journals, etc., to delve deeper into the contours of blockchain. The chapter discusses formulaic definitions and concepts surrounding blockchain and Open Data with a special focus in the integration of the two concepts for practical application in real-world environments. It is hoped that exploring the formulaic underpinnings of blockchain and Open Data will open up avenues for consolidating their usage into the different contextual socio-economic set-ups.

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1 Introduction

The ever-penetration and realisation of knowledge economy in different parts of the world demand that accountability and transparency be the order of the day in many different contextual settings (Jaikaran 2018; Third and Domingue 2017a). The knowledge economy postulates that the competitiveness of the economy is hinged on the quantity, quality, and the harnessing or accessibility of information by everyone in society regardless of status and its integration into the different socio-economic sectors. The different attributes of accountability are achieved by appropriately opening up the data and ensuring that nothing is done in secrecy. Demand for Open Data in differential contextual settings is growing due to increased calls for transparency and accountability. Open Data is a principle that can only be realised by the availability of appropriate and requisite tools and frameworks. One of the potential tools is blockchain. Blockchain is an innovative and progressive technology solution that is being used in many aspects given the emerging fourth industrial revolution which has a potential to revitalise the way human beings live and work. A fundamental conceptualisation of blockchain is that it is a distributed database of records and can be considered as a public ledger of distributed transactions of digital agents executed and share amongst the participating nodes in a network.

As a result, there has been increased adoption of Blockchain, especially given its characteristic potential for facilitating multiple validations of different information resources. When applied together, Open Data and Blockchain have massive advantages that can be explored in different contextual settings. It is worth mentioning that Open Data and blockchain have come to stay despite the current lack of standards for its operationalisation. The development of blockchains and their increased utilisation in the different business processes in different organisational contexts attest to the fact that there is a huge opportunity that the peer-to-peer model will continue being utilised in diverse contextual settings. For example, blockchains threaten the existence of some traditional banking systems which are not aggressive in incorporating new technology trends. Another key attribute of blockchains is their potential to be used towards functional integration of business processes to the point where inter-organisational business processes are streamlined. Blockchain is a potential technology that can be used to replace bureaucracy in governance systems to the point that decisions are made based on the evidence compared with given business requirements as espoused in different contextually relevant business rules and logic.

Several issues have been identified as bottlenecks to realising the full potential of both Open Data and blockchain (Jaikaran 2018; Third and Domingue 2017a). Many of the publications in this area have focused on acknowledging that these concepts exist but have adequately explored the understanding of the different contextual nuances that can influence their adoption or adaptation in different scenarios (Jaikaran 2018). Further, the innovative potential of Open Data and blockchain especially with regard to how they can be used in integrating them into different public or private programmes such as e-Government, payment systems,

management of financial databases, dispatch of project resources, etc. has not been achieved to any appreciable extent. This chapter explores the formulaic underpinnings of Open Data and blockchain so as to unlock and showcase the potential innovative paradigms which can be explored in different contexts. Further, this chapter explores scenarios pertaining how the Open Data and blockchain revolution can be explored to come up with far-reaching interventions in different business processes of both the public and private sector.

To delve deeper into the themes explored, this chapter is basically hinged on systematic literature review (SLR). The first section presents the formulaic definitions of blockchain and articulates its basic components. The next articulates its usage of blockchain followed by the definitions of Open Data. After that, the synthesis of Open Data and blockchain is presented. This chapter presents the conclusion with a recap and summary of what has been discussed in the chapter.

