IGBAL SAFAROV

Open Government Data

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#utilization #utilization

#implementation #implementation

#adoption #adoption

Open Government Data
Utilisation, Implementation and Adoption

Igbal Safarov

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Open Government Data
Utilisation, Implementation and Adoption

Open Overheidsdata
Gebruik, Implementatie en Adoptie

Proefschrift

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CHAPTER 1

#utilization

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Chapter 1: Introduction

1.1. Promise and rise of open data

> "Within 45 days, each agency shall identify and publish
> online in an open format at least three high-value data sets
> and register those data sets via Data.gov. These must be
> data sets not previously available online or in a
> downloadable format".
>
> US Open Government Directive, December 8, 2009

The practice of proactively publishing government information and data has expanded strongly over the past 10 to 15 years. It is a development that in essence was catalysed in 2003 by the adoption of the Directive on the reuse of public sector information (PSI Directive) by the European Parliament and the European Council. In the beginning, the PSI Directive, which was replaced by the open data and the reuse of public sector information Directive in 2019, covered not only data but all public information and documents, with a few exceptions. Several public initiatives subsequently introduced sets of principles proposing norms for publishing open data, such as the 8 principles of open government data initiated by the Sebastopol group[1] in 2007; the Open Government Data book by Joshua Tauberer[2] in 2012; and the Open Data Policy Guidelines issued by the Sunlight Foundation in 2014. Importantly, the principles formulated within the context of these initiatives all shared a recognition that government data should be released in a reusable/machine-readable, free and accessible format. Since the early 2010s, these open data principles, policies and data sharing technologies have been updated and become more mature.

The US Open Government Directive (2009) officially initiated the publication of machine-readable government data in a central open data portal, to enable its reuse. Following this initiative and because of the expectations regarding the reuse of such datasets, many governments went on to publish tens of thousands of public datasets (*Data Portals*, 2019; *Open Data Barometer*, 2017). Some of the

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[1] https://opengovdata.org/
[2] https://opengovdata.io/

organizations aimed to create more transparency and accountability, others published data with a view to promoting commercial use cases. Sharing government data without reuse barriers, which is known as Open Government Data, promised a new reality for a more open government, proactive in terms of freedom of information and facilitating data-driven solutions targeted at delivering effective services (Janssen & Zuiderwijk, 2014; Ruijer, Grimmelikhuijsen, & Meijer, 2017a; Shepherd, 2015; Zeleti, Ojo, & Curry, 2016). Furthermore, the release of government data has been said to facilitate our knowledge economy (Bakici, Almirall, & Wareham, 2013; Lakomaa & Kallberg, 2013; Lindman, Kinnari, & Rossi, 2014).

The expected benefits of open data depend on a complex set of conditions that comprise both social and technical components (Ruijer, Grimmelikhuijsen, Hogan, et al., 2017; Ruijer, Grimmelikhuijsen, & Meijer, 2017). These conditions determine the type of open data use and the magnitude of its positive effects. For example, visualizing open budget data requires intermediate data use skills and data visualisation tools. Building data-driven services with open transportation data, on the other hand, demands advanced technical skills and real-time access to transportation databases.

The approach to the influence of these conditions is highly fragmented in both academic and government activities. Scholars either discuss specific conditions in a particular context or the general benefits and the barriers to the adoption of open data. For instance, a recent paper explored the important role of training and engagement in increasing the relevant skills of potential users to encourage the use of open data (Gascó-Hernández, Martin, Reggi, Pyo, & Luna-Reyes, 2018). Chatfield and Reddick (2018), on the other hand, underline the significance of open data policy adoption for policy innovation diffusion and the need for a sustainable approach to open data adoption. Although some studies have attempted to elucidate the influencing conditions within the big picture of open data adoption (e.g. Dawes, Vidiasova, & Parkhimovich, 2016; Zuiderwijk, Janssen, & Davis, 2014), these studies do not provide a comprehensive overview of how social and technical conditions interact and *together* influence open data utilisation.

Researchers in various fields have explored the value of different technical conditions, such as metadata for the discoverability of data, the role of user-friendly tools, the importance of one-stop-shop open data portals and the search capacity of these portals (Ding et al., 2011; Hendler, Holm, Musialek, & Thomas, 2012; Lourenço, 2015; Zuiderwijk, 2015). Such knowledge provides a clear picture of the challenges in open data implementation. Although there are many technical barriers that impact open data implementation (Janssen et al., 2012), it is a relatively predictable and controlled process. Advanced data technologies, available open-source solutions for data sharing, cataloguing and data governance enable organizations to implement cutting-edge technologies for publishing government data (Attard, Orlandi, Scerri, & Auer, 2015; Chatfield & Reddick, 2018; Lourenço, 2015; Machado & Oliveira, 2011). With a clear action plan and supportive ICT infrastructure, a government can deploy open-source tools with recommended functionalities, such as a data catalogue, search functionality and user interaction tools. However, the experiences of the best-performing countries have shown that even tailor-made open government data implementation can fail to yield a direct societal, governance or economic impact (Ruijer & Meijer, 2019; V. Wang & Shepherd, 2019). Today, data collecting and sharing technologies are readily available and thousands of datasets have been published, yet the full potential of OGD has not been realized.

Compared with the technological conditions, the social conditions are more complex and influential. Better open data utilisation is contingent upon a broad range of conditions with societal roots, such as open data awareness, data usage skills, supportive legislations and policies etc. (Gascó-Hernández et al., 2018; C. Martin, 2014; Rosnay & Janssen, 2014; Ruijer, Grimmelikhuijsen, Hogan, et al., 2017; Susha, Grönlund, & Janssen, 2015b). The social conditions affecting data utilisation have also attracted the attention of scholars. Various aspects of these conditions, such as the need for training for users (Gascó-Hernández et al., 2018) or the legal framework for open data and policy design (Viscusi, Spahiu, Maurino, & Batini, 2014) have been separately investigated. Social conditions also have a strong impact on the improvement of technical conditions. As open data infrastructure and quality of data are not static conditions but

require systematic improvements, such a mechanism necessitates well-institutionalized community awareness and support.

Open data implementation is relatively simple in terms of realizing technological conditions, but constitutes a socially difficult process, and we know little about how the interaction between social and technical conditions impact the utilisation of open data. Therefore, this thesis aims to explore the social conditions that impact the utilisation of open data in three phases.

First, the idea of "open data utilisation" is operationalized to understand its components and to position its influencing conditions. Although such conditions are widely, yet separately, explored by scholars and the open data community, we know little about the integrated picture and how the conditions are related to other factors in the open data utilisation framework. Such knowledge is needed to understand how these conditions determine the success of open data implementation and long-term adoption.

The second phase involves the identification of significant institutional dimensions and their role in open data implementation. Typically, the open data literature focuses on a particular institutional context, mostly in western democracies. In general, our knowledge about institutional dimensions is highly fragmented and an inclusive overview consisting of the various dimensions influencing open data implementation is lacking. To cover this gap, a theoretical framework has been developed that can be used to explain these institutional dimensions and to identify their role in open data implementation.

In the third phase, national-level factors are identified, which can impact open data adoption by governments. As open data is a strategic asset of government organisations and the decision to publish data is impacted by various institutional factors (Ruijer, Détienne, Baker, Groff, & Meijer, 2019), it is important to understand the background and characteristics of the various countries in order to explain their adoption of open data. A quantitative method, using data from more than a hundred countries, has been employed to explore the potential connection between open data adoption and national-level factors.

This study was conducted at the Utrecht University School of Governance and aligns with the open data knowledge created in the public administration domain. Many aspects of open data have been explored by the public administration scholars at the School of Governance. Open data in public administration has been studied, for example, as an innovation process which necessitates strong managerial commitment for scaling up open government data (Ruijer & Meijer, 2019). Open data and its utilisation have also been studied as a social construction that emerges over time in a specific context (A. Meijer, Hoog, Twist, Steen, & Scherpenisse, 2014). The authors of that study argue that the effects of open data use depend on specific, local interactions that can be managed and controlled to a limited extent. Studying a particular effect of open data, such as, for example, its contribution to democratic processes, also revealed the importance of a context-sensitive open data design, in which the relevant social and technical conditions must also be taken into account (Ruijer, Grimmelikhuijsen, Hogan, et al., 2017; Ruijer, Grimmelikhuijsen, & Meijer, 2017). The current study expands on the previous research by providing an in-depth understanding of the relations between utilisation, implementation and the adoption of open data.

1.2. Defining the concepts

In this book, as in the open data literature, three other terms are frequently used in addition to Open Government Data. These three terms are: open data utilisation, open data implementation and open data adoption. All four of these concepts need to be systematically defined prior to proceeding to the discussion on the research gaps addressed and the research approach deployed in this dissertation. Doing so in this section opens the door for their documentation and subsequent consistent use throughout this study.

First of all, this book follows the definition of "Open Government Data" developed by the Open Knowledge Foundation, a definition that is widely used by scholars, the European Union funded European Data Portal (EDP, 2020) and international organisations such as the World Bank (WB, 2019) and OECD (OECD, 2019). According to this definition,

government data means *any data produced or commissioned by government or government-controlled entities* (OKF, 2017). In the Open Definitions 2.1., open data refers to data that *anyone can freely access, use, modify, and share for any purpose* (OKF, 2016). We know that open data can be generated by researchers (called open science data), crowds (open crowd data), and by governmental, private and international organizations. In this thesis, open data is understood to refer to data generated only by government entities.

Open data utilisation, the next concept, recurs frequently in this book. The objective of open data utilisation is to achieve the reuse of open data. Government organizations are the core facilitators of open data utilisation (Jetzek, Avital, & Bjørn-Andersen, 2013; Ruijer & Meijer, 2019; D. Wang, Richards, & Chen, 2018). As was discussed in the previous section, several factors involve the open data utilisation process. For example, scholars have classified different categories of open data users who are active in open data utilisation (Gonzalez-Zapata & Heeks, 2015). The users of open data work to transform raw data into positive economic, social and governance effects. In general, open data utilisation is the reuse of open data by users to achieve its social, economic and good governance effects under certain conditions.

Open data adoption and implementation are frequently used in the open data literature as a means to study factors that are of influence or to describe the components of the adoption and implementation process. These terminologies have not been clearly defined and in some cases, open data adoption and open data implementation are used interchangeably. In this dissertation, these concepts have been defined as complementary yet different concepts. Overall, open data adoption can be viewed as a broader concept than open data implementation.

As part of the innovation-decision process, both adoption and implementation are well-studied in the innovation literature. In Roger's (2003) innovation-decision model, the process comprises five stages: knowledge, persuasion, decision, implementation and confirmation. Organisations obtain information about the innovation in the knowledge stage, which creates awareness via communication channels. In the persuasion stage, an opinion (positive or negative) is established about the innovation. Likewise, ideas about the relative

advantage, complexity, compatibility, friability and observability of the innovation are established. During the implementation phase, the innovation is launched in practice. At the end of the innovation-decision process, either the innovation meets the expectations and receives support, or it fails to do so and, as a consequence, is rejected. Within the context of open data, the implementation stage is when the technical conditions, such as functioning open data portals, user-friendly tools, and data quality control that facilitate various types of open data use, are created.

Klein and Sorra (1996) define innovation implementation as the process of gaining relevant employees' appropriate and committed use of an innovation. The authors also position implementation as the link between the decision to adopt the innovation and its consistent use. Open data, as a public innovation, is not targeted at making government data reusable by data owners, but at making this reusable by external interest groups. In this regard, "appropriate and committed use of an innovation" is the process by which initially closed government data becomes reusable. This process is realized by equipping open data portals with user-friendly data services such as browse, search, download, a feedback mechanism and reusable, high-quality data sources (Dahbi, Lamharhar, & Chiadmi, 2019; Fitriani, Hidayanto, Purwandari, Nazief, & Hardian, 2017; Ruhua, 2019). Therefore, open data implementation can be defined as the putting in place of technical conditions, such as functioning open data portals, user-friendly tools, data quality control, that facilitate various types of open data use.

Although the scope of open data adoption is not clear, the open data literature denotes the following as factors influencing open data adoption: the perceived benefits of open data, organisational readiness and external pressures (H. Wang & Lo, 2015). Hossain and Chan (2016) distinguish six factors - political leadership, institutional pressure, digital technologies, perceived interoperability, organizational readiness and management commitment – as being key to the successful adoption of open data. Barriers to open data adoption include institutional factors, task complexity, data use, legislation and data quality (Janssen et al., 2012). We can conclude that open data adoption is a combination of a well-functioning open data implementation process and various

institutional dimensions, extending from the implementation of open data programs, strategy and design to facilitating open data portals.

In sum, open data implementation is not the same as open data adoption. Three terms that are frequently used in this book are listed and defined below:

	Definitions:
Open data utilisation	Open data utilisation is the reuse of open data by users to achieve its social, economic and good governance effects under certain conditions.
Open data implementation	Open data implementation is the creation of technical conditions, such as functioning open data portals, user-friendly tools and data quality control, that facilitate various types of open data use.
Open data adoption	Open data adoption is a combination of a well-functioning open data implementation process and institutional dimensions. It covers the implementation of open data strategy, the design and facilitation of open data portals.

1.3. Gaps in the literature

At the beginning of the 2010s, OGD began generating the interest of researchers in many fields, including public administration, transparency studies, e-government and information technologies. The early studies explored the technical foundations needed to support the implementation and use of open data such as building data portals (Ding et al., 2011), open data architecture (Machado & Oliveira, 2011), benchmarking (Veljković, Bogdanović-Dinić, & Stoimenov, 2014), open data semantics (Hendler et al., 2012), and e-service creation (Chan, 2013). These studies also revealed that technical conditions alone did not automatically result in open data reuse, the ultimate goal of open data projects. This led scholars working in the public administration, innovation and business domains to turn to examining the social aspects of open data utilisation, as well.

Three different groups have contributed to the literature on the social conditions that shape open data utilisation. In the first place are the scholars who documented the institutional characteristics, such as policies, regulations and organisational barriers which might have an impact on open data implementation (e.g. Janssen et al., 2012;

Zuiderwijk & Janssen, 2014). Second is a group of studies that were focussed on the institutional motivation and pressure driving the implementation of open data (Altayar, 2018; Blasio & Selva, 2016; Ruijer & Meijer, 2019). The third group of studies examined the effect of a particular institutional dimension on the success of open data implementation in a specific context. Examples include open data in education (Kool & Bekkers, 2015), open transportation data (Kuhn, 2011), open data in local government (D. Wang, Chen, & Richards, 2018), smart cities (Janssen, Matheus, & Zuiderwijk, 2015; Kitchin, 2014; A. Meijer, 2017), healthcare (E. G. Martin, Helbig, & Birkhead, 2015), democracy (Ruijer, Grimmelikhuijsen, & Meijer, 2017) and tracking corruption (Rajshree & Srivastava, 2012).

These studies on open data using institutional dimensions have shed light on the influence of a wide range of dimensions on open data implementation and its performance. However, the extant literature has several limitations. A comprehensive analysis and holistic approach to the institutional dimensions influencing open data implementation is lacking. Weaver and Rockman (1993) point out that an institutional perspective should not be considered a monolithic phenomenon, but should be viewed as a complex set of connected elements. This complexity and multifaceted nature of institutional dimensions have not been employed and empirically tested in the understanding of open data implementation. Many studies considering the institutional factors in open data implementation do not treat these as constituent parts of an integrated whole, but instead explore the legal frameworks, open data strategies, skill requirements and public support separately.

While the barriers to open data adoption are described in the literature as relating to institutional factors, complexity, user-oriented barriers, legislation, data quality and technical aspects (Barry & Bannister, 2014; Janssen et al., 2012; Smith & Sandberg, 2018; H. Wang & Lo, 2015), there are three omissions in the literature that this dissertation addresses:

1. Fragmentation in the literature on open data utilisation
2. No in-depth understanding of institutional dimensions of open data implementation
3. Lack of understanding of the national-level conditions and their impact on open data adoption

1.3.1. Gap 1. Fragmentation in the literature on open data utilisation

Open data utilisation happens within a complex and multifaceted environment. This complexity makes it important to define open data utilisation in the light of its factors and categories. These factors and categories are extensively covered, albeit often separately, in the open data literature. A significant body of early studies investigated the potential benefits of open data. Another group of studies examines the various purposes of open data use, such as anti-corruption, business decision making, research, service delivery. These studies were aimed at revealing the true potential of open data. Still another group of open data studies classifies the (potential) users of open data. Yet it is also important to understand how are these various factors are connected. This first research gap is addressed in this section, where the open data literature is reviewed to find and connect open data utilisation factors and their categories.

The paradigm shift from reactive to proactive information openness in the public sector has brought new requirements to open government, of which open data is a significant pillar (Lee & Kwak, 2012). Compared with freedom of information (FOI) mechanisms, open data requires intermediary processing to transform data into meaningful information. A literature review shows that although the users and expected benefits are relatively similar in both concepts, the technological nature of open data increases the complexity of its sustainable adoption (Afful-Dadzie & Afful-Dadzie, 2017). This complexity relates both to the many different types of open data utilisation as well as to the conditions that facilitate such utilisation and the quality of the expected effects.

These technical aspects, however, are not the only ones to influence open data utilisation; favourable social conditions are also essential, if positive effects are to be achieved. These conditions include organisational support, the availability of relevant regulations and the availability of relevant skills compatible with the types of open data used. Open data offers a broader range of opportunities to use the information than established information channels such as FOI requests. As open data comprises raw, unprocessed data, the type of open data that can be used depends on the users. It is therefore crucial to understand who

the users of open data are and the type of data that is used. For instance, some researchers have argued that a context-specific approach is needed, which connects open data with user requirements and societal issues (Ruijer, Grimmelikhuijsen, Hogan, et al., 2017).

In sum, the literature on open data discusses many users, technical and social conditions that determine the type of open data use and its expected effects. The question is, therefore, who are the potential users of open data? And: what types of open data use are available and how are the users associated with a specific type of open data use? What are the mediating conditions? How do the mediating conditions link the users and the potential effects of open data utilisation? Little is currently known about the broader picture of an eventual open data utilisation framework. To better understand how and by whom open data is utilised, all the factors and their categories must be linked together within such a open data utilisation framework.

1.3.2. Gap 2. Institutional dimensions of open data implementation

As the popularity of open data continues to grow, researchers are increasingly seeking to understand the success factors in open data implementation and, in a further step, the reason behind the adoption. Much like in the innovation studies, the literature on open data also highlights the significant role of the institutional context in which open data adoption occurs (Janssen et al., 2012; Ruijer et al., 2019; H. Wang & Lo, 2015). However, little is known about what this role comprises and about the institutional dimensions influencing open data implementation. The primary challenge is to find an answer to the question of how the institutional context relates to open data implementation and which institutional dimensions are the most significant for explaining open data implementation. In this regard, differences in the configuration of institutional dimensions may explain the variance in open data implementation practices between countries. Addressing the second research gap, this section therefore explores the potential link between institutional dimensions and open data implementation.

Even before the concept of open data surfaced, the innovation literature had already established that innovations do not emerge and take shape in isolation, but require a socio-technical environment, that includes policy and legitimacy, specific knowledge, and social support which enable the implementation, diffusion and use of innovations (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008). Such a nurturing environment for innovation is made up of stakeholders who contribute to the implementation process in numerous ways, through supporting policy development, providing economic resources, increasing public awareness, and innovation usage. These stakeholders and interest groups align their actions with the characteristics of the innovation, technological artefacts and institutional settings.

In the literature on open data and on innovation, institutional dimensions are widely discussed, although as separate entities. Institutional dimensions expand or limit the scope of open data implementation and thus affect the success of open data projects. Institutions operate at various levels of influence with varying degrees of authority, from the world to local governance and from the national level to interpersonal relations (Scott, 2008, p. 48). Institutions impose restrictions through regulations, create barriers and cultural boundaries, incentives, and initiate strategic action and ideas (Peters, 2000; Scott, 2008, p. 50). Institutions describe the set of rules governing the social and political interactions in society, which impact the adoption of innovations. The level of influence, complexity of the regulations and multifaceted interactions conspire to make the institutional dimensions significant, but also make it difficult to operationalize their role in the process of innovation implementation.

Hekkert, et. al., (2007) discuss a broad range of key activities in the innovation process, including knowledge development and diffusion, guidance, market creation, resource mobilization, change management and entrepreneurial activities. Such activities are performed by the components of an innovation system - actors, networks and institutions, with the latter considered the central feature of technological innovation (Carlsson & Stankiewicz, 1991). Klein Woolthuis, Lankhuizen and Gilsing (2005) underline the crucial place of institutions in innovation policy design, distinguishing between the hard institutional failure resulting

from a lack of standards and relevant legislation; and soft institutional failure, due to the perception among users that an innovation is not reliable in terms of performance and safety.

In sum, open data implementation does not ensure that its use will be embraced and adopted. If certain conditions fail to be taken into account, open data implementation may fail even if its adoption is initially given high-level support. Conditions that determine the effectiveness of innovation implementation include the institutional climate and the perceived benefits of the innovation, i.e., the extent to which it fits with the principles of the adopting institution (Klein & Sorra, 1996). As the value of open data is created by external user groups, more than just the government institutions may be expected to influence open data implementation; non-governmental institutions are also likely to strongly impact the sustainability of open data adoption. Consequently, defining the institutional dimensions of open data implementation could allow us to explain the success – or failure – of open data adoption.

1.3.3. Gap 3. National-level conditions and their impact on open data adoption

A third gap in the literature is the lack of attention for national-level conditions affecting open data adoption. A crucial difference with the institutional dimensions is that national-level conditions do not depend on a single organisation or even on a group of organisations. National-level conditions apply to a government as a whole rather than to its institutes. For instance, a national-level condition is the overall state of democracy in a country; an institutional dimension is how open data is coordinated and organised by a ministerial department. Furthermore, national-level conditions are difficult to modify and improve in a short period of time. Considering the fact that national-level conditions influence nearly all aspects of social, economic and governance activities of governments, they may be expected to play a role in open data adoption as well. But which national-level conditions should be considered in open data adoption? To what extent do they explain open data adoption? To answer these questions and thus fill the third research

gap, this section explores the potential link between national-level conditions and open data adoption. To date, this link has not yet been explored in the open data literature.