2 Blockchain and Its Architecture

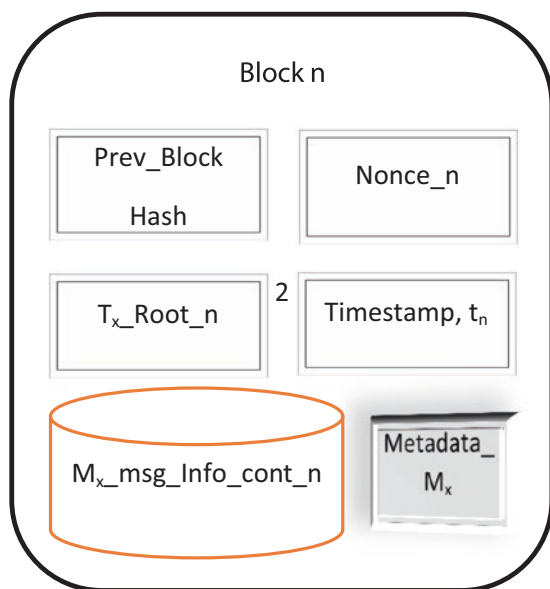
Of late, there have been increased practice and research into the use of blockchain technologies in different socio-economic set-ups. Research has intensified on the design of the blocks themselves, block information architecture, block configuration, and security and block linkage in an information space. There is almost consensus amongst researchers that the conceptualisation of blockchain was conceived when Satoshi Nakamoto published a paper entitled ‘A peer-to-peer electronic cash system’ in 2008 which was the genesis of an active debate on distributed ledger system application such as in the bitcoin mechanism.

Although principally considered only as a form of distributed ledger technology, blockchain brings out possibilities to be more than just a shared record over a networked environment. Using hash tagging, the different blocks in the blockchain environments are interlinked (Jun 2018). The idea of blockchain is to open up information systems so that data are easily available and promote co-creation so that there is a significant level of data sovereignty amongst users. The data are managed in a series of blocks which are functionally integrated into the blockchain architecture.

Based upon the distributed ledger technology (DLT) which allows sharing, synchronisation, and replication of digital data across geographically dispersed environments, blockchains enable multiple agents (or applications) to access data sequentially. At each phase of the sequence, a block is released onto the system and is accessed by multiple agents. Distinct with DLT, blockchain does not store information in one centralised database, and there is no central administrator to guide the interactions with blockchains. Each of the decisions done in the blockchain environment is as a way of consensus.

In Fig. 1, a basic configuration of a single block in a blockchain is shown highlighting the key components of a block.

Fig. 1 Conceptual configuration of a block in a blockchain



The first block in a blockchain is called the genesis block. The other blocks are called subsequent blocks. Each of the blocks has the following configuration as espoused in Fig. 1. The hash is a pointer connecting blocks to one another and contains the technical specifications of how blocks are connected. Hash values are at the centre of blocks' integrity. Blockchain is designed in such a way that if any value is changed in the block, the hash value also changes. The Nonce_n is arbitrary and is meant to be used once in the blockchain communication channel as a cryptographic 'lexeme'. The blockchain also contains the actual information being transferred, its description in the metadata and the merkle tree in the root_n which is the data structure of the content in the blockchain which gives a summary of the transactions on the blog by logging list of actions and by naming the agent initiating the action. According to Hyperledger (2017), the following are the key components desired in the architectural configuration of any Blockchain network:

1. Consensus Layer – handles the intermittent interactions between the different blockchain actors and consoles/modules in time of decision-making.
2. Smart Contract Layer – is embedded with carefully thought business logic and is responsible for processing transaction requests by ascertaining whether the different transactions conform to the set rules and regulations. Smart Contracts take the full attributes of traditional contracts and employ machines to digitally the different actions and deliverables.
3. Communication Layer – is a transport medium that is used to pass peer-to-peer messages between the nodes.
4. Identity Services – are at the centre of participant identity management by managing the instantiation of a system entity during network operation: This involves enrollment, registration, and identification.
5. Use of blockchain in the management of electronic medical records.

In order to adequately understand what blockchains are, there is need to explore the basic components that make up a blockchain. Any functional blockchain has basically the following five components:

1. Ledger – entails a list of cryptographically and logically linked transactions. The ledgers are normally presented in a tightly coupled fashion. A digital ledger makes it possible for two or more nodes in a system to communicate without using a centralised authority that has a role to validate transactions.
2. P2P network – without a central body, the network infrastructure is set in such a way that machines are able to communicate with each other by discovering the information available in the network (Hileman and Rauchs 2017).
3. Cryptography – uses a variate of cryptographic techniques to ensure that outsiders without access tokens do not have access to the blockchain system. Some of these techniques include public key infrastructure which generates both public and private keys (Hileman and Rauchs 2017).
4. Validity rules – set of rules that are commonly applied across the network on different aspects of validity requirements.
5. Consensus mechanism – algorithm responsible for ensuring that there is sanity in the blockchain environment, especially with regard to coordinating actions that can be executed (Hileman and Rauchs 2017).

For each of the blockchain instance, identity services are also at the centre of authentication and authorisation. Identity services are achieved by the following:

1. Crypto Abstraction – different crypto modules or algorithms in the same information space can be swapped without affecting the functional state of other modules in the same domain.
2. Data Store Abstraction – data stored in different locations in different databases can be accessed by other data stores and used by secondary modules. In aiming to achieve store abstraction, it is important to consider key attributes for privacy and security since blockchains are generally secure databases.
3. Application programme interfaces (APIs) – gateway to the system, established by the provision of a technology platform through which the clients and applications can interact with blockchains.
4. Policy Services – by interfacing other service modules, policy services aim to manage the different policies such as the endorsement policy, consensus policy, and group management policy.

Blockchains are based on the fundamental concepts of distributed computing. The following are some of the key characteristics of blockchains:

1. Distributed power and functional independence: each of the nodes in the distributed network operates relatively independent and cannot affect the functional state of the system regardless of what happens in the system.
2. Security and privacy – participants use asymmetric cryptographic systems using both a primary and a private key to send and receive information from the network. All the nodes use a public key infrastructure (PKI) to ensure that the blockchain system is protected from unwarranted eavesdropping. Excellence in security configuration is achieved by employing a layered architecture.

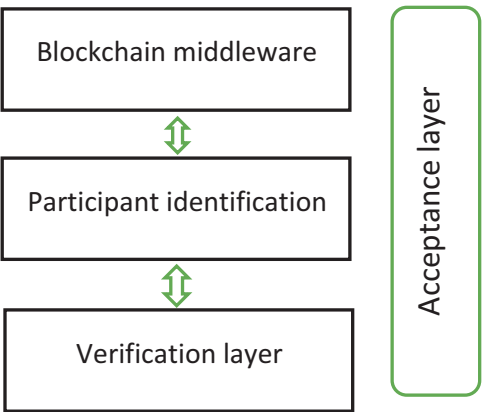
- 3. The architectural configuration of blockchain allows it to have a rigid physical structure that does not allow it to be susceptible to unwarranted attacks and therefore presenting it as a tamper-proof system (Jun 2018). This characteristic has allowed it to be attractive to government agents handling huge sets of public data that need not be forged.
- 4. Blockchain allow blocks to be chained together cryptographically and using mathematical indisputable properties create tamper-proof history. This entails that information already added to the blockchains cannot be altered but that only new information can be added in new blocks (Jaikaran 2018).

Figure 2 shows the architectural configuration of a blockchain with key technical and functional modules.

One of the key technical modules for a blockchain is the middleware. The blockchain middleware is a software and hardware abstraction that provides an open interoperable layer that allows different types of blockchains to access the transport layer of the OSI protocol stack in a networked environment. The middleware also allows marshalling of the different packet message formats giving it a chance to reach its desired node in the distributed blockchain network configuration.

Identity management, use of asymmetric encryption to achieve immutable transactions for authentication of problems, has been used in managing the security dimension in blockchains. Identity management is implemented using a rigorous user authentication model. The remaining modules in the blockchain infrastructure are focused on authentication of the users in the blockchain environment. Authentication is important to validate if the identity provided by the user represents the said user and articulates the true identity of the user or application that seeks to access information in the blockchain. Authentication is provided by participant identification and verification layer, and finally completed by the acceptance layer.