To implement open data projects, countries need to have a sufficient level of information and communication technology (ICT) development. Without an adequate ICT basis, implementing an open data policy will prove nearly impossible, even if there is a will to do so. Furthermore, ensuring the sustainability of an open data initiative requires extra economic resources. New employees are needed to maintain the implementation, systematically improve the quality of data, communicate with the stakeholders and provide relevant skills and knowledge to potential users. In general, the capacity of a country in this respect may help, at least partially, to explain open data adoption in a country.

Successful adoption of innovation, particularly at the national level, is associated with the availability of human resources (Dakhli & Clercq, 2007). As data use is a knowledge-driven activity, open data requires knowledgeable stakeholders to obtain value. This applies both to the demand side of open data adoption, as well as the supply side. Along with the relevant stakeholders, public officials must also possess the data skills required to collect and share data. Nevertheless, human capital is not enough to utilize open data. Open data use is a community activity and requires civic participation from activists, context experts, software developers and data analysts. Furthermore, the long-term trust of data owners is needed to develop data-driven services for using open data. In sum, there are several societal factors that contribute to the development of a strong basis for open data adoption and sustainability.

The most widely discussed effects of open data relate to good governance, which is understood to refer to transparency, accountability and other democratic practices (R. Meijer, Conradie, & Choenni, 2014). Possible good governance effects of open data require higher-level political will and the intention to support the sustainability of the implementation. The literature on transparency and open data clearly indicates that countries with higher levels of corruption limit the adoption of open data to minimize the possibility of information being disclosed about illegal activities (Kim, Kim, & Lee, 2009; Lindstedt &

Naurin, 2010). All these features make it imperative to take national-level factors that lay the foundation for open data adoption, such as the level of democracy, corruption and free media, into consideration.

In sum, to achieve better open data adoption, it is essential to understand which and to what extent national-level factors are related to open data adoption. As open data adoption has not been quantitatively studied at the international level, such a study will help to explain why some countries perform better than others in respect of open data adoption.

1.4. Problem statement and research questions

Following the introduction of the concept of open data, many countries decided to launch open data projects of their own. Despite high expectations, open data has, to date, failed to reach its hoped-for potential. Furthermore, many open data projects have proven to be economically and otherwise unsustainable, with government organisations in various countries failing to maintain the projects. The assumptions coming from this reality triggered this research. In general, the literature on open data was found to provide little empirical evidence for a comparative understanding of certain conditions of open data utilisation.

Before studying the conditions influencing open data utilisation, these must first be positioned within a broader open data utilisation framework. Open data utilisation is not a linear process, but is contingent on a number of utilisation conditions. Depending on these settings, the behaviour of potential users towards the usage of data and expected effects of use will change. The utilisation conditions, furthermore, influence the types of open data use and the quality of the effects this use will have. For example, only high-quality data with good support can be used to develop sustainable data-driven services (Magalhaes, Roseira, & Manley, 2014). Only supportive policy and legislation can promote open data use for anti-corruption purposes (Murillo, 2015).

Furthermore, there are methodological challenges that need to be solved. The majority of the earlier studies are descriptive and rely on data

from a single country (or from a few similar countries) to describe the institutional dimensions (see exceptions: Lourenço, 2015; Murillo, 2015; Susha, Grönlund, & Janssen, 2015a). A cross-country comparative framework is required to explain the appearance of institutional dimensions in various contexts. Such a comparative framework helps to better explain the relationships between innovation implementation and institutional dimensions (Yang, 2003). Although government institutions are the main facilitators of open data implementation, non-governmental institutions also have a strong position in the implementation process. Nevertheless, the extant literature predominantly only explores governmental institutions within the institutional perspective. In general, an inclusive and comparative approach to the institutional dimensions is needed to overcome the limitations of earlier studies.

Thus far, open data literature was discovered to mainly discuss the conditions from the perspective of one or a few organizations, typically within a single country. This allows us to understand the existing challenges of open data utilisation in a specific context. However, we know very little about how the conditions that facilitate the utilisation of open data are perceived in countries with similar and different backgrounds, development levels and public administration model. To explore these research gaps, this thesis centred on the following main research question:

> What conditions are associated with higher
> open government data utilisation?

This main research question is divided into 3 research questions, each of which aims to clarify the three gaps in the literature discussed above:

RQ1 | What are the factors and categories of open government data utilisation and how are they connected?

The aim of this question is to establish theoretical clarity on the concept of "open data utilisation" and its components. Although there is consensus on the benefits of open data utilisation, the conceptual clarity regarding the framework of open data utilisation is incomplete. It is uncertain how the components of open data utilisation are connected. The absence of a widely accepted understanding of open data utilisation

makes it difficult to evaluate the conditions that determine open data reuse. The first research question is explored in Chapter 2. Subsequent chapters bear relevance to this question by expanding our knowledge about open data utilisation conditions in different settings.

RQ2 | How do institutional dimensions impact open government data implementation?

Establishing an institutional basis for open data implementation is deemed an effective approach to maintain the sustainability of the implementation and to accelerate open data reuse. While the institutions are considered to be significant stakeholders in ensuring the sustainability of open data implementation, the institutional dimensions influencing this and the way these dimensions impact on open data implementation remain underexplored. This research question is answered by first framing the institutional dimensions and then testing this framework within the context of developed countries (Chapter 3) and transition countries (Chapter 4) separately.

RQ3 | To what extent do national-level factors of countries explain differences in open government data adoption?

This research question aims to extend our in-depth understanding of the national-level factors that have an impact on open data adoption. Only when it is understood which factors behave as drivers of or barriers to open data adoption will governments and organisations be able to effectively customise an adoption strategy tailored to fit these fundamental conditions rather than merely replicating best-performing cases. In Chapter 5, this question is examined in close detail, in the light of the three groups derived from the literature review: capacity factors (economic and technological), societal and governance factors.

1.5. Research objective and strategy

The previous sections emphasised the importance of gaining a complete picture of the conditions influencing open data implementation and adoption, because:

- Open data has significant potential to generate social, economic and governance value.
- Governments and governmental institutions worldwide have stated their aim to implement open data in order to achieve a higher level of open data utilisation.
- Open data utilisation strongly depends on social and technical conditions which increase or decrease the potential for open data to generate the anticipated value.
- Social conditions have robust institutional roots which determine the quality and sustainability of open data implementation.
- Without considering the fundamental national-level conditions, open data adoption may fail and not reach the expected goals.

Thus, the objective of this book is:

> To determine the conditions that have an impact on the utilisation of open government data with a focus on institutional dimensions of open government data implementation and fundamental factors of open government data adoption on the national scale.

To achieve this research objective, this study first determined the conditions that affect the realisation of open data use. This research studies the conditions for open data utilisation and investigates their relation to this. The main thrust of the research was to uncover the deterrents to the utilisation of open data by explaining the conditions that influence its use. The research strategy and subject have been derived from the practical question that developed as a consequence of the problem of the limited realization of the potential of open data. This problem in the utilisation of open data could be characterised as the lack of a systematic approach to several facilitating conditions, despite acknowledging the need for and releasing public data.

The systematic literature review served to provide an understanding of open data utilisation in general and to identify the conditions that facilitate or hamper open data use, in particular. Some 101 academic studies discussing one or more factors of open data utilisation were analysed within the scope of the literature review. The review offered general insights into the utilisation of open data, from which an initial

overview of the influencing conditions could be obtained. Certainly, the results of the literature review showed that the utilisation of open data depends on various social and technical conditions. The open data literature and preliminary observations of national experiences demonstrated the strong deterministic role of social conditions, which subsequently led to an investigation of the impact of social conditions on open data implementation.

To investigate this relationship, a theoretical framework was developed to better understand these social conditions. The literature on social conditions showed that such conditions are more stable and sustainable if they are maintained and coordinated by institutions rather than individual initiatives. That is the reason why this study also explored the extent to which institutional dimensions could explain technical conditions. To comparatively test the role of institutional dimensions, the three best-performing countries in terms of open data practices were selected; 32 expert interviews were conducted and document analysis was carried out to understand the performance of various institutional dimensions and their role in the open data implementation.

The majority of open data studies reviewed were focussed on Western, democratic and developed societies. However, it is nearly impossible to generalise the research results of a study performed in the Netherlands, Sweden or the UK to non-Western European countries that are undemocratic or less developed. With that in mind, a group of developing countries which are known to be undergoing a process of significant transformation in public administration, economic model and throughout society, was selected to test the same theoretical framework. These countries - Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine - are collectively referred to as the Eastern Partnership countries (EaP). EaP is a mutual initiative of the European Union and six neighbouring and post-Soviet countries to discuss governance, economic integration and convergence with the EU. Compared to developed countries, very little academic literature, reliable sources and expert opinion are available to understand innovation adoption – and specifically, open data adoption - in these countries. Hence focus group discussions were held, comprising a total of 89 participants representing nearly every stakeholder group and aimed at

gaining an understanding of the open data practices in these countries. To increase the reliability of the data and for triangulation purposes, document analysis covering 31 legal documents and independent reports was carried out.

Studies in both the developed and the transition countries revealed that there are additional fundamental factors, next to the institutional dimensions, that determine the performance of open data adoption. These fundamental factors are not covered in the open data literature although they have been well-studied in the fields of e-government and innovation adoption. Using this available knowledge from close fields such as e-government, open government and innovation adoption, the initial theoretical framework is proposed in the fifth chapter of this thesis. The fundamental determinants, such as economic and technological capacity, societal and governance factors were then tested by employing quantitative research methods using data covering 115 countries.

In sum, to ensure the reliability of the research results, credible and well-reported data collection and analysis methods were used throughout the study. In pursuit of a holistic view, not only developed countries, but also developing countries were investigated, in order to gain insight into the specific conditions determining the performance of open data implementation. Expert interviews and focus group discussions were formulated such as to be as inclusive as possible. The results not only yield a descriptive overview of the countries and their open data practices but also allow the similarities and differences between the countries to be identified. Likewise, the most reliable data sources were used for the quantitative study, which aimed to deliver an understanding of the fundamental factors. Various statistical measures were considered in the inclusion/exclusion of variables and interpretation of the results.

1.6. Dissertation outline and reader's guide

To achieve the objective of this research, this dissertation is structured in the following manner. To gain insight into the utilisation of open data, Chapter 2 explores the extant literature to clarify our understanding of

open data users, types, conditions and effects. As the discussion of these factors was found to be fragmented, a framework combining all factors was required to be constructed. Based on the conditions identified within the open data utilisation framework, in Chapter 3, a theoretical outline has been provided that extends the understanding of these conditions from the institutional perspective. The theoretical framework was subsequently tested within the context of a group of developed and a group of transition countries.

The results of the tests are presented in Chapter 3 and 4. In Chapter 3, the countries with developed western economies, although with different public administration models and centralization in open data adoption practices are discussed. Chapter 4, on the other hand, explores the transition countries: countries sharing a similar historical background but with varying maturity levels in terms of democratic institutions and experience with open data adoption.

Moreover, different methodological approaches were adopted in Chapter 3 and 4, in view of the differences in the availability and reliability of data. Within the context of the developed countries, expert interviews were conducted in addition to the use of extensive document analysis. Next to the 31 documents from the selected transition countries, focus group discussions were held in which 89 participants took part. These focus group discussions were helpful to cross-check facts and opinions with different open data stakeholders. Furthermore, these discussions proved a good way to compensate the dearth of information and the sometimes over-optimistic official reports and documents in the transition countries, to enable a more realistic overview of open data implementation and the position of institutional dimensions to be depicted.

In the following chapters, the national characteristics of countries and their impact on open data adoption are discussed. Hence, data from more than a hundred countries have been used in Chapter 5 to quantitatively explore capacity, social and governance factors in open data adoption. This is the first study to explore fundamental conditions such as the level of democracy, economic capacity, human capital in the context of open data and helps to explain why some countries perform better than others in terms of open data adoption.

Chapter 6 is the final part of the dissertation and it is here that the results of the foregoing studies are discussed. In this chapter, the primary patterns in the impact of conditions on open data are explored. First, the open data utilisation framework and the role of institutional dimensions in developed and transition countries are comparatively presented. Then, the findings regarding the national characteristics that determine open data adoption are discussed. The chapter concludes with an elaboration of the academic and practical contribution of the results of this research.

Ch	Title	RQ	Theoretical work	Empirical work	National focus	Article status
1	Introduction		Introduction of the study			
2	Utilisation of open government data: A systematic literature review of types, conditions, effects and users	1	Based on a systematic literature review, building an open data utilisation framework and its factors			Published in Information Polity (2017)
3	Institutional Dimensions of Open Government Data Implementation: Evidence from the Netherlands, Sweden, and the UK	2	Building a theoretical framework for understanding institutional dimensions.	The explorative study, document analysis and qualitative interviews with open data experts.	Developed countries (the Netherlands, UK and Sweden)	Published in Public Performance and Management Review (2018)
4	The role of institutions in Open Government Data implementation: Evidence from transition countries	2	Building a theoretical framework for understanding institutional dimensions and the context of transition countries.	The explorative study, document analysis and focus group discussions with open data experts and stakeholders.	Transition countries (6 EaP countries)	Under review
5	Determinants of open data adoption: An empirical cross-national study	3	Based on open data and innovations literature, building	Quantitative research with Open Data Barometer data	International (115 countries)	Under review

		a theoretical framework for explaining open data adoption.	and 7 independent variables
6	Conclusion	Answering research questions, discussing the conclusions	

Figure 1. Outline of the dissertation

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CHAPTER 2

Chapter 2. Utilization of Open Government Data: A Systematic Literature Review of types, conditions, effects and users

ABSTRACT

This paper presents a comprehensive overview of the literature on the types, effects, conditions and user of Open Government Data (OGD). The review analyses 101 academic studies about OGD which discuss at least one of the four factors of OGD utilization: the different types of utilization, the effects of utilization, the key conditions, and the different users. Our analysis shows that the majority of studies focus on the OGD provisions while assuming, but not empirically testing, various forms of utilization. The paper synthesizes the hypothesized relations in a multi-dimensional framework of OGD utilization. Based on the framework we suggest four future directions for research: 1) investigate the link between type of utilization and type of users (e.g. journalists, citizens) 2) investigate the link between type of user and type of effect (e.g. societal, economic and good governance benefits) 3) investigate the conditions that moderate OGD effects (e.g. policy, data quality) and 4) establishing a causal link between utilization and OGD outcomes.

1. Introduction

Open government data has attracted much attention in recent years, becoming part of the everyday lexicon of transparency activists, NGOs, and public officials. An increasing number of academic studies focus on Open Government Data (OGD) initiatives and policy-making in order to explain differences in OGD provisions among various government organizations [1]–[3]. Indeed, there has been considerable scholarly attention devoted to OGD and its provision by governments [4].

However, numerous OGD studies highlighted that a key problem of OGD lies not so much in its disclosure, but in its usage, and – more precisely – the lack of OGD use [5]–[9]. In recent years, many scholars have therefore sought to understand what determines OGD usage and what conditions are necessary [3], [10], [11]. As a result of this surge in academic attention on OGD usage, a systematic and comprehensive overview of what we know about OGD utilization is lacking.

There have been two recent systematic literature reviews on OGD. Attard, Orlandi, Scerri, & Auer [4] aim to assess OGD initiatives and describe the life-cycle of OGD. Attard et al. [4] focus predominantly on the provision of public data, thus focusing on the supply side of OGD. Hossain, Dwivedi, & Rana [12] conducted a comprehensive systematic review about the insights from extant studies and provide a research agenda for future studies. This study presents the classification of context, perspectives, research methods, benefits and barriers of open data and information about publications.

Both literature reviews provide important insights about the current state-of-the-art in OGD research. However, these studies have a broad aim and do not specifically focus on the utilization of OGD. As we noted, the latter is particularly important because in practice OGD is barely used and a better understanding is needed to improve this.

Another study, while it is not a pure systematic review, is targeted to provide a taxonomy of OGD research areas [13]. This study provides 35 research areas of OGD including the summary of research literature and research objectives. Charalabidis et al. [13] highlight the importance and relevance of OGD usage and value as a research area which is very supportive for our study. Comparing the mentioned reviews, our study

focuses only the papers about the public open data specifically utilization of OGD.

We will discuss the literature in four broad categories: the types of OGD utilization, the subsequent effects, the contextual conditions moderating these effects, and the user groups of OGD[3]. These four categories were chosen because it aligns with an often made distinction in technology acceptance models, which have been widely used and tested (e.g. [14], [15]). Although these categories are predetermined, the content of these categories is not and will emerge from the literature itself. Thus the objective of this paper is to present a comprehensive overview of what the academic literature has found on 1) the types of OGD utilization 2) effects of OGD usage 3) condition that moderate these effects and 4) who are identified as users.

The *type of utilization* covers the various ways in which practitioners employ OGD. For instance, open data can be utilized as a research tool [16], in hackathons [17], [18], or in data analytics [8], [19]. It is important to analyze these types according to how they influence the effects of OGD. The *effects* constitute the second part of our review. OGD has the potential to contribute to an array of (positive) outcomes, for example, transparency [20], accountability [21], or as a source of innovation [22]–[24]. The third topic in the review is the *moderating conditions*. For instance, research has indicated that the potential impact of OGD usage may be moderated by various conditions, such as low data quality [25], [26] or legal barriers [27], [28]. The fourth and final factor that we take into account is the *users*. Many studies have highlighted users' roles and participation in the OGD value-extraction process, defining different user groups, such as developers [28], citizens [29]–[31], activists, and NGOs [32], [33].

The contribution of this systematic literature review is twofold. First, it provides an overview of the current OGD research focusing on the utilisation of OGD. Second, our objective is to synthesize the current body of knowledge by developing a multi-dimensional framework of

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[3] This also means the systematic literature review will not include *all* literature on OGD, only the literature that discusses various factors of OGD utilization.

OGD utilization and use this framework as basis to present suggestions for future research.

This article presents a systematic analysis of both tested and hypothesized relations in order to develop a multi-dimensional framework of OGD utilization. This framework opens up the black box of OGD utilization by identifying various patterns of usage, user groups, contextual conditions, and effects. The article begins by outlining our review methodology, after which we present the descriptive results of the review in the descriptive analysis section. Descriptive analysis presents year of publications and its dynamics, the countries that the articles dedicated, diversity of methodologies and other descriptive aspects of selected studies. Next, we discuss thematic analysis in which each factor of OGD utilization is handled and elements of factors are discussed. The review continues by synthesizing findings into an OGD utilization framework and discussing avenues for further OGD utilization research in the "Synthesis and discussion" section. Finally, we discuss conclusion and research limitations at the end of the review."

2. Methodology

In order to analyse the existing knowledge, we conducted a systematic literature review based on the established procedures [34]–[36]. The design of the literature review consisted of a systematic collection of articles for the review, a systematic analysis of these articles and a systematic synthesis of these findings (see Figure 1 below).
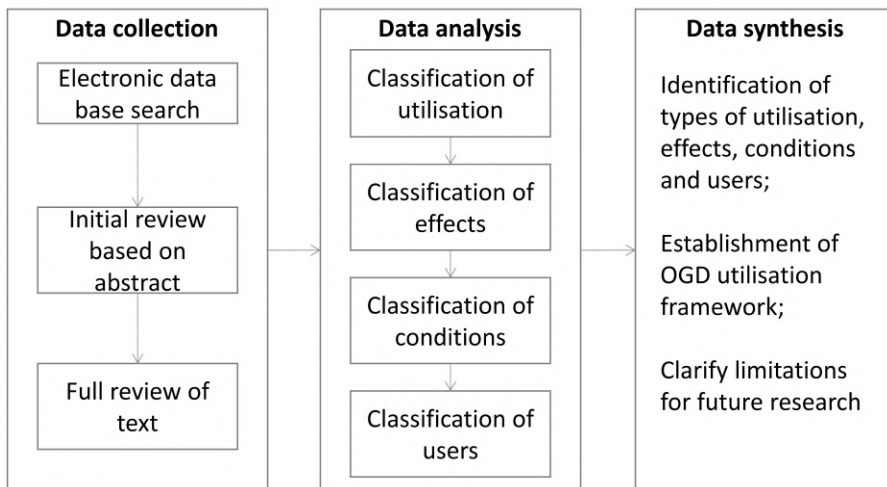
Figure 1 General research design

Data collection. To explore the heterogeneous literature in the field of OGD, the following bibliographic databases were searched:

- www.scopus.com – Scopus database;
- apps.webofknowledge.com – Web of Science database maintained by Thomson Reuters;
- dl.acm.org – Association for Computing Machinery database;
- www.sciencedirect.com – ScienceDirect database maintained by Elsevier[4].
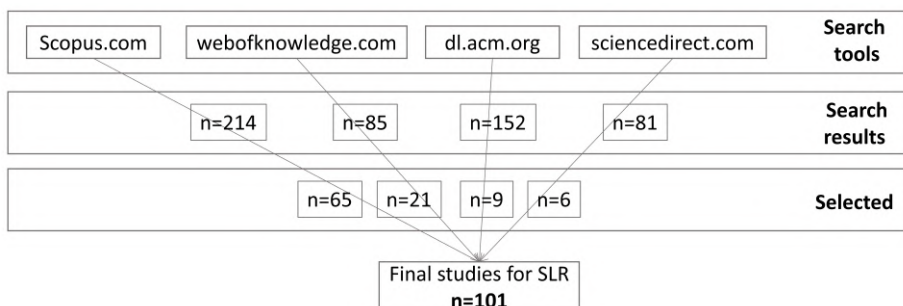
Figure 2 Selected primary studies

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[4] We carried out an additional search on Google Scholar to search for articles containing the keywords "open government data". The search results on "Google Scholar" were very similar to our primary search results or did not meet the requirements of inclusion.

The searching of the studies was conducted from 1st December 2015 to 21st January, 2016. Since the same article can be reached through various scientific databases, the majority of selected studies (n=65) was retrieved from the first used database (Scopus). The terms "open government data" and "open data" were used as keywords to search each database in the title, abstract and keywords of articles. However, "open data" has not been used as a separate search keyword to keep the search results in the frame of public or government based open data.

Selection criteria. We attempted to reduce the risk of bias because of data (study) collection by implementing clear exclusion and inclusion criteria. the following inclusion criteria were used in our review.

1. We only considered the peer-reviewed articles that were written in English language.

2. Only open government data studies were included in the review thus we excluded studies regarding open science data, open data from NGOs and international organizations.

3. We included studies that regarded one or more dimensions of utilization: types, effects, conditions and users. Studies that regarded open government data in general, without mentioning these dimensions were excluded.

The types of utilization refer to the use and re-use of OGD for a particular purpose, typically as a field of study or practice. *Effects* refer to the potential results and outcomes of OGD utilization from social, economic or good governance perspectives. *Conditions* refer to the environmental features or aspects of overall OGD utilization functioning as technical, social or political paradigms of public data usability. The fourth factor of OGD utilization is *users,* which describe individuals or groups that use public data for achieving the targeted effects and gaining value mostly in the form of product, advantage or practice. Each selected study was added a data extraction form in Excel to summarize information about publication, research method, research question, abstract and results, utilization, effects, conditions, users, research domain and research country.

Data synthesis. Based on the data extraction form, main trends and elements were determined for each factor of OGD utilization. All elements were grouped and classified regarding their most common characteristics to understand better the overall picture of OGD utilization. In the final stage, the factors, elements and their classification were depicted on the unified OGD utilization framework including connections between factors.

3. Descriptive analysis

This study analyses 101 academic articles about Open Government Data (OGD) in order to identify what is known about different types of utilization, the effects of utilization, the key conditions, and the different user groups. For the purposes of a systematic literature review, we categorized studies based on the country where the study was conducted. The collected literature shows that OGD-related studies are primarily conducted in developed countries. Only a couple of studies are devoted to developing countries, such as Brazil, India, Chile, Mexico, Russia, and Romania, and regions, such as the Middle East and Latin America. The most researched countries are the Netherlands (12), the United States (11), and the United Kingdom (6), which indicates that scholars from these countries contribute significantly to the field of study. Several studies investigate and compare two or more countries, such as Sweden and the Netherlands [22]; the European Union [1], [37]–[39]; the Netherlands and Brazil [40]; the Netherlands and Greece [41]; and, Australia, Canada, France, New Zealand, Singapore, the UK, and the US [2].

Figure 3 shows that there is a predominant focus on the USA and the Netherlands. This means that findings on OGD utilization are mainly found in two countries with strongly developed economies and longstanding democratic tradition. More research from a more diverse set of countries is needed to see if current insights about OGD hold in different institutional contexts.
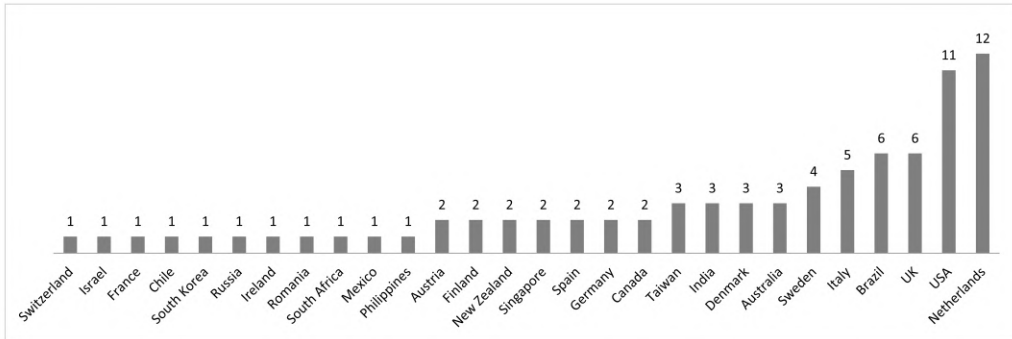
Figure 3. Number of articles by country

Next, we analysed the publication trends of open data over time. Figure 4 illustrates the rapid increase of academic publications about OGD in the last five years. Remarkably, more than one-third of selected studies were published in 2015 (39 articles), whereas no articles were found from before 2010. This finding is in line with OGD's rising popularity in public policy following the declaration of OGD principles by advocates in 2008 [42] and the publication of the first Open Government National Action Plan of the United States in 2011. As governments began investing increasingly in open data infrastructure, funds to study those investments seem to have followed. This dramatic increase also indicates the need for a more systematic overview and research agenda.
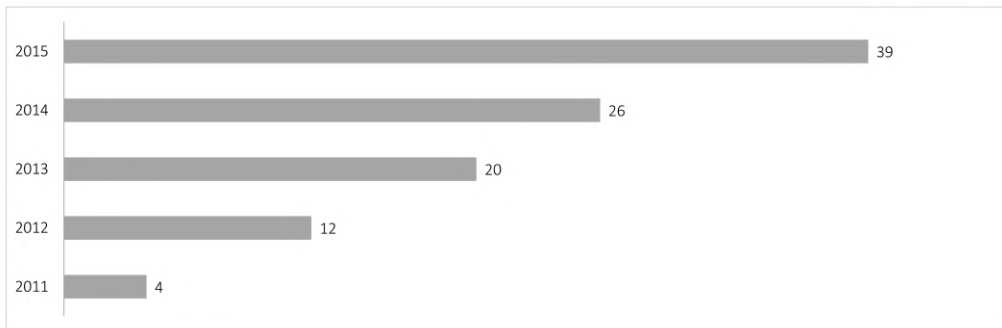
Figure 4. Number of selected studies by year

Further evidence for the growing popularity of OGD is the distribution of studies published in journals and presented at conferences. A breakdown of the relevant studies is provided in Table 1. This table shows that OGD research is mainly published in journals related with e-

government and information science in general. Interestingly, a great deal of papers was published in official conference proceedings and not in journals. This may be due to the youngness of the field; it takes a relatively long time to get article published in journals. Furthermore, we also found many thematic journals that published articles about OGD, such as *Journal of Public Transportation* and *Journal of Public Health Management and Practice*, etc., that publish OGD-related studies (Table 1). This implies that OGD research is quite dispersed over various disciplines, such as public administration and information science and that it is a nascent field with many publications in conference proceedings.

Name of journal	Number
Lecture Notes in Computer Science (LNCS) - Springer	14
Government Information Quarterly	11
International Conference on Theory and Practice of Electronic Governance	7
Information Polity	7
Journal of Theoretical and Applied Electronic Commerce Research	5
Social Science Computer Review	5
Hawaii International Conference on System Science	4
International Conference on Digital Government Research	3

Table 1. Sources of studies

The variety of publication outlets also resonates with the diversity of methodologies used to study the topic. The majority of the studies are qualitative (76), while only 25 out of 101 are quantitative. Four studies combined both qualitative and quantitative methods. Taking into account that the studies used a broad range of methodologies, those were coded and generalized in order to clarify and group standard methods. Thus, we found that the selected studies mostly adopted case studies (54), desk research, which was primarily used to investigate OGD portals (14), literature reviews (13), document analysis (12), surveys (12), and interviews (7) to investigate the targeted areas. The imbalance between qualitative and quantitative studies indicates that there may be room for more quantitative studies on OGD.

4. Thematic analysis

4.1. The types of utilization

We found 70 articles that discussed one or more types of OGD utilization. The reviewed literature revealed that there are many types of utilization. Some types of utilization were very broad, such as innovation and decision-making, while others were very specific, such as creating new stories from data, informal settlement analysis, or climate change research. Figure 5 lists the types of utilization that were mentioned in at least three different studies.
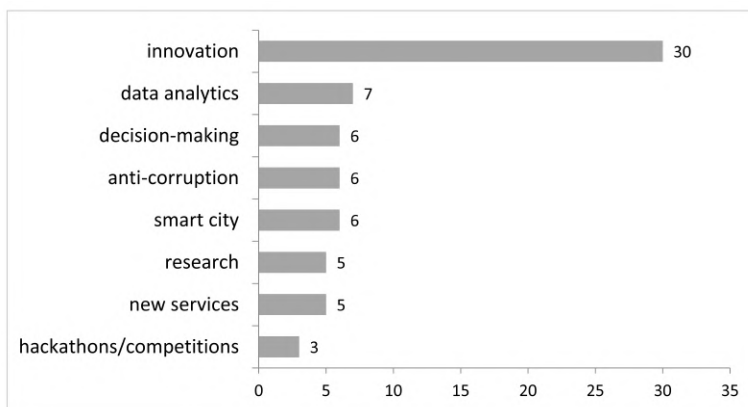
Figure 5. Number of articles on the types of utilization

Innovation. Figure 5 highlights innovation as the most prominent type of OGD utilization in the selected studies. The literature mentions various types of innovation, such as business-driven innovation for the purposes of generating economic value [24] and innovation spurred by citizens to co-produce public services [21]. In addition, according to the literature, a lack of public data sharing significantly decreases innovativeness, hinders entrepreneurial incentives, and prevents the execution of many new business and Internet start-up plans [43]. In this paper, we included "innovation" as a type of utilization rather than as an effect of utilization. We acknowledge that, in some cases, innovation can be an outcome or effect of OGD utilization, in this paper, innovation is seen as an intermediary variable that generates a broader effect, such as economic gain or societal value. Therefore, we consider using OGD for innovation as a type of utilization itself (using it for innovative purposes) and not an effect, as we conceptualize effects more broadly.

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Data analytics. Data analytics allow users to utilize released public data more productively—for instance, to create visualizations that are important for discovering and understanding complex datasets [44]. According to the literature, the development of big data analytics in the public sector may offer opportunities for predictions and forecasting by combining and analysing government data [19], [28]. Furthermore, several studies investigate data analytics as a tool for different fields of study, including utilizing transportation data for public transportation services [8], conducting environmental impact analysis [45], and studying early childhood development [46].

Decision-making. Quality of decision-making partly depends on available data, which is rapidly transforming with the implementation of digital tools, such as big data and machine learning. Power, Robinson, Rudd, & Reeson [47] argue that decision-making possibilities have been improved through the wide variety of OGD available to key decision makers, experts, and non-experts, including members of local communities. OGD can contribute to decision-making processes in very diverse ways. It can improve participatory decision-making [48] real-time transparency of decision-making [9] and enable data-driven decision-making in the planning process [49].

Anti-corruption. Promoting anti-corruption and the effective use of public resources are seen as dominant reasons for releasing public data. A lack of information can lead to corruption, and OGD can be a powerful tool to increase awareness while reducing the misuse and waste of economic resources due to corruption [11], [50]. . However, most of the released public datasets on the OGD portals seem less relevant in terms of utilizing them for anti-corruption purposes, which decreases opportunities to achieve OGD's anti-corruption possibilities [41], [51].

Smart city. Smart use of technologies is key for enabling urban populations and stakeholders to participate in and collaborate on urban management to become a 'smart city' [37]. Bakici, Almirall, & Wareham [52] argue that OGD is a main component of smart cities, which also include smart districts, living labs, initiatives, electronic services, and additional infrastructure that enable the dynamic generation of new ideas through the utilization of released public data. Spatial open data infrastructure, which is a core type of open data for smart cities, may

improve urban management [53]. Furthermore Chakraborty, Wilson, Sarraf, & Jana [49] suggest that a lack of reliable open urban data can negatively impact urban planning and implementation.

New services. Service creation over OGD is mostly associated with innovations and smart city. However, some new services cannot be considered innovative while those services are new as an approach or a location. OGD also can be utilized to extend existing services, increase number of functionalities and quality of services. Geographic information and postcode data can be a resource for improving existing classic services [43]. Service creation based on OGD is in the early stages of its development which Chan [54] notes that competitions and increasing awareness are the important factors to extend the participation of users.

Research. Planning and predicting the potential directions of OGD utilization, particularly in the research areas are very difficult. OGD allows a researcher to combine his/her internally collected data and public data in order to test and confirm new hypotheses [25]. OGD can be utilized for various academic studies such as unemployment research combining UK election data and non-government open data [25] for ecological research combining data on the number of trees (OGD) and open street maps (non-government open data) [55] and many other fields of research. Martin et al. [16] consider the researchers as a part of the open data ecosystem and argue that there is less awareness of open data among researchers.

Hackathons/competitions. Hackathons and competitions are considered a type of utilization to create value from released public data. Hackathons are events which focus on developers and mostly other information technology related stakeholders to work in partnership on a specific domain or project. Matheus et al. [17] emphasize the importance of contests and hackathons to develop applications for social control, transparency and improvement of public policies in healthcare, transportation, education and etc. Hackathons are also suggested as a significant component of open innovation strategy to spur citizen engagement, to seek new ideas and improve awareness for utilization of OGD [54]. While civic hackathons have a positive impact on

citizen participation, limited adoption of the results may decrease their effect, thus pursuing and maintaining the outcomes are important [18].

4.2. Effects of OGD utilization

We found 83 articles that considered one or more effects of OGD. According to the literature, OGD utilization has diverse effects, mostly related to generating social and economic value and achieving good governance. Thematic analysis of selected studies revealed six prominent effects, which were determined to be so due their occurrence in at least three studies:
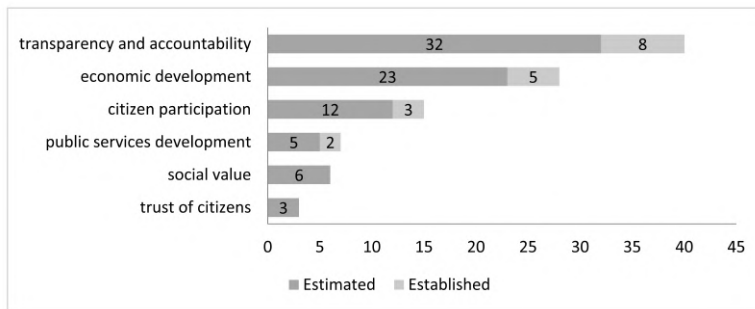
Figure 6. Number of articles on effects

Figure 6 highlights the important difference between 'estimated' and 'established' effects. Not all studies that discuss effects employ empirically verified approaches. In addition, some articles are not intended to confirm or cannot empirically confirm a solid connection between OGD utilization and the discussed effects. In this regard, the effects can be classified either as established effects or estimated effects. If the study empirically proved the effect of OGD, it is considered an 'established effect', while hypothetical consideration and assumed effects are considered 'estimated effects'. Among 83 articles that discuss one or more effects of OGD utilization, 19 studies' approaches to the effects were classified as established, while 64 out of 83 studies were classified as estimated.

According to this distinction, only one-fifth of the selected articles indicated one or more established effects of OGD utilization. Nevertheless, the majority of studies either do not discuss OGD utilization effects at all, or they estimate the potential effects of OGD utilization. As is clear from the reviewed literature, while OGD has gained

extensive popularity with the recent establishment of many public data portals, Empirical studies have yet to fully validate the potential effects of OGD utilization. A total of 40 studies considered transparency and accountability as effects of the release and the utilization of OGD. Economic development and citizen participation are the next most mentioned effects of OGD utilization.

Transparency and accountability. Transparency and accountability are the core expected effects of all OGD initiatives, regardless of the scope, government organization, and type of data. OGD can be considered an important component of so-called computer-mediated transparency [56]. Releasing public data decreases information asymmetry and thus increases transparency and accountability [57]. Moreover, the creation of modern tools based on OGD [58] promotes the utilization of public data by civil society, which increases transparency, accountability, and government efficiency by enabling citizens to collaborate with the government to tackle threats against public interests [59]. However, increasing transparency and accountability is not an immediate result of releasing public data. These outcomes require the fulfillment of many preconditions. For instance, the data that is released must be relevant, and data analytics skills and awareness must be increased. Murillo [51] argues that although a moderate number of datasets relevant to achieving transparency have been released, thus their contribution to openness is limited regarding to provide relevant data.

Economic development. Generally, economic development is perceived as quality and prosperity improvements realized by innovation, diminishing transaction costs and the utilization of proficiencies toward realization of new goods and services which positions the economy on a rising growth trend [60, p. 12]. A main driver for national governments' to release datasets is economic development [61]. Availability of public data creates opportunity for citizens to conduct social control, suggest developments of public services thus achieve local economic development [33]. The contribution of OGD to the economic development is mostly related to the establishment of new business, [23] and using OGD for anti-corruption purposes to reduce the economic loss, hence lead to social and economic development [50]. Moreover, OGD may contribute to information markets, which consequently

enhance economic growth and efficiency [43]. However, several studies highlight that open data utilization by private sector is in the initial stage of its development and does not necessarily effect on the creation of economic value, thus economic outcome is uncertain [22], [61].

Citizen participation. According to the UN World Public Sector Report 2008, the notion of citizen participation, which strongly correlates with good governance, is the participation of citizens in policymaking, including levels of service, budget, and adjusting government programs toward community needs and building public support [62]. Openness is considered a strong determinant for participation by citizens and other stakeholders which is fundamental subject in the studies of public administration [63]. OGD initiatives and utilization of public data can decrease the citizen participation barrier and encourage political participation by providing indirect channels into government activities [27]. M. Janssen et al. [64] discuss citizen participation and self-empowerment as one of the political and social benefits of open public data. Achieving better results with citizen participation will essentially be determined by the prerequisites, like specific abilities and skills of the citizens [37] which is discussed more broadly as an utilization condition in the next section.

Public service development. New public services based on OGD either appears as an innovation building new services or functional improvement of existing services. The important contribution of OGD to the public services as regulations, procedures and standards is a common subject in the literature, emphasizing its capability to foster the quality of services. By means of information openness, government bodies are expected to deliver more cohesive, precise and innovative services to the citizens [65]. To improve the public administration and the outcomes, OGD can be utilized for public service development creating synergy with citizen participation on policy and service creation [66]. New public services based on OGD created by citizens increase cooperation between government and community with real social innovation [52]. Public service development is discussed as an estimated effect of OGD utilization in the literature with strong expectations by scholars for improving quality and effectiveness of public services. However, public bodies less willingly support OGD initiatives with

assumption that released data might be utilized to establish better service applications than existing tools that the government provides [65].

Social value. Although the reviewed literature predominantly discusses social value as an estimated effect of OGD utilization, there are enormous expectations on OGD for obtaining more social value with effective utilization of public data. Consequently, social value is one of the primary driving factors of OGD initiatives by governments and utilization by society members [22]. Broad aspects of social value generation are discussed in the literature as an effect of OGD utilization such as social control for efficiency of public services [17], social innovation for innovative solutions of social problems in cities [52], increase citizen interaction with government for solving local problems [28] or social value from better transportation, health care, education and etc. However, getting better results are strongly depended on the elimination of disabling conditions of OGD utilization regarding institutional issues, user participation, legislation and technical issues [64].

Trust of citizens. Social and political trust of citizens in government is considered an important potential effect of increased government openness [67]. While trust is widely studied subject in political science and public administration, only three OGD related studies discuss trust of citizens as a social and political benefits of OGD. There is insufficient empirical verification for utilization - effect relationship between OGD and trust of citizens, thus trust is an estimated effect of OGD utilization. The trust of citizens effect can only be achieved under severe circumstances associated with quality of released data, including the completeness of datasets, accuracy and reliability of OGD that has been collected in a reliable record management conditions [68]. Depending on complexity and preconditions, OGD might not create trust in government, even cause negative consequences and bad experiences [64]. Consequently, transparency and data openness can be considered supportive effect for improvement of citizen trust [69].

4.3. Conditions of OGD utilization

With respect to the types of utilization and the effects, conditions are a central phenomenon of OGD utilization. They not only impact the enhancement of effects, but they also increase the possibilities of utilization. Not surprisingly, the most discussed condition for the use and re-use of OGD resources is the quality of data, which is followed by legislation/policy, skills, and infrastructure.
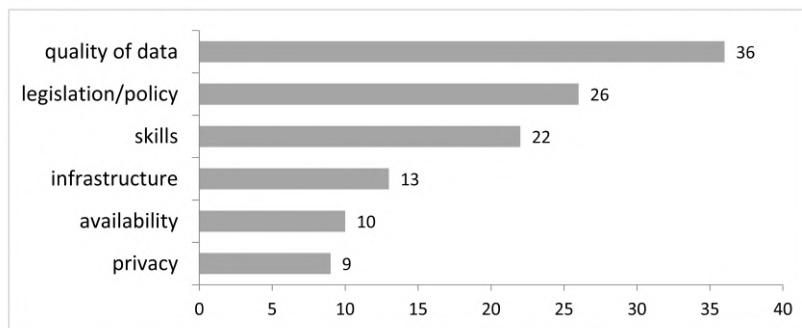
Figure 7. Number of articles on conditions

The relationships between the utilization of OGD and the acquired effects are not a simply "drag and drop". Instead, they require many technological and social pre/post-conditions to be accomplished that may either enable or disable the utilization process. According to our observations, 77 studies discussed at least one or several conditions that impact the utilization of released public data. Some conditions cover very broad aspects of OGD and are discussed in only one study. These include open innovation strategies [54], information policy [1], open data ecosystems [16], organizational culture and leadership [31], or organizational support [45]. The conditions that directly influence OGD utilization and are discussed in three or more studies are listed below.

Quality of data. Nearly 36 studies mention one or several parameters of data quality that have impact on use and re-use of public data. In this regard, there are strong theoretical arguments that quality of data is prerequisite for obtaining better effects from OGD initiatives and utilization. Potential users and user groups cannot anticipate the expected benefits that can be achieved, thus users may be unwilling to utilize OGD if data quality is low [70]. Data quality is a complex and multidimensional concept. The literature generally identifies timeliness

[4], availability of metadata [71], accuracy [72] and usefulness [2] as key components of data quality. In this regard, quality assurance might be a useful mechanism to increase effects of utilization and hamper problems regarding OGD utilization [2].