Fig. 2 Architectural configuration of a blockchain



3 Blockchain Functional Modalities and Usage

One of the most important things that need to be achieved in the blockchain environment is consensus. In ensuring that there is accountability and authenticity of information, blockchain uses the concept of consensus which is at the centre of the vetting process of blockchains. This involves the networked nodes guarantee that appropriate ordering of transactions has been followed. The complete consensus procedure involves confirmation of the correctness and order of all participating transactions in a given block according to the relevant policies and the smart-contract layer.

Participants in the blockchain environment are able to agree on the order and correctness of any blockchain transactions and application execution that has taken place. Consensus in blockchain environments is achieved using distributed computing concepts such as those used in server farms where several servers are involved in optimistic or pessimistic locking mechanisms where voting is involved. Although voting-based methods (such as the redundant Byzantine Fault Tolerance (RBFT)) are the common type for indicating consensus, there are different types of consensus that can be used to indicate a collective decision such as Proof of Work (PoW) or Proof of Elapsed Time (PoET) which are ideally lottery-based algorithms. The description of the different consensus mechanisms is given below:

Lottery-based algorithms are hinged upon the ability of a given node which wins the lottery to propose a block which is then transmitted to the rest of the participants in the distributed network. The nodes receiving the packets are able to validate the contents of the blockchains. In situations where there is absolute tie by two or more nodes, forking may occur which needs to be resolved in line of each of the forks produced by the nodes. Although the voting-based mechanisms are good because they accord each of the nodes a chance to be part of the decision-making processes in a distributed network, there is a lot of computational overhead as a result of this. As a result, there is reduction on the speed with which parcels and blockchains can transcend into a network therefore negatively impacting on the overall efficiency of the system.

In a blockchain environment, when data is confirmed to be genuine by consensus-building procedure, a replica data confirmed and validated as bona fide data (original data) is stored in the blockchain at a particular instance. This data will be the one that has been collectively agreed upon by the various participants in a blockchain environment.

Due to their ability to not only store information but also to execute applications due to their executable codes, blockchains have provided a possibility for them to be used in Smart Contracts. The executable codes are embedded into all the blocks throughout the system. Customer and stakeholder can then execute the code to monitor the progress of their projects or engage the different players in the blockchain informational architecture. Owing to their unique characteristics as one of the high-end technology innovations, blockchains have been used in diverse applications. The following are some of the contexts in which blockchain has been used:

1. Jun (2018) posits that there are over 100 blockchain projects all over the world used to transform government systems with the hope for multiple stakeholder assessment and validation of government projects. Blockchain facilitates consensus where machines can communicate and come up with common ground on many aspects of governance according to desired service level agreements.
2. One of the other possibilities brought about by the blockchain technologies is making it possible for individuals to experience seamless mobility by the utilisation of the conceptual underpinning Seamless Mobility as a Service (Seamless MaaS). Operationalisation of MaaS requires tailor-made digital infrastructure layers.
3. Blockchain has been used in cybersecurity, e.g., in checking the data integrity of huge data sets such as in big data and predictive analytics. The checking of data integrity for huge data sets can be achieved by using the Merkle tree (Jaikaran 2018).
4. In other environments, blockchain has a potential to be used as a tool for achieving a decentralised energy management system (transmission and supply) by taking advantage of the strong capabilities of artificial intelligence and internet of things (Kikitamara 2017).
5. Blockchain could further revitalise the traditional banking system to a point where individuals could transact without having to rely on banks.

Given the aforementioned, it can be posited that blockchain has a potential to revitalise the way human beings live. As posited by Gartner, it cannot be overemphasised that the emergence of blockchain has brought about the idea of programmable economic where the IoT is at the centre of autonomic algorithmic decisions which are made possible by robots and the emerging technological innovations (Kikitamara 2017).