Legislation/policy. Legislation and policy is the most often mentioned condition alongside data quality [65]. Like all other conditions, legislation and policy can either spur or hamper both the types of utilization and effects of OGD utilization. Freedom of Information (FOI) legislation is an important legal backbone and fundamental to enable and enhance OGD implementation and can reduce resistance of public bodies to opening up government data [20], [39]. Development of a legal framework is considered one of the main requirements for further development of OGD initiatives, along with political data publication, data standards and targeting stakeholders' interests [27]. However, legislation and policies are not always supportive for opening up government data. Rather frequently, it is considered as a barrier for building more resilient OGD initiatives. Particularly, legislative barriers and shortcomings regarding data protection and funding models need to be solved for opening up more public data and utilize them without any impediment [31]. Consequently, a clear and harmonized legal framework is needed to regulate the relationship and eliminate ambiguities between copyright, privacy, personal data and data openness to achieve the full potential of OGD [39].

Skills. To be able to use OGD, technical skills and knowledge about data is needed, such as knowledge about statistics or programming. ICT literacy is considered to be a more significant conditions than financial and other resources in order to establish an innovation by utilizing OGD [22]. Graves & Hendler [44] argue that whether important group of users, such as journalists and activists – want to obtain benefits from public data, lack of fundamental skills and expertise regarding data management, data visualization and data operations hamper getting value and creating positive effects by utilizing OGD. Open data focused research centers, think tanks and innovation incubators (e.g. Open Data Institute, Open Knowledge Foundation) have a significant role in development of required skills and expertise and supporting innovations creation processes and businesses using OGD [22].

Infrastructure. The increasing data generation requires infrastructure that facilitate data exchange between government bodies and users, such as software for data analytics and discovery and web-based platforms [24]. OGD infrastructure has specific requirements and capabilities to address the challenges regarding public data sharing and utilization. For instance, OGD infrastructures need to integrate various technologies, analysis techniques and information architectures to support user requirements by using generic or specialized open data platforms [72], [73]. Particularly, feedback mechanisms between supplier and users [9], [74] and data processing capabilities [75] are the vital features of OGD infrastructure which have strong impact on the utilization of OGD.

Availability. Availability of public data is essential element or pre-condition for the value chain of data-driven innovation and OGD utilization [22]. A variety of available public data helps users to combine and link diverse datasets for processing and answering questions that were not possible with a single source and dataset [76]. Availability is considered one of the strongest enabling factors for data-driven innovation which is believed to be the cause the social and economic value generation [24]. Availability of OGD is considered to be a necessary, yet not a sufficient condition for OGD utilization, because this requires the fulfillment of many other conditions, like skills and technical knowledge, public awareness and quality of data, to achieve or increase the expected effects of OGD utilization.

Privacy. Elimination of private-sensitive data and other attributes may cause privacy breaches is the first phase of data preparation for publicly releasing [69]. Complying the data protection legislation appears to be concerned over how public data be anonymized and which parts of data be released [28]. Privacy and confidentiality, copyright and misuse of data are considered foremost possible threats for government decision-makers to freely release public data [10]. As a result, data policies regarding OGD should address privacy issues upfront, including not publishing national security related data and to ensure the compliance of confidentiality and privacy guidelines [72].

4.4. Users of OGD

A systematic approach to understanding the OGD utilization process by investigating users is particularly important because of their purpose on data usage and because they are consumers of utilization effects. Generally, 82 studies noted one or many user groups that utilize OGD. Since the goal of this review is to investigate direct (directly utilizing OGD) and indirect (consuming effects of OGD utilization) users, eight type of users and user groups were extracted. Each of these was discussed in three or more studies. Generally, the users can be divided into two broad groups: revenue-driven service developers and companies; and public-value-oriented users encompassing journalists, researchers and citizens in general [30].
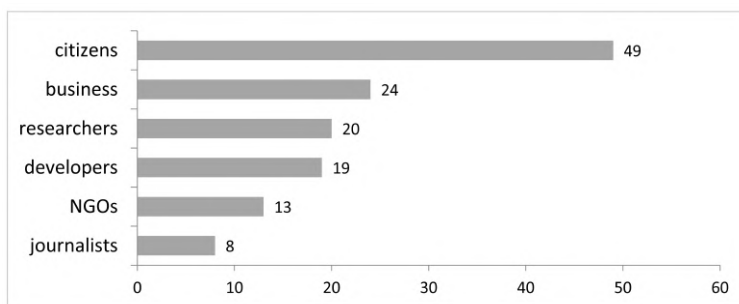
Figure 8. Number of articles on users

Nearly half of the selected articles mention citizens as users of OGD. This is primarily because citizens comprise a very broad user group and the studies are less empirically focused on a particular user group. Moreover, the reviewed literature shows that users of OGD are relatively less researched as subjects and authors. Instead, most literature merely makes estimates about users. Several articles studied users and user groups as stakeholders in an OGD ecosystem [74] or as part of the study domain [49], [77]. The next most discussed user group after citizens is the business community. In general, 6 user categories or groups were determined, with each user category having been discussed in at least 3 articles.

Citizens. Releasing government data is considered to be a key mechanism for reducing the asymmetry of information among citizens and governments bodies [51], [58]. One study identifies citizens as

primary stakeholders (along with businesses, researchers, and journalists) that are the major beneficiaries of utilization due to increased participation, which enables citizens to obtain more insight into government activities [27]. OGD allows citizens to evaluate the activities of government bodies and to take a more active part in government decision-making [78]. The most effective way to deliver public value and address a wide range of community challenges that still need to be improved is through the creation of mobile applications developed by citizens and built to utilize public data (which the author calls "citizen apps") [79]. However, Mainka et al. [80] argues that although there are limited examples of mobile applications developed by citizens, released government data does not necessarily result in the rapid spread of application development. Data analysis skills, the presentation of open data, and data exploration are critical factors for determining citizens' ability to achieve accountability, and these require affordable tools for citizens to analyse and share public data [23]. Therefore intermediary tools that demonstrate to citizens how they can use open data in familiar ways are necessary [81].

Business. As stated, users are perceived as revenue-driven and public-value driven regarding their aims to utilize public data in order that businesses and entrepreneurs are forming an important part of the first category. Susha et al. [22] emphasis that the drivers and motives behind the establishment of social innovation projects that targeted to solve social problems are different from those directing to marketable products using public data for commercial profit. Despite the practical difficulty in observing OGD utilization by business bodies (either because it is not one of the core activity of business or it is hidden under trade secrets), the rapid development of data technologies, such as data mining and data analysis, has created promising chances for research of business as a user of OGD. Very few studies focus purely on businesses as a user of OGD, yet there are exceptions. For instance, some authors discuss the development of commercial products over OGD [23], driving factors of OGD utilization by business [22], diverse business models using open data [77], OGD as a foundation for entrepreneurial innovations and start-ups [43], utilizing specific datasets for business decisions [38]. It is believed that accurate and reliable data can support businesses to utilize

those public data for better decision-making [25], [82], although this effect is not yet empirically validated.

Researchers. Researchers are mostly mentioned in combination of other users like journalists, NGOs and citizens. Graves & Hendler [44] assume that researchers and journalists may utilize OGD to investigate public policies, education system, healthcare and etc. activities of governments. Taking into account the availability of advanced data analytics tools and high professional competencies of researchers, awareness of data availability, openness and limited engagement with OGD projects are primary obstacles for utilization of data by researchers [16]. In addition, to interpret OGD, it is necessary to have precise knowledge about the context of the data. Therefore, researchers need contextual qualitative data along with OGD in order to utilize public data effectively for academic purposes [83]. Although the role of OGD in scientific studies have been less investigated, the increasing number of studies that handle specific open dataset for research purposes, can be considered decent foundation for exploring researchers as a user group of OGD utilization.

Developers. Open data developers perform significant role to encourage the adoption of OGD policies and revealing more and more datasets [28]. OGD initiatives allow developers to establish professional networks of developers to support development of universal tools and encouraging the standardization of the utilization processes of OGD [84]. According to Desouza & Bhagwatwar [79], the majority of the OGD based projects is established by developers as start-ups. Accompanied by the availability of data resources, a complementary additions, such as APIs (application program interface - containing protocols and tools for application development) are considered an essential added value for developers to establish services based on "live" public data [54]. Finally, taking into account the primary role of developers in the utilization process, research on cultural and regional features is needed to get a more comprehensive picture of the role of developers [80] and motivation of developers [85] in OGD.

NGOs. Building resilient OGD ecosystem strongly requires the involvement of NGOs such as Open Knowledge Foundation, World Wide Web Consortium (W3C), Transparency Hacker Groups or Transparency

International, which are very active on constructing guidelines, promoting discussions, pressing national governments for releasing more data and organizing events [17]. Although NGOs are estimated less primary user group comparing to business, media and citizens (particularly for open spending data), they have a professional interest and expertise for releasing and utilizing public data [86]. Additionally, collaboration and partnership mechanisms between NGOs and governments by means of contests, financial and technical supports and grants, offer more effective results [84]. Along with active role of NGOs on OGD movement as defenders, utilization of specific public data may add significant input towards realizing their activities which OGD's potential, in this regard, essentially remains unexplored [87]. Consequently, the literature has mostly discussed the promoter and campaigner role of NGOs in OGD utilization rather than as an end user of OGD.

Journalists. Journalists are a user group that are highly involved in utilization of OGD for their daily activities to conduct studies and write newspaper articles, including a visualization of public data [44]. Journalists, for instance, may integrate several datasets for bringing new insights that individuals may not be able or eager to conduct such research [7]. Moreover, along with opening up relevant public data, government policy should effort to increase motivation of data journalists and their community implementing grant programs, supports of NGOs and targeted funds to solve social problems, particularly corruption and misusing public resources [88]. The studies mostly handle the journalists as a user group along with other potential user groups without specific attention thus, some studies discuss journalists with NGOs and business [86] or journalists with other citizens [59], [81].

Finally, the summary of thematic analysis and classification are presented in the Table 2:

Factors and brief description	Num. of articles	Categories	References
	30	innovation	[22]; [33]; [23]; [44]; [24]; [37]; [28]; [90]; [55]; [54]; [61]; [115]; [9]; [74]; [84]; [52]; [48]; [79]; [112]; [38]; [40]; [18]; [88]; [100]; [81]; [21]; [53]; [105]; [58]; [80].
TYPES the use and re-use of OGD for a particular purpose, typically as a field of study or practice	7	data analytics	[44]; [28]; [25]; [19]; [8]; [48]; [46]
	6	decision-making	[47]; [25]; [48]; [96]; [79]; [49]
	6	anti-corruption	[51]; [50]; [88]; [11]; [106]; [103]
	6	smart city	[37]; [52]; [40]; [53]; [49]; [80]
	5	research	[6]; [25]; [55]; [16]; [83]
	5	new services	[48]; [40]; [100]
	3	hackathons/ competitions	[17]; [54]; [18]
EFFECTS the potential results and outcomes of OGD utilization from social, economic or good governance perspectives	40	transparency and accountability	[4]; [17]; [51]; [71]; [20]; [44]; [6]; [28]; [57]; [97]; [66]; [7]; [101]; [88]; [29]; [10]; [2]; [86]; [31]; [84]; [87]; [59]; [109]; [64]; [79]; [68]; [95]; [83]; [38]; [102]; [21]; [105]; [107]; [58]; [82]; [106]; [39]; [103]; [69]; [91]
	28	economic development	[22]; [17]; [32]; [33]; [23]; [27]; [24]; [28]; [90]; [55]; [54]; [61]; [115]; [50]; [8]; [29]; [77]; [30]; [52]; [48]; [64]; [112]; [45]; [18]; [100]; [46]; [41]; [49]
	15	citizen participation	[27]; [37]; [57]; [54]; [97]; [66]; [101]; [48]; [9]; [10]; [86]; [64]; [68]; [11]; [103];
	7	public services development	[47]; [17]; [33]; [8]; [52]; [79]; [85]
	6	social value	[22]; [17]; [24]; [28]; [30]; [64]
	3	trust of citizens	[64]; [68]; [69]
CONDITIONS the environmental features or aspects of	36	quality of data	[108]; [51]; [71]; [23]; [113]; [6]; [57]; [25]; [55]; [61]; [97]; [26]; [66]; [2]; [16]; [74]; [72]; [87]; [64]; [68]; [95];

overall OGD utilization functioning as technical, social or political paradigms of public data usability			[83]; [70]; [73]; [102]; [45]; [81]; [41]; [103]; [49]; [94]; [104]; [80]; [22]; [79]; [5]
	26	legislation/policy	[114]; [65]; [51]; [20]; [27]; [78]; [28]; [61]; [115]; [110]; [1]; [74]; [31]; [64]; [39]; [103]; [91]; [22]; [71]; [97]; [68]; [90]; [10]; [99]; [96]; [9]
	22	skills	[116]; [22]; [47]; [24]; [7]; [96]; [10]; [98]; [16]; [74]; [77]; [59]; [64]; [83]; [46]; [82]; [41]; [106]; [39]; [91]; [44]; [37]
	13	infrastructure	[24]; [96]; [9]; [74]; [70]; [73]; [75]; [5]; [91]; [104]; [10]; [85]; [95]
	10	availability	[22]; [71]; [24]; [25]; [97]; [66]; [16]; [40]; [45]; [41]
	9	privacy	[71]; [28]; [50]; [29]; [10]; [72]; [109]; [39]; [69]
USERS individuals or groups that use public data for achieving the targeted effects and gaining value mostly in the form of product, advantage or practice	49	citizens	[47]; [51]; [23]; [27]; [78]; [44]; [37]; [28]; [61]; [97]; [26]; [115]; [50]; [66]; [19]; [110]; [8]; [96]; [29]; [10]; [2]; [86]; [98]; [30]; [31]; [72]; [84]; [59]; [52]; [109]; [79]; [95]; [83]; [70]; [81]; [21]; [46]; [53]; [105]; [58]; [82]; [11]; [38]; [103]; [69]; [94]; [91]; [104]; [80]
	24	business	[4]; [22]; [23]; [78]; [25]; [55]; [115]; [110]; [8]; [96]; [9]; [86]; [77]; [48]; [109]; [79]; [112]; [38]; [45]; [76]; [81]; [82]; [41]; [80]
	20	researchers	[32]; [6]; [55]; [19]; [8]; [111]; [9]; [16]; [109]; [95]; [83]; [38]; [45]; [76]; [46]; [105]; [82]; [106]; [49]; [94]
	19	developers	[37]; [28]; [54]; [61]; [110]; [101]; [29]; [9]; [84]; [48]; [79]; [112]; [70]; [40]; [18]; [85]; [100]; [46]; [80]
	13	NGOs	[4]; [17]; [51]; [32]; [96]; [88]; [29]; [86]; [84]; [87]; [109]; [82]; [91]
	8	journalists	[44]; [26]; [7]; [88]; [9]; [86]; [59]; [81];

Table 2. Summary of thematic classification

5. Synthesis and discussion

5.1. Synthesizing our findings: the OGD utilization framework

The systematic literature review has resulted in a more comprehensive understanding of the types of OGD utilization, effects, contextual conditions, users and the relations between these factors. Most importantly we find that most relations between utilization factors are assumed or hypothesized and not tested empirically. Based on the four categories we introduced at the start of this article (types, effects, users, conditions), we can now 'fill' these categories with insights from the literature in a conceptual framework (Figure 9).
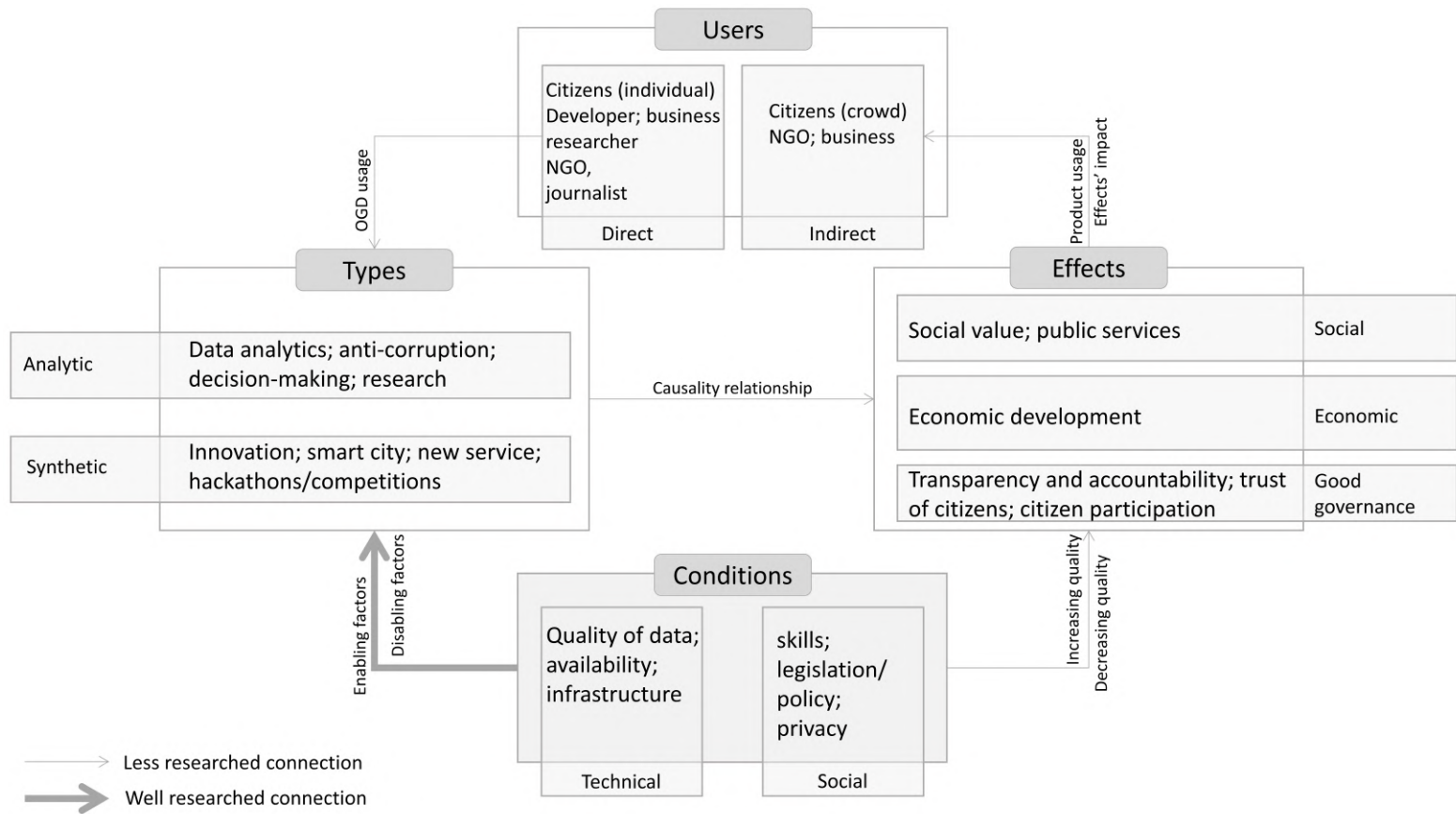
Figure 9. OGD utilization framework

In the proposed OGD utilization framework, two types of utilization can be distinguished based on the literature: *analytic utilization* and *synthetic utilization*. Moodysson, Coenen, & Asheim [89] distinguish between analytic and synthetic utilization according to types of knowledge creation as follows: analytic denotes the understanding and explaining of characteristics of the world and its features, while synthetic contributes to the design or establishment of something to reach functional objectives. In this regard, analytic utilization refers to OGD utilization that explains specific features or solves particular problems, such as public, business, or government problems by implementing a specific set of algorithms to analyse specific public data sets. On the other hand, synthetic utilization refers to the utilization of OGD to develop tools and appliances that solve functional problems, such as delivering better services.

The conditions of OGD utilization are also separated into two categories: technical and social. *Technical conditions* are features such as the quality of data, their availability, and the infrastructure for making them available. *Social conditions* are of an institutional nature (legislation, policy, etc.), but they also refer to the skills of users. Both types of conditions are well studied, since many scholars have recently attended to the availability of data [2], [26], [27], [51], [55], [66], legal and regulatory issues [1], [61], [78], barriers to and enablers of OGD [10], [28], and many other conditions that impact OGD utilization. However, each study concentrated on different types of conditions and used a different methodology to measure the impact, which makes it difficult to generalize their results.

The review found various hypothesized and established effects of OGD utilization: *social effects* include social value generated by utilizing OGD and public services (e.g. [22], [24]), *economic effects* include OGD utilization for economic development and increasing the efficiency of various economic activities (e.g. [28], [90]), and *good governance effects* include transparency and accountability, the trust of citizens, and citizen (e.g. [51], [91]).

We found a distinction between *direct users* – those who make use of the open government data themselves – and *indirect users* – those who make use of data that has been processed by intermediaries. According

to the findings of this review, studies that investigate OGD stakeholders [32] and commercial uses of OGD [77] discuss users more comprehensively. The authors highlight the benefits of OGD for different users, including commercial organizations [44], [55], [79], which have extensive expectations for OGD. In addition to those who have professional skills and technical knowledge, users also include those who can utilize simple datasets or who consume the effects of OGD utilization. The results show that most studies globally describe users (like citizens) rather than focusing on specific types or groups of users, and users' motivations are less researched. Therefore,

5.2. Challenges and opportunities for future research

The review revealed some gaps in the literature on OGD utilization. First and foremost, we found that many of the effects of OGD were not empirically tested but only proclaimed. More rigorous empirical research is needed to assess if the estimated effects of OGD are actually measurable. Our findings highlight that various relations are proposed but only the relation between conditions and data utilization has been empirically tested. Below we will highlight four potential future research directions.

1. Investigate the link between type of utilization and type of users

The relation between users and types of utilization could be studied. In other words, what types of users are there and in what way does this shape the way OGD is used in practice. For instance, we know very little which citizens use OGD but more importantly we do not know the type of utilization that would be interested in. Our review made clear that there is a wide range of potential utilization types, and some may be more closely aligned with citizen preferences than other. To improve usage, we would need to better map the link between *who* uses OGD and *how* this type of user will do so. A promising way to enhance OGD utilization might be to investigate users and their motivation, which could improve the efficiency and number of utilization types and their positive results.

2. Investigate the link between type of user and type of effects

Another link that warrants empirical attention is the link between types of users and effects. How will different users social, economic and governance effects? For instance, data journalist will produce newspaper articles and may influence public debates and possibly resulting in better governance, whereas entrepreneurs will be likely to try to find a business model that brings economic gain. So far, the literature has paid little empirical attention to the conditionality of the type of use, users and potential effects and further research is needed.

Furthermore, there is a strong focus on good governance effects, such as transparency and accountability. As these are core good governance principles, but there are other good governance effects that are currently lacking serious attention. These include citizen satisfaction [47], cost reduction [28], crowd-sourced monitoring and cooperative planning [87], fostering competitiveness [52], and better urban planning [79], [80]. Overall, we need more empirical evidence to prove the estimations made in the literature and to establish mechanisms for measuring the mentioned effects.

3. Investigate the moderating conditions of OGD effects

The third link in our framework that requires investigation is between conditions and effects. To result in positive outcomes on society, governance and economy with utilization of OGD, we need to know more about what conditions moderate these effects. For instance, there may be utilization for analytic or synthetic purposes, but this will only result in positive outcomes (stronger economy, better governance) if certain conditions are met. Our review showed that quality of data, skills, policy and legislation are all potential conditions that effect the link between usage and outcome. We know very little, however, what conditions moderate what type of use and which of these conditions are more or less important. We encourage scholars to develop empirical studies that investigate these conditions as potential moderating variables between OGD usage and one or more potential outcomes.

4. Establish causal link between utilization and potential OGD outcomes

The fourth and final direction is a more general concern and more difficult to solve research issue. The causal link between utilization types and effects is another important connection that requires rigorous

research to reveal direct causality relation among a specific utilization dimensions and its effects. To be able to draw causal inferences other research designs may be needed. We found that the predominant research type in OGD studies is qualitative or quantitative (mostly survey based). Although these methods have their merits, they may less successful in drawing robust causal inferences about cause and effect, as reverse causality may be an issue.

For instance, on the one hand, using OGD may result in greater wealth when successful businesses are created. But the reverse possible as well, wealthier jurisdictions (states, countries, cities) may also have more resources and more enterprises already. To investigate truly causal effects carefully designed experiments are needed, a trend already witnessed in some areas related to OGD, such as government transparency [92]. Experiments are useful to establish cause and effect separately, by carefully manipulating one or two crucial variables that are expected to cause an effect. For example, to investigate the effect various types of utilization, in a field experiment a researcher could encourage various slightly different datasets encouraging data analytics, research, or something else, and closely monitor results in what type of effect.

5.3. Practical implications

We identified a growing attention on the OGD initiatives, and also an increasing need to understand the nature of OGD utilization and its factors. In this regard, the systematic review delivers a ground for practical decision-making regarding OGD utilizations. Policymakers wishing to achieve better utilization outcomes are advised to evaluate possible types of utilization in a specific context. Moreover, it is required to understand better the conditions of OGD utilization process which consist social and technical components. This is particularly important as the conditions moderate the effects of OGD utilization. Thus, a holistic picture on OGD utilization is needed, including the consideration of diverse user groups, their requirements and potential effects. In respect of policy, there are strong implications that the discussed four factors have a substantial role to play in the success of OGD initiatives,

nevertheless evidence is currently not systematic and strong enough to inform policymakers on how they can consider, support and facilitate potential outcomes.

6. Conclusion

This paper presented the results of a systematic literature review on OGD by analysing 101 studies which has several limitations. OGD is relatively new field of study so that, there are limited number of empirical studies which researched OGD utilization. We used only 4 the most recognized academic databases: Scopus, Web of Science, ACM and ScienceDirect. An additional search in other databases (*Emerald, Taylor & Francis, IEEE and InderScience*) did not result in any new entries in our corpus. The searching process may have also excluded some relevant studies which cover OGD but named differently such as "open transportation data", "open healthcare data" etc. However, we believe that the selected wide-ranging studies still afford to provide a comprehensive description of the current state of OGD research.

The review of literature resulted in an OGD utilization framework, consisting of four generic categories (users, effects, types and conditions) with a variety of subcategories. The framework shows the multitude of relations between these four categories and also highlights that we have little empirical knowledge on most of the relations that relate to the *effects* of OGD. While most authors highlight positive effects, many studies focus on OGD initiatives, facilitators, barriers and challenges. Overall, this paper offers an overview of the current OGD research, and where we can go from here.

Investigating the effects of OGD on social, economic and governance outcomes is a formidable task however. As we mentioned in the previous paragraph it is hard to try determine cause and effect. Experimentation with OGD could be a possibility. However, we also envision that qualitative studies using in-depth interviews may be able to trace causal mechanism between the utilization of certain OGD initiatives and its effects.

It is important to keep improving our efforts to investigate who, how and why OGD leads to positive outcomes for society. It is not enough to assume that these effects will occur, and that they will occur automatically. The key contribution of this paper to the literature is the framework unravelling the various implicit relationship in research on the use of OGD. The framework we developed will help future research to systematically analyse the relations between OGD utilization and various sorts of effects. This is important because while OGD is proffered as a solution to many issues of public officials, NGOs and activists, yet this promise is yet to be proven. It is our duty as scholars to show whether and how this promise can be fulfilled.

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CHAPTER 3

#utilization

#implementation

#adoption

Chapter 3. Institutional dimensions of Open Government Data implementation: Evidence from the Netherlands, Sweden and the UK

ABSTRACT

This article investigates the institutional dimensions that shape Open Government Data (OGD) implementation in three developed countries: the Netherlands, Sweden, and the United Kingdom. 32 expert interviews and document analysis were used to research OGD implementation practices. The results reveal that OGD implementation per se is not enough to ensure the sustainability and success of OGD adoption in a country. The research discerns five dimensions: policy and strategy; legislative foundations; organizational arrangements; relevant skills; public support and awareness. The approach to the institutional dimensions differs between the countries. A centralized OGD governance is shown to yield better results and a higher level of OGD implementation. The contribution of the present study is twofold: first, the paper introduces institutional dimensions for explaining OGD implementation. Second, it presents a comparative analysis of best practices in the three developed countries.

1. Introduction

Information technologies have created massive opportunities to collect and utilize data on nearly all activities of government bodies. The significance, benefits, and positive effects of OGD are well recognized by many researchers (Zeleti, Ojo, & Curry, 2016). Studies showing that open data initiatives may promote proactive civic engagement, innovation, and democratic processes (Chan, 2013; Kassen, 2013; Linders, 2013) formed the basis for research into the benefits, policy issues, OGD infrastructure, availability and quality of data, and the skills required for OGD (Barry & Bannister, 2014; Brito, Costa, Garcia, & Meira, 2015; Rosnay & Janssen, 2014). Access to public data is also considered a core building block in the public governance of new socio-technological structures, such as smart cities (Meijer, 2017). These studies have yielded important insights into what fosters and what hinders OGD implementation; yet so far, the literature has largely neglected the institutional dimensions that shape the preconditions for OGD implementation.

Researchers have given increasing attention to the role of institutions in the implementation of innovations. Institutions also have become significant in innovation theory (Edquist & Johnson, 1997). Mueller, Rosenbusch, and Bausch (2013) highlight that institutional conditions have a major impact on the performance of innovations. The public innovation literature shows that the barriers and drivers of public innovations are shaped by institutions (Aagaard, 2012). To institutionalize open data, using analytics and public performance reporting, acknowledging data privacy, are considered significant commitment toward the evidence-based policymaking in the institutions (Ho & McCall, 2016). Hence, OGD could be a next step in the evolution of evidence-based public management and accountability. Implementation of technical innovations in government accountability enables performance of government institutions to be constantly controlled to a situation of dynamic accountability (Schillemans, Twist, & Vanhommerig, 2013). In that light, studying the role of the institutional dimensions of OGD implementation is particularly important.

This study undertakes to do precisely that, guided by the following central research question: *How do institutional dimensions impact open government data implementation?* To investigate institutional

dimensions and how these shape OGD implementation, it is needed to carry out research in different institutional contexts. The in-depth cross-national research fits this aim. This type of research on OGD implementation is limited (but see Michener & Ritter (2017) for an exception) and this study fills this gap by investigating Sweden, the United Kingdom and the Netherlands. All three countries rank highly on OGD implementation – fourteenth, first and eighth, respectively, according to the Open Data Barometer (ODB) results (*Open Data Barometer*, 2017), yet have diverging institutional backgrounds. This paper uses the ODB results to understand OGD implementation in the selected countries.

This paper is structured as follows. The study first introduces the theoretical background and investigates the theoretical model. Then the paper presents the methodology, including the description of case selection and data collection procedure. In the "Results and discussion" section, data from the selected countries is discussed, followed by a comparative analysis of the countries. The study concludes with an overview of the differences and similarities of the institutional dimensions of OGD implementation in developed countries, and the results of this study.

2. Theoretical background
2.1. OGD implementation

The process of implementing OGD requires careful consideration of a formidable web of factors. Releasing data involves a complex decision-making process, in which several variables – the ownership of the data, embargo period, transparency, licensing, the sensitivity of the datasets, data quality and metadata - affect the decision of whether or not this data should be released (Zuiderwijk & Janssen, 2015b). Vetrò et al. (2016) point out that the lack of proper quality control may reduce opportunities to utilize OGD and negatively impact citizen participation. Thus, controlling the quality of the released datasets by taking data quality dimensions into account - the completeness of the data, its accuracy and traceability, - is vital to obtaining better outcomes from OGD initiatives. Since the "quality" of something is relatively subjective,

stakeholder needs are a crucial parameter for evaluating the quality of data.

Participation mechanisms and well-established infrastructures are essential to support the activities and benefits of OGD initiatives (Zuiderwijk & Janssen, 2015a). To obtain the desired results, a comprehensive OGD infrastructure is needed which covers data provision, search and download capabilities, feedback options - and is easy to use while delivering high performance, data upload and processing capabilities (Charalabidis, Loukis, & Alexopoulos, 2014). As a significant component of OGD infrastructure, open government portals constitute a single access point for a wider open government strategy by providing feedback options, applications for data processing, and utilization concepts (Lourenço, 2015). Open data portals can also provide citizen-friendly visualization tools to observe trends and patterns more conveniently and to utilize open data to address specific concerns and interests of citizens (Ho & McCall, 2016).

2.2. Institutional dimensions

The concept of institutional dimensions in the present study builds upon the discursive institutionalism concept proposed by Schmidt (2008) without attempting to apply the detailed approach that she applied. In general, discursive institutionalism is an approach for explaining the interaction of policy-relevant ideas, discourse and institutions. Discursive institutionalism also focuses on the interactive processes of policy coordination and communication by which ideas and discourse are generated, articulated, and contested by agents (Schmidt, 2015). This broad perspective on institutions formed the basis for the approach in this paper. In this context, the study concentrated the literature review on OGD related rules and norms, the coordination of OGD activities and the environment of the open data implementation process.

Five fundamental institutional dimensions that contribute significantly to the success of OGD models and determine a country's OGD implementation were extracted from the extant open data literature: 1) policy and strategy; 2) legislative foundations; 3) organizational arrangements; 4) relevant skills and educational support; 5) public

support and awareness. OGD initiatives largely depend on the institutional motivations and capabilities of government agencies. In this respect, more studies focused on the institutional dimensions influencing both OGD implementation and its effects are needed. The outcomes of OGD initiatives could be markedly improved through a systematic approach to the development of these dimensions.

Policy and strategy. Milner (2006) emphasized that the implementation of new technologies has institutional components in which (political) institutions play an important role in defining the diffusion of the new technology. However, some studies argue that the expectations do not match with the realities (Worthy, 2015). Jetzek (2016) has developed a linear process model with internal feedback loops featuring four components that are significant for the implementation of OGD initiatives. These include the strategy and planning, the implementation, the transformation of open data, and the impact of data utilization. As releasing government data is a new activity for public bodies, clear guidelines, including a clear policy on privacy regulation and copyright restrictions are lacking for data professionals (Conradie & Choenni, 2014). According to Zuiderwijk, et al. (2014), the absence of guidelines for releasing public data is one of five main challenges in OGD publishing, along with stakeholder involvement and lack of attention for outcomes. Rather than continually increasing the amount of information disclosed, government organizations should implement information strategy by opening relevant information, recognize diversity and expectations of users to guarantee effective communication (Piotrowski, Grimmelikhuijsen, & Deat, 2017).

Legislative foundations. Embedding OGD initiatives in a strong legal framework is a precondition for the successful expansion of OGD implementation (Parycek, Höchtl, & Ginner, 2014). OGD stakeholders require clear guidelines on such matters as copyright, personal data protection, competition, tort and liability laws (Rosnay & Janssen, 2014). Hence, the availability and development of a relevant legislative framework are necessary to achieve the full potential of OGD. Furthermore, the perceived legal barriers, such as personal data protection, data storage regulations or directives of data protection, have

a direct impact on OGD data resistance (Wirtz et al., 2015). The research findings of Yang, Lo, & Shiang (2015) suggest that legislation and policy have the most significant impact on the OGD initiatives. Particularly, government institutions need to check whether releasing government data comply with regulations such as FOI, personal information protection, copyright legislation, and other specific regulations of government.

Organizational arrangements Organizations play a dominant role in OGD implementation and significantly shape the OGD implementation process. OGD can facilitate realistic, evidence-based and transparent governance and policy-making and provide convenient prospects for citizens and policymakers to evaluate policy outcomes (Sivarajah et al., 2016), which increases the role of organizational leadership in OGD implementation. Meanwhile, organizational factors are considered substantial challenges, that, along with legal and technical challenges, limit the availability and re-use of open data (Rosnay & Janssen, 2014). Particularly, lack of leadership and political support are significant barriers to OGD implementation (Barry & Bannister, 2014).

Relevant skills and educational support. The educational requirements necessary for OGD initiatives to be effective are widely discussed in the literature. Specifically, skills and relevant knowledge for searching, selecting, collecting, processing, analyzing, and presenting data are viewed as vital to effective OGD utilization (Gertrudis-casado, Gértrudix-barrio, & Álvarez-garcía, 2016). Both users and government officials need to know how to prepare and use open data resources. Specifically, to prepare public data for publishing, government officials must possess a specific set of skills that includes data analysis, data cleaning, randomization of data, generalization, pseudonymization and anonymization (T. Yang & Wu, 2016). Nevertheless, the majority of the average citizens are not technically skilled and may not know how to use open data for being more informed and engaged (Ho & McCall, 2016, p. 20).

Public support and awareness. While OGD initiatives are the responsibility of government institutions, strong public support from

third parties plays a crucial role in their success. Thus, increasing public awareness and support for OGD is important for the creation of successful OGD models (Ohemeng & Ofosu-Adarkwa, 2015). Sieber & Johnson (2015) state that the relationships among government agencies, citizens, the private sector, and OGD initiatives of the government, significantly determine how data is used and exploited to obtain private and public benefits. Civil society activists, funding donors, academicians and ICT practitioners are significant interest groups whose support should be sought by governments for an effective implementation of OGD initiatives (Gonzalez-Zapata & Heeks, 2015).

Finally, as is evident from the literature, institutional dimensions are considered to be significant settings for the implementation of OGD initiatives. It is therefore imperative to study the institutional context in countries that have successfully implemented these policies, to understand the differences and similarities in their approach. An overview of institutional dimensions is presented in Table 1.

Dimensions	Descriptions
Policy and strategy	Availability of strong open data program, regulation of open data
Legislative foundations	Availability of strong freedom of information and data protection legislation, institutional support for information openness and data protection
Organizational arrangements	Strong leadership, stakeholders' involvement in data opening process, quick response to societal requirements, adequate open organizational culture
Relevant skills and educational support	Relevant skills of government officials, relevant skills of potential users, availability of educational programs and trainings
Public support and awareness	Active non-government organizations, open data events, competitions and awards organized by public sector, the level of sharing information about open data

Table 1. Summary of the institutional dimensions

The basic idea of this research is that the presented institutional dimensions can explain differences in OGD implementation in different countries.

3. Research method

This study investigates the institutional dimensions of OGD implementation in the Netherlands, Sweden and the UK to better understand the similarities and differences in OGD implementation in the different countries. The study analyzed the available literature to build an initial framework for comparison, using data from the Open Data Barometer for case selection. Open Government Action Plans and other documents were examined to better understand the OGD initiatives and plans in the selected countries. In addition, 32 interviews were conducted with relevant experts.

3.1. Case selection

Case studies are one of the most powerful research methods for the development of new theory and obtaining an understanding of complex situations (Howard et al., 2007, p. 456). Furthermore, case-based research is very suitable for investigating new phenomena (Yin, 2003), such as OGD implementation. Two criteria were used to select the cases: the country characteristics of the public administration model; and the country's open data performance. The characteristics of the public administration are considered as contextual criteria and describe the broader settings of public administration. This criterion is used to select most-different cases among many best-performing countries rather than to explain OGD implementation. Open Data Barometer results were used to evaluate the OGD implementation performance of a country.

The Netherlands has a more than 200-year history of government transparency and administrative practices of information openness (Meijer, 2015). The Netherlands is a "decentralized unitary state", in which decentralized governmental bodies, such as municipalities, have a large degree of autonomy. However, they do not have full control over their budget; they have only a limited ability to levy taxes and their budget is required to be approved by a higher level of government. In this regard, the institutional and public administration characteristics of Dutch government are somewhere between those of Sweden and the UK.

Sweden has the longest history of systematically dealing with transparency in government agencies and openness. Its Freedom of Information Act was constitutionalized in 1766 - the first of its kind in the world (Janssen, 2011). Sweden has a highly-decentralized government structure. Swedish local self-government is protected by the national constitution; municipalities have tax, general decision-making power and land-planning autonomy (Bache & Olsson, 2001).

Adopted in 2000, the freedom of information legislation in the United Kingdom is relatively young. Compared with Sweden, the UK is less decentralized: the local authorities have no constitutionally protected powers or tax autonomy (Bache & Olsson, 2001). In what is known as the Westminster system, both the government and the head of government – the prime minister - have more power than in Sweden or the Netherlands

This study uses data from the World Wide Web Foundation's *Open Data Barometer* (2017) to explore OGD implementation in the Netherlands, Sweden and the UK. The ODB is the only peer-reviewed national comparison indicator covering 115 countries, with an evaluation methodology that includes the entire open data chain: OGD readiness; implementation of OGD initiatives and impact of OGD. It offers the most comprehensive comparison of the studied countries (Susha, Zuiderwijk, Janssen, & Gronlund, 2015). The present study uses ODB results to understand a country's OGD performance in terms of the availability of a well-resourced open government data initiative and the existence of open data initiatives at the national, regional and local government level.

3.2. Data collection and analysis

The primary data for this study is derived from qualitative interviews with open data experts and practitioners from the Netherlands, Sweden and the UK, and from the Open Government Action Plans of these countries. The latter forms the primary document of the Open Government Partnership[5] platform, launched in 2011 for making governments more open, accountable and responsive to citizens. A requirement for

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membership is the development of an action plan in consultation with the public. This study also drew on other literature discussing OGD adoption and its dimensions. Based on the literature, this research established the institutional dimensions determining OGD implementation. The results of the *Open Data Barometer* (2017) were used to analyse OGD implementation in the Netherlands, Sweden and the UK.

Qualitative open-ended interviews were conducted to collect information from OGD experts and practitioners in the Netherlands, Sweden and the UK. Interviewees were selected according to the following criteria: they had to actively engage in OGD activities; were well informed about national policy regarding OGD and involved in national, local or sectoral OGD initiatives. To cover the entire spectrum of OGD activities, open data practitioners from government sector (middle or higher management), academia (researchers with open data research background) and non-government organizations were included to the interview list. Ten or eleven experts were interviewed from each country. All names remained anonymous to encourage openness.

Country	Affiliations	Code
The Netherlands (Nl)	Central government, information policy advisor	N1
	Central government, open data project head	N2
	Non-government organization, chief technology officer	N3
	Central government, open spending project officer	N4
	Non-government organization, board member	N5
	Non-government organization, founding partner	N6
	Non-government organization, co-founder	N7
	Central government, open data policy officer	N8
	Non-government organization, open data project manager	N9
	Central government, academia, head of the department	N10
	Local government, academia, researcher	N11
Sweden (Se)	Local government, director of the department	S1
	Central government, chief information officer	S2
	Central government, IT applications and services officer	S3
	Academia, open data researcher	S4
	Central government, transparency manager	S5
	Non-government organization, owner of open data company	S6
	Non-government organization, data journalist	S7
	Non-government organization, CEO of an open data implementation company	S8

	Local government, IT development leader	S9
	Non-government organization, open data consultant	S10
The United Kingdom (UK)	Academia, open data researcher	U1
	Central government, head of open data project	U2
	Central government, open data manager	U3
	Non-government organization, open data consultant	U4
	Non-government organization, open data consultant	U5
	Central government, head of open data initiative	U6
	Non-government organization, data policy analyst	U7
	Academia, open data researcher	U8
	Non-government organization, founder of open data initiative	U9
	Non-government organization, data and knowledge services manager	U10
	Local government, senior information governance officer	U11

Table 2. Code of an interviewed experts

The interviews were structured around 2 broad categories:

1. Questions on the current formulation and implementation of national OGD processes, as well as related documents;
2. Discussion of influential spurring/hampering factors, challenges, and missing conditions.

The interviews took around 30-45 minutes; they were taped and subsequently transcribed. The transcripts were carefully read and coded according to OGD implementation and the institutional dimensions using Nvivo 11 software. The results and discussion are presented in the following section.

4. Results and discussion

Public sharing of government information is not a new phenomenon in the Netherlands, Sweden and the UK. Although the Directive on the re-use of public sector information, which applies to all EU members, was adopted in 2003 (Directive 2003/98/EC), these countries have a long tradition of freedom of information. This section presents an overview of OGD implementation, compiled on the basis of the interviews, OGP action plans and ODB results, and configuration of the institutional dimensions in the Netherlands, Sweden and the UK.