4 Open Data

Open Data entails making available all data and information and ensuring that there is no unhindered access to information. On its own, Open Data does not culminate into substantial benefits because it is merely a framework or conceptual articulation underpinned by a set of principles based on Freedom of Information (FoI). However, when combined with other technological innovations given the environment in which they are implemented, they culminate into tangible positive impact in the data and information continuum. Integration of Open Data principles into information governance by utilisation and exploring of blockchain will culminate into the unearthing of many potential applications obeying the principles of FoI. Clear definitions of Open Data encompass the following attributes:

1. *Legal openness*: may involve the utilisation of an open licence that allows people and applications to have unhindered and/or free access to a given set of data and add on it whilst observing its integrity and desired quality levels. Issues of legal

openness are embedded upon FOI as the basic principles articulating the need to enable unhindered access to information as a basic human right.

2. *Technical openness*: posits that it is desired that technical roadblocks for accessing data should be erased. There should be no denial of access to data emanating from technical incompatibilities. For example, different versions of computing machines, e.g., should be able to communicate to each other due to their having similar data marshalling capabilities. Further, technical openness enables data in different formats to be easily accessed by people and applications.
3. *Operational openness*: entails that data generated in the different government business processes can be accessed by different people or applications without any hindrance. This enables processes to be accessed and monitored from different vantage points.

5 Blockchain Frameworks

A lot of frameworks are being proposed to act as blueprints for the implementation of blockchain in different contextual settings. Most of these frameworks are focused on articulating the distribution of the data in blockchain environments making it possible to ensure that there is continued availability and reliability of the data and there is an audit trail to clearly show the different versions of the data. Other frameworks have focused on the technical attributes of blockchain.

One of the key requirements in the implementation of blockchains is the need for the linked data facilitated by appropriate indexing to facilitate easy retrieval of information in distributed ledgers. In order to provide appropriate guidelines in linked data realisation in blockchains, Third and Domingue (2017b) proposed the BLONDiE ontology which maps the smart contracts to the Minimal Service Model ontology. Blockchains have been used to form Linked Data using distributed ledgers which make it possible to maintain integrity of the data and guarantee no-tampering. Linked data is at the centre of the formation of web of large-scale data. Within the same line of innovation, linked data are realised using the Resource Description Framework (RDF) which provides the syntax and semantics for linkage (Third and Domingue 2017b). Personen and Koistinen (2017) proposed the Shared MyData infrastructure which gives an opportunity to freely change their service providers without being subjected to mandatory data lock-ins.

In another aspect, it is worth noting that the integration of IP-enabled devices to the Internet infrastructure is at the core of the Internet of Things (IoT) and by extension the realisation of blockchains in any technical set-up. Alphand et al. (2018) proposed the IoTChain as a framework for achieving secured access to information resources in the IoT environment. The IoT Chain scheme brings together the strengths of Object Security Architecture for the Internet of Things (OSCAR) and ACE-based architecture to provide end-to-end encryption of datagrams (Alphand et al. 2018). Security is achieved upon having well-defined topologies and architecture, protocols, and standards.

Some of the contextual security issues in IoT and blockchains include the following:

1. Client privacy – even though blockchains are meant to be publicly accessible so as to ensure that multiple validation of content can be achieved, a user may decide to use dynamic addressing to ensure that each new transaction has a new address to enable transaction isolation (Alphand et al. 2018).
2. Token security – using asymmetric encryption involving the exchange of the Proof-of-Possession (PoP) key which is made available to the client requesting access and the public key generated from the smart contract of the blockchain. The PoP key is given to a requesting client to authenticate the granting of authority of access to the IoT resources.
3. Denial-of-Service (DoS) – continuous intermittent bombardment of the network with requests may culminate into overwhelming its service-handling capacity where requests for access tokens by the new clients may not be efficiently generated. A client may also persistently trigger smart contracts allowing the network to clash due to overwhelmed requests to the authorisation server each time a smart contract is triggered.
4. Bootstrap key server – securing blockchains from man-in-the-middle attacks (MITM) where nodes with no communication with bootnodes is important in contemporary blockchains. Bootnodes are mandated to utilise certificates to avoid intruder nodes from accessing and communicating with the bootnodes thereby diverting the server communication to its own server.
5. Secure communications – in the asymmetric encryption standard, the exchange of private and public keys exposes the network to increased eavesdropping interests from malicious clients (Alphand et al. 2018). The Datagram Transport Layer Security (DTLS) presents itself as one of the secure channels that can be used to connect the resource servers, key servers, and the heterogeneous clients in the blockchain infrastructural arrangements. Apart from ensuring that secure communications channels are put in place, other techniques such as challenge-response and issuance of certificates can be utilised.