4.1. OGD implementation

According to the Open Data Barometer, the UK performs significantly better than Sweden and the Netherlands. The two latter countries score less well on openness on government spending and public contracts data: neither Sweden nor the Netherlands discloses detailed government spending and public contracts data. Of the 15 primary datasets evaluated in ODB, the map data is the only dataset for which these countries achieve an openness score of 100%. Overall, 5 out of 15 datasets in the Netherlands and 4 out of 15 datasets in Sweden achieved a score of 85% or higher, in contrast to the UK, where 12 out of 15 datasets garnered scores of 85% or higher.

The Netherlands has a long history of freedom of information and open government. The country boasts a centralized open data portal (data.overheid.nl) that was developed and is managed by the Ministry of the Interior and Kingdom Relations (MIKR). At the time of writing (12 September 2017), the portal contained 11,557 datasets covering management, culture and recreation, economy, healthcare, etc. Along with published datasets, the centralized portal offers a data requests service, which allows users to request unpublished datasets or adjustments to available datasets. Moreover, the portal offers guidance to government bodies on publishing open data. There are several specialized central and local open data pages. Working in collaboration with other central government bodies, the MIKR plans to build new frameworks to make open data more accessible and to increase the quality of open data, as laid down in the second OGP action plan. However, the quality of data and the lack of useful tools to work with are hampering factors for an effective utilization of open data (N2, N7, N11).

Government transparency in Sweden is strongly correlated with the freedom of the media, first introduced in the Freedom of the Press Act in 1766. The country's centralized open data portal (oppnadata.se) was developed by Vinnova - Sweden's Innovation Agency and, at the time of writing, (12 September 2017), contained 508 datasets, of which more than half had been released by the Environmental Protection Agency (256 datasets). Environmental data is the most shared open data in Sweden. The interviewed experts attribute this success to the country's

advanced environmental data collection and sharing infrastructure, combined with an active environmental sector (S8, S9). Only some 16 organizations provide open data to the central portal. The portal provides an email address as feedback channel and offers no guidance on publishing open data. Data availability is not an explicit aim in the Swedish OGP action plans. While some municipalities have open data initiatives, many local government organizations, particularly in small municipalities, do not. According to a representative from the private sector, the problem for the bigger municipalities is not a shortage of staff, but an unwillingness to provide more open data (S8). Moreover, municipalities have no fixed procedures for publishing open data; each municipality follows its own rules. Standards for open data initiatives are also lacking (S1, S2, S4). While the data availability is not high in Sweden, the quality of data is satisfactory, but uneven across the different sectors, according to the interviewees (S2, S8, S5). The quality also depends on who the data publisher is (S4).

The UK's adoption of open data is one of the first such initiatives in the world. The central government data portal (data.gov.uk) is led by the Data team in the Cabinet Office of the Government of the United Kingdom, who works across government agencies to ensure the sustainability and quality of released open data. At the time of writing (12 September 2017), the portal contained 38,772 datasets, published under the Open Government License (OGL). The central data portal features a data request platform, data request statistics and several tools for using open data, including APIs, map search tools and visualization. Some 31 open data portals are listed in the dataportals.org project. In the early years of open data implementation in the UK, the government focused on encouraging public organizations across the country to open up more data (U1, U5, U11). Later, the most important challenges became gaining insight into the utilization of OGD and improving the feedback mechanism (U1). To that end, the government aims to improve the data.gov.uk portal, within the scope of the OGP action plan, to better meet the needs of open data users. Nevertheless, data quality and better data standards still constitute a challenge in open data initiatives ((U1, U3, U4, U5, U6, U9). To address this problem, the Local Government Association (LGA) has developed various open data standards and

invited the local councils to implement these in fields such as licensing and planning data. As a result, the local councils now release these datasets based on the standards (U10). Data owners cooperate with users to improve the quality of data (U3).

4.2. Institutional dimensions - the Netherlands

Policy and strategy. In the OGP action plans, the Dutch government commits to popularizing open data through the implementation of several initiatives from central government bodies and public organizations. In the second action plan, covering the years 2016-2017, there is a relatively strong focus on open data, with five of the nine actions related to this. To enhance financial transparency and in the name of public accountability, the Ministry of Finance proposed plans to provide access to the government budget and amended budgets (N1). Furthermore, the Dutch government indicated a desire to cooperate with international open data initiatives, such as 'Open Spending' and 'International Aid Transparency Initiative' (MIKR, 2015). Better results could be achieved through a coordinated and systematic approach towards adjusting the relevant policy frames of privacy, freedom of information, open government and information security regulations (N1, N4, N5). While the MIKR provides general support and supervision on the national level, OGD is less well organized at the provincial and municipality level in the Netherlands (N2).

Legislative foundations. Interviewees felt that OGD legislation regulating public data reuse was needed, including relevant licensing and pricing policies (N2, N3, N4). In the Netherlands, there is no sanction for not publishing open data. However, some legislative foundations that encourage open data are in place, such as the Open Government Act (*Wet Openbaarheid van Bestuur*) and the Dutch Reuse of Public Sector Information Act. Another important piece of legislation relating to the implementation of OGD is the Personal Data Protection Act, adopted in 2000. Privacy issues, regulated by the aforementioned data protection act, are the main concern of government organizations (N11).

Organizational arrangements. In the Netherlands, the Ministry of the Interior and Kingdom Relations (MIKR) has a coordinating role in open data initiatives (N10, N11). The Dutch government plans to intensify the coordinating role of the MIKR. While there is no specialized organization monitoring compliance with the laws on freedom of information, institutional support for personal data protection has been put in place in the form of the Data Protection Authority, the body responsible for the enforcement of the Personal Data Protection Act.

Another important organizational aspect in the Netherlands is the existing culture in many public organizations, which is not only protective of data but is resistant to the idea of making data open. For a whole-hearted embrace of OGD, this needs to change (N4). Moreover, an awareness of the business opportunities presented by open data and OGD initiatives is usually also lacking. (N11).

Relevant skills and educational support. The interview results suggest that OGD models are more likely to succeed if users of public data have relevant skills and technical knowledge for the utilization of data (N1, N4, N5, N10). Experts frequently point to the lack of relevant skills and knowledge, on the part of both data users and civil servants, as important factors hampering the utilization of OGD (N4, N5, N6, N7 N8, N9, N11).

The MIKR provides workshops, discussions, and meetings aimed at increasing the skills of government officials in this respect (N6). The Dutch government plans to organize conferences, annual presentations, competitions and hackathons to encourage the re-use of government data within the framework of the second OGP action plan. Currently, Delft University of Technology provides open government and open data related massive open online courses.

Public support and awareness. The interviewed experts agreed that public support for OGD initiatives cuts two ways: first, strong public support empowers new users, new innovations, and more citizen participation; second, public support pushes government authorities to improve OGD policy, to release more data sets and collaborate with the potential OGD users. To increase public support and awareness, the MIKR has established the Stuiveling Open Data Award, a competition open to the re-users of Dutch open data in which a 20,000 EUR cash

prize is awarded to the designer of the best application that makes use of open data from public organizations. NGOs also work with government institutions on building and improving OGD initiatives (N1, N5, N7, N9). The importance of building an awareness of open data among the general public for a better use of OGD was also mentioned by one of the interviewed experts (N6). The fast-growing area of data journalism is another factor in building and developing public support (N8).

Summary

Despite the problems regarding data quality and usability, more than 10 thousand datasets were published on the central data portal in the Netherlands. Improving the open data infrastructure is one of the priorities of Dutch OGD implementation. Furthermore, the Dutch government cooperates with international open data projects and non-governmental institutions to improve open data policies and initiatives. The country has no dedicated open data legislation, although institutional support for these activities is available. OGD implementation and initiatives are coordinated at ministerial level, but strong coordination and supervision of the processes are lacking. There is a relatively strong focus on open data in the OGP action plans of the Netherlands. Regarding educational support, a more systematic approach and institutional support are needed, according to the interviewed experts. Public support for and public awareness of open data are also lacking. Nevertheless, very few non-government institutions put effort into improving public awareness in this area.

4.3. Institutional dimensions - Sweden

Policy and strategy. Sweden lacks a strong focus on open data in its OGD action plans. The country's first such plan, covering the years 2012-2013, focused only on the development of aid transparency initiatives. The second covered the years 2014-2016 and was targeted at the utilization of open data and the release of more public data. In the third action plan (2016-2018), the National Archives has been designated as the facilitating agency for publication of open data and public documents.

Transparency in aid management and implementation also has a significant place in this third action plan.

Despite the fragmented nature of the open data initiatives in Sweden (S4), several institutions are engaged in open data implementation. For example, the Ministry of Foreign Affairs actively implements open aid data projects (openaid.se) based on the IATI standard (S5). The Swedish Association of Local Authorities and Regions (SKL), a membership organization for all municipalities, counties and regions, is working to align the municipalities on the topic of open data (S1). Also, in the limited digitalization budgets, open data tends not to be a priority. (S9). Sweden's major cities, however, are leading by example: Stockholm, for one, has launched a municipality level open data initiative - open.stockholm.se (S10).

Legislative foundations. The Public Access to Information and Secrecy Act that entered into force in 2009 regulates the access to information, supplementing the provisions of the Freedom of the Press Act on the right to acquire government information, and more specifically, official documents. Moreover, Sweden has implemented the EU's Public Sector Information Directive through the Re-use of Public Administration Documents Act, which was adopted in 2010. This, however, is not considered a driver of open data, as it does not mandate the publication of open data (s6). Next to transparency-oriented legislation, there is also the Personal Data Act, which came into force in 1998. In some cases, government agencies make privacy issues an excuse for not opening data (S8). Another significant factor is the practice of selling government data. Owners of, for example, cadastral/mapping data, company information and postcode data, charge access fees for these datasets (S2, S6). According to the independent final report of the first OGP action plan (Ostling, 2016), not only is the potential impact of the Swedish government's activities promoting the re-use of public administration documents low, government actions regarding the re-use of official information are relatively lacklustre. Ostling (2016) pointed out that several milestones on the re-use of public information have failed to be achieved.

Organizational arrangements. The decentralized nature of the Swedish public administration has affected the implementation of open data practices. By 2016, Vinnova - Sweden's innovation agency - had a leading role in the implementation of open data initiatives, particularly in the development of the central open data portal (S1, S2, S6, S8). According to the third OGP action plan, the National Archives were to support government organizations in facilitating actions promoting the re-use of open data, improving monitoring and publishing more open data in the period 2016-2019. Citizens' right to the freedom of information is guarded by the Parliamentary Ombudsmen. Citizens requesting information can complain to the Parliamentary Ombudsman if they are dissatisfied with the decisions of government organizations. Likewise, the Swedish Data Protection Authority is the body responsible for protecting citizens' privacy and personal data.

The government's open data policy, particularly the coordination of and systematic focus on OGD implementation, is rather weak (S1, S8). Nevertheless, high-level political support and the coordinating role of the Ministry of Foreign Affairs has resulted in the successful implementation of open aid data projects and of the IATI aid data standard (S5).

Relevant skills and educational support. Nearly all the interviewed experts acknowledged the value and importance of skills and educational support and the role of these in obtaining better results from open data initiatives. Increasing technical skills for a better use of open data is part of the open data plans of the Swedish National Archives (S10). However, the Swedish ODP action plan solely refers to the improvement of knowledge regarding open aid data and transparency in aid management. Other, mainly individual initiatives to increase knowledge about open data include a free open data course offered by the Open Data Institute, although there are no specialized courses or training programs specifically targeted at educating people to use open data (S6, S10). In general, the quality of the Swedish educational system is such that there is no lack of skills and technical knowledge to prevent the government from opening up data in Sweden (S10).

Public support and awareness. Open data experts consider establishing profound public awareness to be a significant factor for increasing open data use and re-use. To that end, government agencies should build relationships with relevant stakeholders (S4, S7). Depending on the field in question, some sectors have done a better job of garnering public support for open data initiatives than others. The interviewed experts mainly pointed to the activities around transportation data, the result of strong demand from the community, and the support provided for these (S2, S3, S10). The number of public organizations and NGOs working in the field of open data is too low to establish public support and awareness (S10).

Summary

A limited number of datasets was published on the central portal in Sweden, half of which were environment related. Variety and data availability are the main obstacle to OGD implementation, both of which are related to the lack of strong institutional support in the country. The OGP action plans have thus far been aimed at improvements in the field of open aid data only. Sweden's decentralized approach to OGD implementation negatively impacts the quality of the data, as well as hindering both the adoption of standards and efforts to coordinate these initiatives. The country also lacks a solid open data policy and strategy, despite a long history of freedom of information. While the National Archives has been assigned a coordinating role in OGD implementation, its active participation has not been observed. Moreover, the country also lacks a coordinated approach to the development of educational support and public awareness.

4.4. Institutional dimensions - the United Kingdom

Policy and strategy. Government strategy and the role of open data in enhancing access to public information, building trust and encouraging the innovative use of data have been laid down in the Open Data White Paper (2012) and Open Data Strategy (2012) of the Cabinet Office. The interviewed experts all agree that the UK government has established an effective open data policy stimulating government agencies to publish more data and to use the data released (U2, U4, U6, U10). Under

the latest OGP action plan, the British Government aims to implement open contracting data standards, to release more granular data, develop an election data standard, improve the national information infrastructure for making government data more accessible and to involve data users for a better utilization of OGD.

With the publication of a national policy paper entitled - "Open Data: unleashing the potential" in 2012, the UK government gave evidence of the political will to open more data and achieve transparency through open data. Nearly all departments and ministries have their own open data strategy in the UK. A few of the interviewed experts suggested that the monitoring and supervision of open data activities are insufficient (U9, U11); one noted that the effectiveness of the open data policy differs from field to field (U8). While thousands of datasets are released by government agencies, the majority are used by no one (U1).

Legislative foundations. The Freedom of Information Act was passed in 2000 in the UK; its full provisions came into force on 1 January 2005. Along with the Freedom of Information Act, the Local Government Transparency Code (2015) and Transparency Code for Smaller Authorities (2015) protect information openness in the UK. The country has no specific legislation that controls the open data activities of the government agencies. The local government transparency code (2015) sets out requirements for the publication of data and the recommended practice. The use and re-use of public sector information are regulated by the Re-use of public sector information regulations, adopted in 2015. Another important piece of legislation for protecting personal information is the data protection act, which was adopted in 1998.

Organizational arrangements. The Government Digital Service (GDS) in the Cabinet Office is responsible for coordinating open data activities. At the local level, various city councils and local authorities have developed their own open data repositories; they also promote open data usage (U8, U11). The Information Commissioner's Office (ICO) provides support to citizens regarding data protection and freedom of information. One interviewed expert emphasized the important role of the ICO in the open data process, although it lacks the resources to deliver the quality of support to citizens needed (U4, U9). The Local Government

Association also supports the local authorities in their open data activities. The Association has provided guidance documents to encourage local authorities to publish datasets in a standard format (U11). Failing a universal institution for monitoring data quality and sustainability (U9) at the national level, the Office for National Statistics has a monitoring and assessment authority which effectively works to control data quality and privacy issues in statistics data (U3).

Relevant skills and educational support. The interviewees largely acknowledged the role of skills and digital literacy as an enabling factor for the implementation of open data initiatives. The UK government emphasized the need to build the skills and capabilities to use and reuse open data in an effective way in its latest OGP action plan. The NGOs have very active roles in the development of skills and technical knowledge for using open data. The Open Data Institute and Open Knowledge Foundation provide several open data-oriented courses and training programs for the civil sector and data users (U5, U7, U8). Nevertheless, there are still circumstances where the lack of skills and technical knowledge present an obstacle to opening and using public data (U1, U4). Under the framework of the OGP action plan, the UK government plans to provide advanced data science tools and skills to the government officials who work with data through a program supervised by the Office for National Statistics.

Public support and awareness. The UK embarked on its open data policy in the period 2008-2009, at which time the Prime Minister provided high-level, top-down leadership support for making public data open (U5). User involvement in open data sharing is a commitment from the OGP action plan of the UK government. Community initiatives have been established that work to foster public support and public awareness, such as the opengovernment.org.uk initiative, run by the community, which provides information about how civil society is formed in the UK and ways to influence the government to be open (U5). The UK Open Government Network (OGN) is an influential coalition of active citizens and civil society organizations committed to making government work better for people through increased transparency, participation and accountability (U1). Increasing the number of

communities that engage in open data activities is considered one of the challenges in the UK (U10). The UK government plans to maintain the open data activities with civil society groups to improve data access and use by civil society within the framework of the latest OGP action plan.

Summary

The UK's adoption of OGD is one of the first such initiatives in the world. The country has published nearly 40 thousand datasets in the central data portal. Despite quality concerns, depending on the source of data, the UK government has a strong open data policy and strategy. Improving data quality with the involvement of stakeholders and better feedback mechanism is one of the primary aims of the UK government. Nearly all central government institutions have an open data strategy and plan. While the early years of open data implementation were dedicated to releasing as much data as possible, the focus today is on the utilization of published datasets. Harmonization and data standards are still considered a challenge in the open data initiatives. There are several NGOs that work to improve relevant skills and provide educational support. Nevertheless, the country does not have a strong focus on educational support. Similarly, many government and non-government initiatives are aimed at improving public awareness, yet the country lacks a comprehensive approach to achieve this aim.

5. Comparative analysis

The study shows that although the strategic vision of OGD is similar in all three countries, the implementation practices, action plans and focus on open data activities differ. There is a strong transparency rationale behind OGD activities in the non-government sector; in addition, governments seek economic benefits, and to promote government accountability. There are several specialized open data portals; Sweden lags behind the Netherlands and the UK regarding the number of open data initiatives and the functionality of its central open data portal. The policies, strategies and organizational arrangements are the main institutional dimensions that differ significantly in the countries. Sweden

is the traditional champion of freedom of information (FOI) practices and the Netherlands is one of the early adopters of FOI. Compared to Sweden and the Netherlands, the UK took longer to adopt FOI but is now ahead of both countries in the area of OGD implementation.

In the UK, the central government sees OGD activities as a means to enable economic growth, transparency and accountability. These are coordinated by the data team in the Cabinet Office. National OGD initiatives are also a key part of the government's transparency agenda in the UK. They run across government departments and local government institutions, which increases the amount of open data, cooperation between public institutions and OGD initiatives. Due to central and strong institutional support, OGD implementation is more systematic and strategically well-aligned in the UK compared to the Netherlands and Sweden.

Despite the availability of a central open data portal, open data initiatives are poorly coordinated, with little institutional support in Sweden. Compared to the UK and the Netherlands, there is no strong central open data governance in Sweden, which means open data initiatives and coordination are more scattered. The Swedish open data portal was developed by the innovation agency, which also had a coordinating role. Recently, the open data responsibilities of the agency and governance role were transferred to the Swedish National Archives, however, its active participation in OGD initiatives has not yet been observed. By comparison, the Ministry of the Interior and Kingdom Relations, the leading agency in the Netherlands, has a broader role in the OGD implementation process. Along with developing and facilitating the central open data portal, the Ministry ensures the quality of data and metadata and contributes to the development of an open data policy in other government agencies. Unlike the UK and Sweden, the leading institution in the Netherlands monitors the progress made through the central open data portal. A brief overview of the institutional dimensions is presented in Table 3.

		NL	Se	UK
Policy and strategy	Open data focus on OGP action plans	Moderate	Weak	Strong
	OGD strategy	Weak	Weak	Strong
	Open data guidance	Strong	Weak	Very strong
Legislative foundations	Specialized open data legislation	Not available	Not available	Not available
	FOI and personal data privacy legislation	Strong	Strong	Strong
Organizational arrangements	Supervision and coordination	Moderate	Weak	Strong
Relevant skills and educational support	Systematic approach to the education and skill development	Not available	Not available	Weak
	Courses and training programs	Weak	Not available	Moderate
Public support and awareness	Participation of NGOs	Moderate	Weak	Strong
	Coordination of the activities	Weak	Weak	Weak
	Role of public institutions	Moderate	Moderate	Moderate

Table 3. Institutional dimensions' overview

The three countries have different arrangements in terms of policy and strategy, organizational arrangements, public support and public awareness. By contrast, the legislative foundations and educational support are largely similar. The availability of courses, educational and training programs is limited in all three countries, yet according to this research, educational and public support, as well as public awareness are crucial to the sustainability and long-term success of OGD implementation. Several dedicated non-government institutions (very few in the Netherlands and Sweden) do support open data initiatives and seek to improve public awareness. None of the countries takes a systematic approach to the development of education and skills. Both the Netherlands and the UK focus strongly on OGD in the OGP action

plans. Sparseness in governance and coordination has negatively impacted the sustainability of OGD initiatives and facilitation of the central data portal in Sweden. This fits with the decentralized administrative structure of the Swedish government.

6. Conclusion

This study provides an overview of national experiences of institutional dimensions and OGD implementation in three developed countries. In previous studies, the technological, environmental and institutional contexts of open data adoption were analysed together (e.g. Wang & Lo 2015; Yang & Wu, 2016). The research examined OGD implementation and institutional dimensions separately from one another, enabling the role of institutional dimensions to be independently evaluated. Five institutional dimensions were used to investigate the experience of the discussed countries: 1) policy and strategy; 2) legislative foundations; 3) organizational arrangements; 4) relevant skills and educational support; and 5) public support and awareness.

The main objective of the study was to empirically answer the research question of "how do institutional dimensions impact open government data implementation?". Despite the similarities in the socio-economic status of the countries examined, the empirical evidence reveals differences in terms of institutional dimensions. However, in all three countries, the adoption of OGD was seen to promote transparency, economic benefit, and the development of (social) innovations. The emergence of open data policy and strategy encourages OGD implementation. Along with policy tools, organizational arrangements also significantly determine the successfulness of OGD implementation. While the selected countries all had legislative foundations for freedom of information and information privacy, strong institutional support for increasing the required skills of government officials and potential data users was absent.

The findings confirm that different OGD implementation patterns emerge across different configurations of institutional dimensions. The characteristics of the institutional dimensions influence the progress,

success or collapse of OGD implementation. Moreover, the rationale behind the national policy and strategy, particularly the availability of the open data program, the regulation of open data and institutional support are key to the success and sustainability of OGD implementation. Public support and awareness are the main driver of OGD implementation. Open data utilization (for democracy) thrives with the participation of a well-functioning community behind it (Ruijer, Grimmelikhuijsen, & Meijer, 2017).