Hyperledger (2017) proposes a modular architecture for business Blockchain which is based on distributed ledger technology (DLT) which is embedded with different functional modules and specifications of interfaces between them. These different modules bring about increased dynamism, flexibility and scalability of the system.

6 Synthesis of Blockchain and Open Data

Blockchain presents opportunities where future information management platforms will be hinged on open and distributed systems where decisions will be made instantly using discoverable information in diverse pervasive environments (Jun 2018). Blockchains provide an opportunity for distributed mobility systems

to handle information dynamism as such systems traverse through the different information environments. It is worth noting that each industry has different Blockchain requirements depending on the desired levels of security, privacy, network responsiveness (workflow complexity), confidentiality, compliance to set rules and regulations, etc. The specification of these requirements determines the level of sophistication for the technological and managerial base of the system. These requirements further define the architectural configuration of Blockchain networks.

The synthesis of FOI in public administration value chains has enabled transparency and openness in the public service and further enabled a platform for citizens' participation in the different governance processes (Izdebski 2015). Citizen's participation in the governance processes enables multiple vetting and validating of the different happenings in the public sector. Multiple validation and vetting are at the centre of the blockchain. Blockchains aim to eliminate the 'trust-gap' by utilising processes that enable individuals to independently and simultaneously verify information without the need of an intermediary. When a state is reached where there is no need to have trust between nodes in order for them to transact, blockchains may be considered as a key ingredient to achieving sustained transactions in such an environment. The direct outcome of such an arrangement is that there is increased confidence and accountability in the resources managed on blockchain platforms and that there is eventual guaranteed cost reduction in the business processes.

Although blockchain is perceived as a very progressive technology which promotes the realisation of possibilities in the fourth industrial revolution, it is still considered to be in its nascent stage of development. For example, blockchain has limitations in the amount of information that it can process in a given time as compared to traditional centralised systems with a relatively higher information throughput. Newly added blocks will find it difficult to integrate into the chain as the joining process is not done automatically.

Blockchain is continuously sitting at the centre of Open Data agenda because of its key principle of having decentralised control of the blockchains. In a blockchain environment, it will be very difficult to corrupt the data because it can easily link to the one who modified or updated the data (Third and Domingue 2017b).

7 Bottlenecks

As the network grows with a number of network nodes, several challenges need to be addressed in a blockchain environment. Some of these issues include latency in validation and storage limitations.

Apart from the established cognisance of trust as one of the one major bottleneck to the global acceptance of blockchains by a majority of industries and individuals, there are also major challenges that need to be addressed in order to realise the potential of blockchains. Key challenges are surrounding business processes,

financial implications and policy and/or governance issues. Some of the key challenges include the following:

1. The uncertain legal risks that may emanate from the use of blockchains in diverse business processes make it impossible for operators and innovators to completely trust utilisation of blockchains. Further, the lack of clear regulatory and policy frameworks surrounding usage of blockchains makes it very difficult for blockchains to be used globally.
2. In order for blockchains to translate into any meaningful benefits, enterprises need to change their business processes to accommodate the structural and technical changes brought about by distributed ledger technology. With the introduction of blockchains, there is now need for change of both the functional and non-functional requirements in a business translating into an improved experience of end-users.
3. In a typical topology of blockchains, there are heterogeneous gadgets connected to a distributed network and using the same middleware with a shared ledger.
4. There is generally a lack of authoritative business case studies that accentuate the different benefits of using blockchains.