The findings of this study also support the results of the Open Data Barometer, which ranked the UK as the best-performing country in the world in terms of open data readiness, implementation and impact. The UK has a solid and centralized approach to the organizational arrangement of OGD and provides institutional support through the Cabinet Office. Various institutions, such as the Open Data Institute and Open Knowledge Foundation. systematically study and provide support to increase public awareness of open data initiatives. Institutional support in the Netherlands was found to be relatively weaker, although open data activities are coordinated at ministerial level. A recent systematic literature review revealed that the open data activities in the Netherlands have been well researched by scholars (Safarov, Meijer, & Grimmelikhuijsen, 2017). In conclusion, centralization in OGD governance yields better results, as the experience in the UK shows. A more centralized approach accelerates the level of OGD implementation.

This study has several limitations. First, it is well-known that different dimensions work differently with respect to the source fields of open data. For example, privacy issues have a salient role in healthcare data, but less so than in transportation or environmental data. Therefore, as the focus was not on a particular field, the specificity of each source field of open data constitutes a limitation of this study. Second, the comparison was discussed based on the pre-formatted broad institutional context and its very considerable dimensions. However, this discussion may include other dimensions explicitly associated with the context, such as the transparency culture, data standards, licensing or usability of data. Finally, this research presented and discussed the

availability of OGD initiatives in different countries, yet it did not focus on the quality and actual impact of each available initiative. It may be useful to further study the true impact of the OGD initiatives and activities, such as the role of hackathons, open data awards, the quality of the course and training programs or the quality and usefulness of the OGD infrastructure.

The comparative study of institutional dimensions of OGD implementation is particularly relevant for understanding differences and similarities between cases. The proposed theoretical model is a first attempt to explain the institutional dimensions of OGD implementation. It also proposes several new research directions for future studies. A similar theoretical model can be used for a comparative study of open data implementation in different fields, such as transportation, aid data, spending data and environmental data. The present study allows the researchers to investigate the implementation of OGD in other countries from the perspective of institutional dimensions. Such studies are not only significant to contribute to the body of literature on OGD implementation; they can also provide comprehensive guidance for government practitioners on how to weigh the role of a specific institutional dimension in increasing the success of OGD implementation in a country.

Practical implications of this research are that practitioners should recognize the impact of institutional dimensions on a sustainable and effective OGD implementation and utilization of open data. OGD policy needs to be explicit about public awareness and public support. Furthermore, cooperation between relevant stakeholders and policymakers should be encouraged and become common practice in the implementation of OGD initiatives. A more comprehensive cooperation between policymakers and open data stakeholders will enhance the utilization of open data, as the requirements of data users regarding open data quality, variety and infrastructure could then be more easily met.

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CHAPTER 4

#utilization

#implementation

#adoption

Chapter 4. Institutional Dimensions of Open Government Data Implementation: Evidence from transition countries

ABSTRACT

Over the past 10 years, we have observed a significant growth in open data adoption in governments across the globe. Potential barriers and enablers of open government data have been well-documented in the literature. However, nearly all of this research has been conducted in Western, democratic and developed societies, with very little known about open government data implementation in less developed countries. This article investigates how institutional dimensions affect open data implementation in six understudied countries: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine. This research presents rich data based on an analysis of 31 documents and focus group discussions with a total of 89 participants. In general, we find that in these countries the same institutional dimensions influence OGD implementation as in their Western counterparts. A striking difference, however, is that we find open data implementation in transition countries to be much more fragile and highly dependent on foreign aid initiatives. This paper also strengthens the argument that institutional dimensions explain the performance of open data implementation.

1. Introduction

Around the world, open data principles, data portals and open data initiatives are seeing implementation at the national, sectoral, regional and city levels. Numerous studies have not only examined the benefits of this development, but also the economic, social and governance impact, the negative aspects, barriers and the factors hampering open data implementation, particularly in developed countries (Barry & Bannister, 2014; Jocelyn, Oliver, & Gillian, 2014; Kassen, 2013; Ruijer, Grimmelikhuijsen, & Meijer, 2017). Hence, we know a great deal about the benefits, barriers and institutional factors affecting open data implementation in developed countries (e.g. Lourenço, 2015; Safarov, 2019; Susha, Grönlund, & Janssen, 2015a). More recently, open government data has started to gain traction in transition countries where open data strategies have been implemented with varying degrees of success (*Open Data Barometer*, 2017). Although open data implementation and the institutional aspects have been well-studied within the context of developed countries, we know little or almost nothing about open data implementation in transition countries.

Transition in these countries implies a broad range of institutional changes including economic liberalization, the development of market-oriented institutions, achieving economic efficiency, establishing an effective institutional and legal framework, and rule of law (Havrylyshyn & Wolf, 1999). Transition countries, therefore, face significantly different societal and institutional problems compared to developed countries. Open data in developing economies could contribute significantly to enhancing public transparency and accountability (Schillemans, Twist, & Vanhommerig, 2013), creating economic value, improving governance and empowering citizens (Verhulst & Young, 2017). The conditions under which open data can engender positive societal impact are relatively under-researched and require more attention, particularly in the transition countries.

Institutional dimensions play an important role in open data implementation. Several theoretical frameworks have been developed and tested to evaluate open government adoption (Grimmelikhuijsen & Feeney, 2016), urban innovations (Meijer & Thaens, 2016), adoption of the internet of things (Tang & Ho, 2019) and early innovation adoption (Yun,

2019). A recent study across three developed countries shows that institutional dimensions have a significant impact on the level of effective open data implementation, even in the best-performing countries (Safarov, 2019). That study found that policy and strategy, as well as organizational support, determine the level of success in open data implementation.

In the present paper, we test the same theoretical framework and study the role of institutional dimensions in open data implementation in transition countries. The main reason for choosing this framework is that first, it covers both the demand and supply side of open data implementation and knowledge basis required to transform raw data into data-driven products. Second, this framework is the most comprehensive theoretical framework that developed to explore open data implementation at the institutional level. In addition, new institutional dimensions specific to transition countries will be identified, if available. To that end, the following main research question has been formulated: *to what extent do institutional dimensions explain the open data implementation process in transition countries?* This question will be answered by the empirical research we conducted in six transition countries, consisting of a literature review, focus group discussions (total of 89 participants) and document analysis (31 documents).

A group of transition countries in Eastern Europe known as the Eastern Partnership countries (EaP) and comprising Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine have been selected as case countries. These countries are interesting cases for several reasons. First, they have similar backgrounds regarding public administration. Second, they have joined the initiative aimed at harmonising digital markets within the scope of the European Union's (EU) Digital Single Market. In other words, these countries have shown the political will to learn and adopt the experience of European countries, to receive financial and technical assistance within the European Neighbourhood Policy and to integrate with the EU. Third, these countries offer significantly diverse yet interesting experiences with the implementation of open data, e-government and digital policies.

As a joint initiative, the EU's Eastern Partnership project, which is a specific dimension of the European Neighbourhood Policy, was

launched in 2009, initiated by Poland and Sweden. The initiative is aimed to support the EaP countries in the fields of comprehensive institution-building, public reforms, regional and economic development, good governance and trade (Wiśniewski, 2013). Between 2014 and 2017, EaP countries have benefited €2.8 billion of EU funds to strengthen economy, harmonise digital markets, good governance, realize anti-corruption initiatives, integrate EaP and EU research and innovation systems ("Eastern Partnership," 2016).

While these countries were de-facto independent in the Soviet era, they were subject to the standard Communist Party-dominated rules and public administration model. After the collapse of the Soviet Union in 1991, all the member states became independent, initiated democratic, market-oriented public reforms and became members of the Council of Europe (except Belarus). These comprehensive transformation processes pose a challenge to the implementation of innovations such as open data. In this study, we propose to investigate whether and if so, why this should be the case.

This paper, therefore, has targeted to explore the relationship between institutional dimensions and open data implementation in relation to transition countries. The empirical results show that institutional dimensions strongly affect open data implementation. Despite the historical and public administration similarities of the countries reviewed, the implementation of open data in the region has occurred with varying degrees of success. The disparity among the countries is manifest in more fundamental factors, such as political will, the level of public support, and the anti-corruption/transparency intentions of the countries. At the same time, the findings show that open data implementation in transition countries is fragile and highly dependent on foreign aid initiatives. This fragility of open data implementation can be explained by the performance of institutional dimensions.

This research contributes to the open data literature and practice in three ways. First, it tests an existing theoretical framework in the transition countries. This investigation provides an alternative clarification to the institutional dimensions of open data implementation in the context of transition countries; this context has not been explored before. In the open data literature, studies focus on

open data activities primarily in developed countries, which generally already have stronger ICT development and institutions to encourage open data implementation (Jaakola, Kekkonen, Lahti, & Manninen, 2015; Safarov, 2019; Zuiderwijk & Janssen, 2014). Second, extensive empirical evidence is provided to support and extend our understanding of open data implementation and the role of institutional dimensions at the country level. So far, open data literature mostly provides either a conceptual focus or tend to explore specific institutional dimensions separately in the organizational level (e.g. Gascó-Hernández, Martin, Reggi, Pyo, & Luna-Reyes, 2018; Susha, Grönlund, & Janssen, 2015b). Third, practitioners and open data activists can use the insights from this study to adjust and increase the efficiency of open data implementation. The results can help them to address the critical institutional dimensions that are lacking rather than providing temporary technical solutions.

The paper is structured as follows: the next section presents the theoretical background, covering the open data literature and providing insight into institutional dimensions and transition countries. The methodology is introduced in section three. That same section also describes the methods used for case selection and data collection. We present our findings in section four and show that institutional dimensions similar to those found in developed countries also impact open data implementation in transition countries. In addition, we identify a new institutional dimension, namely that of international aid, that explains the level of open data implementation in transition countries. Finally, in section five we present our conclusions and the implications of the study.

2. Institutional perspectives on OGD implementation

Open data utilisation does not only depend on publishing government data but also includes sound guidelines; an open data strategy in which standards are set; quality control; a clear understanding of the user needs to be addressed; and recognition of the attendant sustainability challenges (Janssen et al., 2012). This insight has led to increased attention for the complex interplay between the technical, social and institutional contexts in which open data is adopted, implemented and

used. The barriers and challenges of open data implementation discussed in the open data literature are primarily related to institutional factors (Conradie & Choenni, 2014; Janssen et al., 2012; Sieber & Johnson, 2015). A recent study in Switzerland identified institutional factors as one of the four main barriers that determine open data adoption (Cahlikova & Mabillard, 2019). Our analysis will follow this line of research and focus on institutional dimensions of open data implementation.

While institutions have been defined in various ways, they are generally understood to stand for stable rules and norms of behaviour (Williamson, 2000). North (1991) defines *institutions as the humanly devised constraints that structure political, economic and social interaction which consist of both informal (e.g. customs, traditions) and formal rules (e.g. laws, constitutions).* Similarly as Safarov (2019), the institutional dimensions concept in this research is understood within the scope of the discursive institutionalism concept developed by Schmidt (2008). Discursive institutionalism is an approach for explaining the interaction of policy-relevant ideas, discourse and institutions. Institutions have long been considered an important driver of both innovation creation and innovation adoption (Grimmelikhuijsen & Feeney, 2016). The transformations currently altering the nature of governance and organizations cannot be understood without taking into account both the institutional and technical contexts that are restructuring economic and organizational activity (Orlikowski & Barley, 2001).

The impact of institutional dimensions is a frequently discussed, rather separately, topic in the open data literature. Several open data studies identify one or even several institutional factors as obstacles to open data implementation (Barry & Bannister, 2014; Conradie & Choenni, 2014). Ruijer and Meijer (2019) highlight that scaling up open data use, which is a primary challenge, necessitates managerial commitment and changes in organizational landscape such as constructing rules to stimulate open data utilisation. Others view these as encouraging mechanisms for open data use (Gascó-Hernández et al., 2018) and determinants to influence government agencies' intentions to release government data (Yang, Lo, & Shiang, 2015).

A study by Safarov (2019) provides a comprehensive theoretical framework that both synthesizes the various dimensions that are mentioned in the literature and tests the relations between several institutional dimensions and open data implementation. His empirical study of the situation in the Netherlands, Sweden and the UK shows that the institutional dimensions of policy and strategy, legislative foundations, organizational arrangements, relevant skills, public support and awareness play a significant role in the implementation of OGD. We will test this theoretical framework to see whether the same six dimensions are also relevant in transition countries. We introduce these institutional dimensions below.

- *Policy and strategy.* Zuiderwijk and Janssen (2014) show the importance of a comprehensive national and organizational open data policy to ensure consistency throughout the open data process of implementation. In their study on Australian Federal and State governments' open data policies, Chatfield and Reddick, (2018) show that not only are clear policies essential to obtain positive benefits, the early adoption of an open data policy also determines the success rate of OGD implementation.

- *Legislative foundations.* The main legislation impacting open data implementation is data privacy and freedom of information laws, as these can serve either to limit or promote data openness (Shepherd, 2015). The perceived legal barrier is considered a significant source of government resistance towards releasing more government data (Wirtz et al., 2015). A supportive legislative foundation is therefore vital to achieving impactful open data implementation. According to the Global Right to information rating[6], more than a hundred countries have adopted freedom of information laws. However, proactive freedom of information legislation covering open data is rare (Darbishire, 2010).

- *Organizational arrangements.* This dimension is a driving force behind open data sustainability, the facilitation of an open data

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[6] https://www.rti-rating.org

infrastructure and consistent support for open data use. Based on case studies performed in the Netherlands and Sweden, Susha, Grönlund and Janssen (2015b) consider organizational factors to be the primary challenge in establishing systematic support for open data users having various needs and skills. Public organizations have limited communication with open data stakeholders and users of open data. Along with the policy and strategy dimension, the high-level organizational support (open data activities are coordinated by Government Digital Service of the Cabinet Office) provided in the UK made it the best-performing country in terms of open data implementation (*Open Data Barometer*, 2017; Safarov, 2019).

- *Relevant skills and educational support.* A supportive open data policy, legislation and organizational arrangements notwithstanding, various stakeholders with different roles, knowledge and skills are required in order to transform raw open data into data-driven services and meaningful information (Ruijer, Grimmelikhuijsen, & Meijer, 2017). The growing array of open data use possibilities (e.g. data analytics, building data-driven services, data journalism) requires a dedicated approach in order to develop the relevant skills for data interpretation. Along with soft skills and domain knowledge, statistical, analytical and technical skills are needed to gain insights from open data. Hence supportive policies to address the existing skills gap are also necessary (Carrara, Fischer, & Steenbergen, 2015).

- *Public support and awareness.* The lack of public awareness of the possibilities accompanying open data is a significant barrier to existing open data implementation (Barry & Bannister, 2014). Public support and awareness are strongly related to the previous dimension, namely the availability of relevant skills, in terms of their role in leveraging open data. Gascó-Hernández, et al. (2018) argue that public awareness of the benefits of open data is insufficient to promote OGD usage, as specific data analyst skills are required to take advantage of these benefits. Their study reveals that open data training is more effective when the

relevant training programs include context-driven knowledge and interaction with public organizations.

Now that the institutional dimensions have been introduced, we will focus on the core dependent variable of our framework: open data implementation. OD implementation refers to the realisation and the availability of an open data infrastructure. The Open Data Charter (ODC), which has been adopted by 69 national and local governments, has developed a set of six principles as guidance for the implementation of open data, including timeliness, comprehensiveness, accessibility, reusability, comparability and interoperability (ODC, 2018b). Furthermore, in any open data implementation process, the channels for citizen engagement and inclusive development should be considered.

Various methodologies have been developed to measure open data maturity level, including the Open Data Barometer developed by the World Wide Web Foundation, the Open Data Index developed by the Open Knowledge Institute and the Open Data Readiness Assessment developed by the World Bank. While these methodologies also measure various organizational/institutional aspects of open data adoption, nearly all assess the facilitation of open data portals, data quality, user-friendly tools, availability of feedback and participation mechanisms for citizens (Susha, Zuiderwijk, Janssen, & Gronlund, 2015). Likewise, these components of open data implementation have been used by scholars to analyse the open data performance of various countries (Chatfield & Reddick, 2017; Wang, Chen, & Richards, 2018).

Open data implementation process is realized by facilitating open data portals with user-friendly data services such as browse, search, download, feedback functionalities and reusable, high-quality data sources (Dahbi, Lamharhar, & Chiadmi, 2019; Fitriani, Hidayanto, Purwandari, Nazief, & Hardian, 2017; Ruhua, 2019). Therefore, open data implementation can be understood as the facilitation of technical conditions such as effective open data portals, user-friendly tools, data quality control that facilitate various types of open data use.

- Policy and strategy - Legislative foundations - Organizational arrangement - Relevant skills and educational support - Public support and awareness	→	- Open data portals - User-friendly tools - Quality control - Participation mechanisms
Institutional dimensions		**Open data implementation**
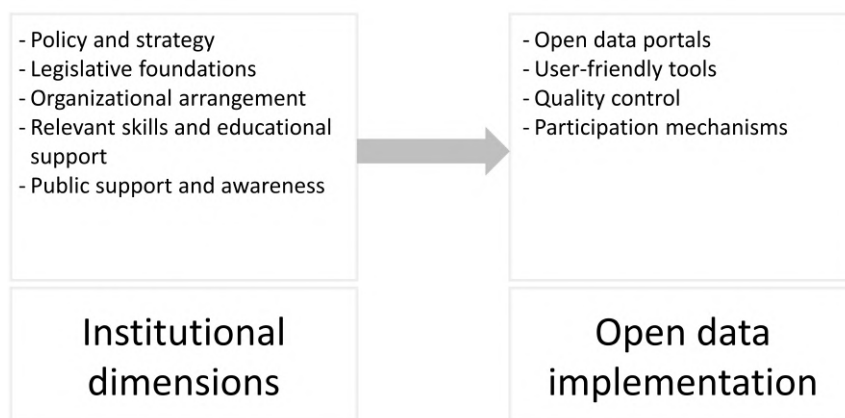
Figure 1. Research framework

The position of the institutional dimensions that determine the trajectory of open data implementation in transition countries has largely gone unstudied. To remedy this gap, we have undertaken this study on the open data experience of six transition countries, using pre-formulated institutional dimensions, based on the research framework presented in Figure 1.

3. Transition countries: EaP cases

One important limitation of the literature on OGD implementation is the predominant emphasis on the institutional aspects of open data in developed countries. In these countries, with their strong democratic traditions, the institutional dimensions held to be so important for OGD adoption are fairly stable. In transition countries, however, institutions and institutional dimensions are much younger and more fragile. The transition countries are still endeavouring to establish democratic institutions while wrestling with the strong influence of Soviet/communist legacies, and in particular, a monopolistic model of economy, hierarchy and management inflexibility in public administration (Liebert, Condrey, & Goncharov, 2013).

Although all are developing countries, the transition countries, in the throes of the transformation from a centrally-planned economy to a market economy, stand apart from the other developing countries in terms of their economic, institutional and social performance. A majority of the transition countries have a higher share of employment in

industry and a higher energy consumption relative to their income per capita; they have extensive physical infrastructure and a higher proportion of their population in secondary and tertiary education (Gros & Suhrcke, 2000). Life satisfaction in such countries is lower than in other countries due to a high level of perceived corruption and fragile public institutions (Djankov, Nikolova, & Zilinsky, 2016). However, BenYishay and Grosjean (2014) argue that a variation within the transition countries is seen which can be explained by the institutional quality and their natural resource abundance. Privatization reforms, enterprise restructuring and competition policy in particular strongly impact this transformation process.

The experience of the Eastern Partnership framework with institutional transition, capacity-building and open data implementation began with its recognition of the Open Data Charter, adopted by the G8 countries in 2013, as well as of the EU Directive on the re-use of public sector information (PSI) and the European Commission's guidelines on the re-use of PSI as guidance to move towards wider access and re-use of public data (EaPMM, 2015). Batura and Evas (2016) view the year 2015 as a major turning point. That year, during its first ministerial meeting, the EaP adopted the declaration on the digital economy, accepting the value of open data as a part of e-government to enhance public transparency, effectiveness and innovation creation. However, the second declaration of the ministerial meeting (EaPMM, 2017), signed in 2017, made no mention of open data. Instead, the focus was on security and infrastructural issues of the digital economy.

Because of the institutional fragility of the transition countries, the ICT capacity of the EaP countries lacks the scope, support and intensity needed for effective instruments such as greater participation of stakeholders and learning from the best practices of EU countries (Batura & Evas, 2016). Furthermore, the transformation and democratization programs of these countries have not effectively exploited the benefits of the digital democracy, failing, for example, to deploy e-participation and e-democracy tools to engage with citizens and encourage their participation (Misnikov, 2016). In their research on Moldova and Ukraine, Nyman-Metcalf and Repytskyi (2016) note that while institutional structures have been established to support e-

government implementation, the development of good governance tends to be inconsistent throughout the region. The authors also emphasize that these countries tend to pay more attention to technical issues than to the possibilities of achieving good governance and citizen participation through the use of digital solutions.

Nonetheless, these countries have introduced digital technologies into public administrations, albeit with a varying degree of success. According to the results of the UN E-Government Survey 2018, the EaP countries perform above the world average in terms of e-government development and e-participation. While Belarus is not a member of the Open Government Partnership (OGP) framework, it is the best-performing of the EaP countries in the E-government Development Index. The lowest-ranking EaP country on e-government development is Armenia, with a result just above the world average (world average: 0,5491).

These same countries also score above the world average (world average: 0,5654) in the E-participation index. All have climbed in the E-government Development Index and E-participation index compared to the results of 2012. In recent years, the Eastern Partnership countries have reformed public administration, implemented e-government and digital solutions to promote the efficiency and effectiveness of governance and public service delivery due to the influence of the developed countries. They have also started to implement open data, although with a limited scope and level of utilisation (*Open Data Barometer*, 2017). The Eastern Partnership countries (except Belarus, and partially Azerbaijan) have joined the Open Government Partnership initiative, which aims to promote transparency, empower citizens and to utilize new technologies. These countries (except Belarus) also have adopted freedom of information legislation. As this region has a centralized and closed socialist background, it is interesting to contemplate the impact of the institutional characteristics of the countries on open data initiatives, which are associated with openness and democratic culture.