Other challenges at the core of the realisation of efficient utilisation of blockchains within the ambit of IoT are bordering on security including verification, authorisation, and access control. As a result, the Internet Engineering Task Force (IETF) has been motivated to propose a generic framework focusing on different issues on authorisation and authentication (Alphand et al. 2018).

The health sector has been grappling with problems surrounding the ever-increasing need for simultaneous access to health records by health institutions scattered throughout a given municipality or country (Zhang and Ji 2018). Although blockchain, as a seemingly tamper-proof system, presents itself as one of the potential technology innovations that can be employed in the management of healthcare records, it has still an array of concerns bordering on security and privacy. Blockchain presents itself as one of the potential innovations to solve one of the key problems in healthcare – management of personal health information or personal health record systems. Many of the healthcare documents have been accessed by third parties and used to disadvantage the owner of the records (Jaikaran 2018). The security and privacy issues are at the centre of managing healthcare information so as to avoid unintended access and manipulation. The unintended and unauthorised access to information will culminate into difficulty in maintaining currency and integrity of information and therefore presents risks of misrepresenting health facts attributed to a certain individual (Zhang and Ji 2018). Therefore, there is need to ensure that personal health information is secured as much as possible.

Although blockchain has a huge potential for use in the management of healthcare records, it has one more bottleneck that needs to be solved – slowness in the achievement of uniform information integrity. The slowness in achieving integrity is brought about by the time consumed in propagation of information across the distributed ledgers in the blockchain as new information emerges.

Other than security and the need to ensure unhindered access to information, one of the key concerns for Open Data and blockchains is how to maintain quality, relevance, and integrity of data and information as it is being shared amongst the different blocks (Izdebski 2015). Another security characteristic of blockchain transactions is that it uses asymmetric key encryption standard where both a public and private key define the cryptosystem. In order to effectively participate in the blockchain, users are expected to make two cryptographic elements – public key is used to identify transactions deployed by themselves on the blockchain and a private key which is a reciprocal requirement in order to decode transactions encoded by the private key (Jaikaran 2018).

Over a period of time, a blockchain will grow in size to a point that the network resources on which it sits will no longer be durable enough to handle huge sets of data and application. In this regard, it is logically coherent to posit that blockchains will need to split as they grow. The smaller blockchains will need to be linked together so that they can share the common resources.

The formal security clearance involves verification of identity and acceptance of the node requesting to join the blockchain. When both verification and acceptance have been achieved, there is consensus for the new block to join the chain. The consensus algorithms are:

1. Proof of Work (PoW) – using a hash-based algorithm such as Merkle hash to find a nonce value less than the current target value.
2. Proof of Stake (PoS) – intends to change the game on how blockchains achieve consensus by replacing the PoW way of doing things by emphasising that the node generating a block needs to give assurance by producing tangible proof that it has adequate number of coins which can be accepted in a given distributed network.
3. Practical Byzantine Fault Tolerance (PBFT) – the PBFT aims to tolerate arbitrary faults or unexpected joining or leaving the network at an unexpected time so that the functional totality and state of the system are not disturbed.
4. Delegated Proof of Stake (DPoS) – operates in such a way that network participants use representative democracy where stakeholders are elected to do the generation and validation of a block to be added to a network.
 - The Merkle tree root is a data structure that facilitates efficient summarisation of the transactions in a blockchain.
 - Some of the key applications of blockchain are the following: focusing on the decentralisation principle, bitcoin was the first variant of blockchain to be implemented; smart contracts and crowdfunding; digital payment systems.
 - Blockchain has a huge potential for use in the voting systems and stands as one of the promising disruptive technologies for use in corruption-infested developing world context voting systems. One of the potential systems in this regard is the blockchain-enabled e-voting (BEV).

8 Conclusion

This chapter has explored the formulaic and practical definitions of blockchain and Open Data and showcased different scenarios how these can be synthesised for beneficial applications. In order to foster clear understanding of the concept of blockchains, this chapter brought out the basic and fundamental topologies and architecture of blockchains. Further, the key challenges in implementing blockchains have been brought out, and scenarios of how different researchers and practitioners have approached the said problems in their own contextual settings. Since blockchain is a relatively new concept, there are still no global definitions and understandings of each of the different aspects. It is therefore important that there should be continued exploration and discussion of these concepts given the different contextual settings.

There has been pronounced interest in blockchain's usage in cryptocurrencies such as bitcoin and ethereum in different contextual settings. The public service has been aggressive in adopting blockchains due to their potential in enshrining accountability in managing public resources. Blockchains call for the whole gamut of public data to be made available in the public domains for the benefit of the citizens. The public data or data from the different business processes comprises of Master Data (attributes and descriptions for different services or public service service), Transaction Data (emanating from everyday businesses), and visibility data (meta-data and tags for tracing and tracking). Although the public sector in different countries leads in adopting and implementing blockchains, the private sector has also not been completely left out from this marathon as many exciting blockchain innovations emanate from the private sector.

In conclusion, it can be posited that there is need to develop global standards that are going to guide the development of the different frameworks to facilitate technology innovation. These standards are also going to guide the enforcing of interoperability amongst the heterogeneous gadgets deployed in the blockchain environment. There are a lot of open areas that need to be explored if blockchains were to be implemented in different contexts. Some of the key issues revolve around security, access rights, data storage, etc.

References

- Alphand, O., Amoretti, M., Claeys, T., Dall'Asta, S., & Duda, A., et al. (2018). *IoTChain: A blockchain security architecture for the internet of things*. IEEE Wireless Communications and Networking Conference, Apr 2018, Barcelona, Spain. hal-01705455.
- Hileman, G., & Rauchs, M. (2017). *Global blockchain benchmarking study*. Online: https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-global-cryptocurrency-benchmarking-study.pdf. Accessed 14 Dec 2018.
- Hyperledger. (2017). *Introduction to Hyperledger business blockchain design philosophy and consensus*. Online: https://www.hyperledger.org/wp-content/uploads/2017/08/Hyperledger_Arch_WG_Paper_1_Consensus.pdf. Accessed 14 Dec 2018.

- Izdebski, K. (2015). *Transparency and open data principles: Why they are important and how they increase public participation and tackle corruption*. Online: <https://transparencee.org/wp-content/uploads/2015/12/open-data-principles-by-krzysztof-izdebski.pdf>. Accessed 14 Dec 2018.
- Jaikaran, C. (2018). *Blockchain: Background and policy issues*. Online: <https://www.hsdl.org/?view&did=808684>. Accessed 7 Dec 2018.
- Jun, M. S. (2018). Blockchain government - a next form of infrastructure for the twenty-first century, *Journal of Open Innovation: Technology, Market, and Complexity*, 4(7), 1–12.
- Kikitamara, S. (2017). *Digital identity management on blockchain for open model energy system*. Unpublished Masters thesis – Information Science.
- Personen, L., & Koistinen, M. (2017). *Employing the principles of My Data and blockchain in building trust in farm data sharing*. MACS-G20 Workshop, Berlin.
- Third, A., & Domingue, J. (2017a). *Linked data indexing of distributed ledgers*. Online: <http://papers.www2017.com.au.s3-website-ap-southeast-2.amazonaws.com/companion/p1431.pdf>. Accessed 14 Dec 2018.
- Third, A., & Domingue, J. (2017b). *LinkChains: Exploring the space of decentralised trustworthy Linked Data*. Online: <http://blockchain.kmi.open.ac.uk/desemweb2017/desemweb2017.html>. Accessed 6 Dec 2018.
- Zhang, M., & Ji, Y. (2018). *Blockchain for healthcare records: A data perspective*. Online: <https://peerj.com/preprints/26942.pdf>. Accessed 3 Dec 2018.

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