4. Methodology

We focus on the national level of open data adoption in transition countries, which are relevant empirical cases for the research goals of this study. A case study method allows us to investigate a system (a case) or multiple systems (cases) through comprehensive and in-depth data collection from multiple sources and reports (Creswell, 2012, p. 97). We follow a multi-case research design for two reasons: first, all the selected countries have only just started to implement open data initiatives and have achieved a varying level of adoption. In this regard, a multi-case study approach enables us to observe the differences and similarities between the cases. Second, the multi-case research design allows us to investigate the role of institutions through the replication approach. According to Yin (2014), if the majority of the case studies in a multi-case study deliver similar patterns, this can indicate significant support for the initial proposition that describes the research subject. Eisenhardt and Graebner (2007) note that even though the multi-case study method consumes more time and resources, it creates a more convincing theory compared to a single case study.

4.1. Data collection and analysis

In order to answer the research question, we relied on several data sources, namely desk research, document analysis and focus group discussions. The focus groups organized in the relevant countries constituted the primary source of data. These groups, which met for half-day sessions, were comprised of 15 open data stakeholders (average) and open data stakeholders (89 in total) involved in IT, start-ups, e-government, transparency and open data practices. All the focus group meetings were organized in the mid of 2018, namely 10 May in Moldova, 14 May in Ukraine, 17 May in Belarus, 25 July in Georgia, 27 July in Azerbaijan, 31 July in Armenia. To guarantee the stakeholders to fully express their opinions and not subjected to groupthink, we restricted broader political discussion and focused on fact-based operational discussion. In Moldova, the meeting was in the local language and translation was used to translate the discussions to the English language. In Ukraine and Belarus, Russian and English languages were

used as a working language in the meetings. In Azerbaijan, the meeting was in the local language. In Armenia and Georgia, the meetings were in the English language. The meeting notes were transcribed in the English language afterwards.

The main reason for selecting open data stakeholders was their involvement in and expertise of open data activities in their countries. In the first round of the selection, we used publicly available information to find and contact stakeholders. For example, authors of open data reports, open data hackathon organizers, founders of open data start-ups and non-government organizations, public officials responsible for open data activities of government organizations were contacted and invited to participate the focus group meetings. Then, in the second round, the shortlisted stakeholders asked if they have any recommendations for other stakeholders to ensure maximum coverage of the open data stakeholders.

The focus group approach allows the participants to explain their perceptions in terms of institutional settings, the role of institutions and open data implementation. Furthermore, collective discussions in which the participants included open data providers, data users and open data activists helped to determine the most relevant research paradigm. The focus group participants and the documents which were reviewed are presented in Table 1:

Country	Focus groups	Documents
Armenia (Am)	13 participants: – 4-public administration (PA) – 4- non-government organization (NGO) – 1- start-up* – 3- academia – 2- journalist	Law on Freedom of Information (2003); Law on protection of personal data (2015); Digital Transformation Agenda of Armenia (2018); Open government action plans (2011-2012; 2014-2016; 2016-2018; 2018-2020).
Azerbaijan (Az)	15 participants: – 4- PA – 7- NGO – 2- academia – 2- journalist	Law on Access to Information (2005); Law on personal information (2010); State program for the implementation of the national strategy for information society development for 2016-2020 (2016); Open government action plans (2012-2015; 2016-2018).

Belarus (By)	16 participants: – 3- PA – 6- NGO – 3- academia – 3- journalist – 1- start-up	Law on Information, Informatisation and Information Protection (2008); State Program on Development of Digital Economy and Information Society in Belarus for 2016-2020 (2016); Draft Law on Personal Data protection (2019, expected).
Georgia (Ge)	17 participants: – 7- PA – 8- NGO – 1- academia – 1- journalist	Law on personal data protection (2011); General administrative code (1999) chapter 3 - freedom of information; Digital Georgia: e-Georgia strategy and action plan 2014-2018 (2014); Open government action plans (2012-2013; 2014-2016; 2016-2018; 2018-2019).
Moldova (Md)	17 participants: – 7- PA – 6- NGO – 4- academia	Law on access to information (2000); Law on personal data protection (2011); Law on the re-use of public sector information (2012); Government decision on the approval of the methodology of publishing open government data (2014); National strategy for information society development: Digital Moldova 2020 (2013); Open government action plans (2012-2013; 2014-2016; 2016-2018; 2018-2020).
Ukraine (Ua)	11 participants: – 2- PA – 5- NGO – 2- journalist – 1- start-up – 1- academia	Law on access to public information (2011); Law on the protection of personal data (2010); Cabinet of Ministers of Ukraine Resolution on approval of the provision on data sets to be released in the form of open data (2015); The concept of the development of the digital economy and society for 2018-2020 (2018); Open government action plans (2012-2013; 2014-2015; 2016-2018).
Open data reports and studies prepared by non-government organizations		Situation Review: Safety and Security of Cyberspace and E-Democracy in the Eastern Partnership Countries (Reinsalu, Rikk, Krenjova, & Pernik, 2017); Access to open data in Georgia and Visegrad countries (IDFI, 2018); ICT innovation and start-up ecosystems in EaP countries: study report (Molen, 2018);

	Open data index of the government organizations: Azerbaijan (not published) (Muradov, 2017); Open data readiness assessment Ukraine (Shcherbinina & Zubko, 2017).

*only the start-ups using open government data

Table 1. Focus group participants and reviewed documents

The focus group discussions started with an assessment of the institutional dimensions, the role of the institutions and the institutional challenges in a country. In this round, each participant was asked to provide an overview of the institutional dimensions of open data adoption. The collected views were then discussed with all participants. In the second round, the results of the implementation of open data and data sharing formed the basis for a discussion on the implementation of open data. The participants were asked about their expectations in terms of open data use and re-use. Then, user expectations were discussed with all participants by focusing on where the expectations of users had been or had not been met. The focus group discussion data is referenced in the finding section according to country and the participant's sector (e.g. [Georgia: 11-PA] – the focus group discussion country - Georgia; the sector of a participant - public administration; 11 - participant's number in the transcript).

The qualitative data from the focus group discussions and notes of the document analysis were transcribed and coded by using Nvivo 10 software. The textual analysis was employed to select important discussions around institutional dimensions and open data implementation and completely carried out by the author. Therefore, the findings discussed in the next section, have not been validated by inter-coder reliability check. To warrant sufficient reliability of the coding process the following measures were taken. To conduct the textual analysis, the codes were developed from theory. Then, the codes were cross validated with document analysis. In the coding process, the inductive and deductive approaches were employed to code transcribed meeting discussions. Deductive codes were categorized based on five institutional dimensions and comprised codes related to policy and strategy, legislation, organizational arrangement, relevant skills, public support and awareness. Then, the transcripts were coded by

open data implementation components. In addition, some codes were created inductively (such as political will and international aid) to understand the specificity of transition countries, role and impact of institutional dimensions on open data implementation.

Documents provided another source of data. Official documents such as freedom of information, data protection legislation, digital programs and the Open Government Partnership action plans of the countries, regional and country reports, studies on open data activities (presented in Table 1) and open data initiatives were reviewed to gauge these countries' institutional readiness and their motivation for open data adoption. For cross-verification purposes, we also reviewed the recently published studies and reports prepared by non-government institutions. All the documents were publicly available and accessed in May – October 2018.

The aim of this document analysis was to investigate the way in which digital, e-government and open government policy content could support and add value to open data implementation. Although the institutional settings of the countries for open data implementation were derived from desk research and document analysis, we also cross-checked these data in the focus group discussions. Next to official documents, we also used secondary data – the UN E-government Survey - to understand the level of digitalization and the availability of an IT infrastructure to collect, store and share public data. We also reviewed the official open data portals of the countries to determine the data and information sharing level.

4.2. Operationalisation of the framework

As this study investigates the connection between the concept of institutional dimensions and open data implementation, the focus is on the specific set of dimensions extracted from the literature review that describes the quality of institutions. In this study, the quality of the institutions is evidenced by the development level of the institutional dimensions. Furthermore, the degree of effectiveness, coverage and the sustainability of the initiatives also influence institutional dimensions.

These mainly cover the national level activities focusing on open data implementation. Open data implementation is also measured to some extent on the basis of the technical and facilitation capacity of a country.

In the following tables, we present the measures of institutional dimensions and evaluation criteria:

	Definition	Weak	Moderate	Strong
Policy and strategy	Well-developed open data policy and strategy, detailed action plans with clear milestones, deadlines and performance measurement mechanisms.	- Open Government Partnership action plans have data-related commitments. - A country has a national open data strategy. - A country has open data guidance.	- Open Government Partnership action plans have at least 2 dedicated open data commitments and clear plans to fulfil the commitments. - A country has a national open data strategy with a clear roadmap. - A country has open data guidance which considers the open data principles.	- Open Government Partnership action plans have more than 2 dedicated open data commitments and resources, clear plans to fulfil the commitments. - A country has a national open data strategy with clear roadmap considering the list of data that needs to be open and quality control measures. - A country has open data guidance which considers the open data principles, data publishing rules and data quality measures (e.g. sustainability, machine-readable, timely).
Legislative foundations	Functioning freedom of information and data protection acts, their organizational support and established a connection between these legislations and open data implementation.	- A country has dedicated open data legislation. - A country has Freedom of Information and Personal data protection acts.	- Open data legislation obliges public institutions to publish data as open data. - The Freedom of Information and Personal data protection acts are open data-friendly and do not limit publishing government data.	- Open data legislation obliges public institutions to publish data as open data. The legislation provides monitoring and regulatory authority to the supervisory institutions. - The Freedom of Information and Personal data protection acts promote publishing more and better open data.

Organizational arrangements	Clear roles and responsibilities of the supervisory organization, its mandate, quality control instruments and functioning feedback mechanisms.	A country has a formal or official organization which supervises and coordinates open data activities.	A supervisory organization has a dedicated team to supervise and coordinate open data activities. Several important public institutions have dedicated personnel to supervise their open data projects.	A supervisory organization has a monitoring and regulatory authority to maintain the quality of published data and sustainability of publishing procedures.
Relevant skills and educational support	Availability of dedicated training programs, sustainable educational support, promoting open data usage skills by hackathons, competitions and awards.	There are at least 3 training programs dedicated to open data.	There are several open data courses and training programs cover multiple sectors.	A country has dedicated institutions, training programs to increase relevant skills and provide educational support to open data implementation.
Public support and awareness	Established open data community and strong support from public institutions, communication and collaboration among government and non-government	- There is at least one non-government institution dedicated to open data. - There are at least 3 national level government institutions that	- There are at least 3 non-government institutions dedicated to open data. - There are several national level government institutions	- There are many non-government institutions dedicated to open data. - There are several national level government institutions that actively involve open data activities. - Supervisory organization and NGOs organize periodic events, conferences, competitions and

organizations, availability of dedicated organizations, level of public demand.	actively involve open data activities.	that actively involve open data activities. - The supervisory organization has a role to coordinate relations among open data stakeholders and public institutions.	roundtables to increase open data use, public awareness and coordinate relations among open data stakeholders and public institutions.

Table 2. Evaluation criterion – Institutional dimensions

Many open data implementation measures have been developed by scholars and international organizations (e.g. Open Data Barometer, Open Data Index). As the assessment of open data implementation is not our primary goal and the EaP countries reviewed in this study are in the early stages of open data adoption, a simplified framework is used to evaluate open data implementation. The factors representing the maturity of open data implementation, definitions and their evaluation criterion are presented in Table 3:

	Definition	Weak	Moderate	Strong
Central open data portal	Availability of central open data portal.	A country has an open data portal with limited facilitation.	The open data portal has at least a hundred open government data.	The open data portal has at least a thousand open government data.
Specialized open data portals	Availability of specialized open data portals (e.g. open environmental data portal, open spending data portal).	A country has at least 3 specialized open data portals (e.g. open transportation portal, open procurement portal).	A country has at least 5 specialized open data portals with better maintenance.	A country has many functioning specialized open data portals with strong facilitation and maintenance.
User-friendly tools	Availability of search, visualization and data use tools.	An open data portal has basic tools to search, filter and overview data.	An open data portal has advanced search tools and data visualisation tools.	An open data portal has advanced search tools and data visualisation tools, API connection and download options.
Quality control	Effective open data quality control and availability of high-quality datasets with considering sustainability, data standards, quality of metadata and licensing.	An open data portal provides metadata and data quality information (e.g. versions, last updated).	An open data portal provides metadata, data quality information, deadlines for publishing data, error reporting options.	An open data portal provides metadata, data quality information, deadlines for publishing data, error reporting options. All published data is in the framework of open data principles.
Participation mechanisms	Participation mechanisms, active feedback tools and email communication.	There is an email communication option.	There is email communication, commenting, ranking of each data options.	There are an email and interactive communication, commenting, ranking of each data options. The portal provides communication channels to communicate with each data owners.

Table 3. Evaluation criterion – Open data implementation

Components or factors that do not exist are labelled "Absent". The maturity of the institutional dimensions and open data implementation are labelled weak, moderate or strong. A "weak" evaluation indicates that only very few direct and indirect cases and activities related to the measured issue are available. For example, Georgia's OGP action plans do not include a dedicated commitment to open data, although the country plans to improve the open procurement system and implement a number of open data projects in municipalities. As this country lacks an open data strategy, it received a "weak" rating on the Open data focus in OGP action plans and was marked "absent" on open data strategy. A "moderate" evaluation indicates the availability of several direct and indirect cases, activities and their preliminary impacts on the measured issue. For example, Moldova has a supervisory organization and a dedicated staff to coordinate open data activities. However, as the organization lacks the authority to monitor and regulate open data activities, Moldova has been given a "moderate" rating on the organizational arrangements dimension. A "strong" rating indicates the availability of working and impactful cases and activities related to the measured issue. For example, in Ukraine, a resolution on the publication of open data has been adopted by the Cabinet of Ministers (CMU, 2015) which clearly defines open data publishing principles, formats, the list of data that needs to be published, criteria for publishing data etc. Thus, for Ukraine, the open data guidance subsection of the policy and strategy dimension has been marked "strong".

5. Findings

The aim of this study is to explore the extent to which institutional dimensions explain the implementation of open data in transition countries. To that end, we first discuss the institutional dimensions and then present a comparative analysis of the institutional dimensions and open data implementation. To do so, based on our initial observation of their approach to open data adoption and institutional dimensions we divided the countries under review into two groups, namely the early adopters Georgia, Moldova and Ukraine; and the laggards, a group made up of Armenia, Azerbaijan and Belarus. Both groups are discussed in the light of the results of the focus group discussions, desk research

and document analysis results. We also discuss the level of implementation, facilitation and whether the quality and sustainability of the open data initiatives are adequate in the transition countries. This in-depth discussion will subsequently be followed by a comparative overview of all transition countries.

5.1. Institutional dimensions: early adopters

The findings show that the three early adopters - Georgia, Moldova and Ukraine - performed satisfactorily in terms of institutional dimensions' development. These countries have started to adopt an open data policy and strategy and have appointed supervisory institutes to coordinate the implementation of open data practices. For these early adopters, external actors are an important driving force to build capacity in governmental and non-governmental institutions and to increase public awareness [Georgia: 11-PA; 9-NGO; Ukraine: 3-NGO]. Several data-related awareness events have been organized such as the Data Festival Tbilisi, data hackathon (datafest.ge), Open Data Challenge Ukraine (odc.in.ua) and the Ministry of Data Challenge (ministryofdata.info). All have been supported by foreign donors.

Georgia. While the Georgian government promotes the idea of open government and actively participates in the Open Government Partnership framework, the country lacks an open data policy and strategy, which has resulted in a volunteer approach to open data adoption. Hence the quality and sustainability of the open data initiatives are low.

> Publishing data is not obligatory, and many government organizations don't care about this initiative. As there is not a policy, open data activities are voluntary in Georgia [Georgia: 1-NGO].

This voluntary approach is a reflection of the fact that Georgia's latest OGP action plan does not include a commitment to open data. Nevertheless, the Georgian government has promised to deliver new Freedom of Information legislation, to publish court decisions and public officials' asset declarations, the latter of which were delivered,

although in a non-machine-readable format. Aside from the company information (Ge, 2018a) and open contracting data (Ge, 2018b) projects delivered by Transparency International Georgia, there are no other sustainable open data-driven projects.

The lack of skills and relevant knowledge in the public sector constitute another barrier to realizing Georgia's open data commitments. As a public sector representative reflects:

> We have organized several training programs with the support of donor organizations to increase IT and digital knowledge of government workers. I think public organizations have a strong need for digital skills, particularly data management and governance. It is very hard to find knowledgeable workers, partly because of lower salaries [Georgia: 11-PA].

Moldova. The focus group participants in Moldova likewise view the institutional dimensions of relevant skills and educational support, and organizational dimensions as the most significant. Open data and releasing public information are the primary themes in Moldova's OGP action plan. The Moldavian government is specifically committed to increasing transparency in public procurement and government budgets by releasing more open data. To do so, the government plans to organize awareness and training programs for the open data community and events with civil society and developers to use public procurement data and other open data. However, the shortage of skills needed to build a data-driven public sector able to deal with open data is seen as a factor hampering the opening up of more data in a reusable way in Moldova. Open data projects in Moldova are also supported by international organizations such as the World Bank, which funded open contracting data and open spending data within the scope of the BOOST project [Moldova: 9-Academia; Moldova: 6-NGO].

Moldova is the first country in the region to have implemented open data initiatives. The re-use of public sector information initiative started in 2012. While the recent public administration reforms in Moldova have slowed down open data implementation, the civil sector still attaches importance to open data as an anti-corruption and transparency tool.

> Before the administrative reforms, each ministry had a responsible person for open data. But, after the reforms, some ministries did not appoint open data person [Moldova: 7-PA]... If there is not open data person in a ministry, they will not update published data. If there is not a focal point, you will find open data from 2016. In general, each institution is responsible for its own open data activity. There is no supervision for publishing data [Moldova: 5-PA].

While the open data portal is maintained by the E-Governance Agency, this institute does not have the authority needed to monitor the quality and sustainability of the portal [Moldova: 8-NGO].

in Ukraine, the institutional dimensions of policy and strategy, and legislative foundations were viewed as the most critical by the focus group participants, despite the fact that this country has the most advanced open data policy in the studied region. Several open data-driven competitions were organized by NGOs, such as the open data challenge (ODC, 2018a), e-governance for accountability challenge (EAC, 2018), and Apps4Cities competition (AFC, 2018). All these events were supported by external donor organizations. As NGO representatives note:

> Donor institutions have a very strong impact on open data implementation. Already mentioned, the TAPAS project is supported by international donor organizations. Ukrainian Government partners with these projects [Ukraine: 1-NGO]... The State Agency of E-government was a very small organization two years ago with 10-12 employees. International organizations helped to build the capacity of this organization to be sustainable, capable of doing e-government related works [Ukraine: 3-NGO].

Ukraine's OGP action plans do not include a separate commitment to open data. Nevertheless, the government has plans to increase transparency in public procurement and government budget areas by

using open data. Open data projects in Ukraine have had some initial impacts on transparency and accountability:

> Open spending data portal covers any governmental spending including local government institutions. Based on spending data, there are court decisions, and some government officials from the local government were jailed because of corruption [Ukraine: 9-PA].

The open data policy of Ukraine is the most comprehensive in the region and covers the data formats and list of government data that should be open. However, the policy lacks systematic supervision and needs better coordination [Ukraine: 9-PA, 3-NGO]. Along with the proposed dimensions, the participants in the focus group named several other factors with an impact on open data implementation, such as financial resources, evidence-based policy culture and the mindset to embrace transparency. Regarding the skills and educational support dimension, both a dedicated training program and government strategy in this area are lacking [Ukraine: 2-NGO, 8-journalist]. In general, the need to increase data skills have not been a part of the open data policies in the countries under review. Only very few short-term training programs for journalists and entrepreneurs were organized by non-governmental institutions in Georgia, Ukraine and Moldova.

In sum, the availability of policy and strategy, although varying in degree of effectiveness and coverage, is a significant factor for the quality and development of institutional dimensions in Georgia, Moldova and Ukraine. In all three countries, open data implementation is supervised and coordinated by e-government agencies with only limited capacity. Bottom-up initiatives, relatively strong support from external actors (e.g. international donor organizations, developed countries) and an active NGO sector are the primary driving forces of open data implementation. NGOs have a significant role in the initiation and implementation of open data-related projects, specifically in Ukraine and Georgia.

5.2. Institutional dimensions: laggards

The results of the focus group discussions and desk research revealed that three countries – Armenia, Azerbaijan and Belarus – lag behind in the development of institutional dimensions and lack both organizational arrangements and a clear open data policy and strategy. These countries have significantly less external support from international aid organizations and developed countries. Of these countries, only Azerbaijan has an open data portal, albeit one that is inadequately facilitated.

Armenia. The critical institutional dimensions in Armenia were found to be organizational arrangements and legislation and policy. The Armenian government does not yet have a central open data portal. No government organization to coordinate open data activities has been appointed. As in Georgia, Ukraine and Moldova, the international donor organizations support transparency and accountability-oriented projects, but the majority of the projects cover politically sensitive subjects such as elections, free media, civil sector development, etc. Introducing transparency and access to data is a reform target of the Armenian government within the economic development framework set down in the Armenia Development Strategy 2014-2025 (Am, 2014). The absence of organizational support and policy is due to the political issues in this country.

> I guess open data idea has not developed in Armenia. The main reason is the political turmoil in the country. Normally, the government has an interest in the implementation of innovations, improving start-up climate. But, to implement such a broad and a comprehensive program with clear strategy requires stability and strong support from society. We currently live in political transformation. So open data is not on the agenda of our society [Armenia: 1-PA].

There are several specialized information sharing web pages such as the Data portal of the Central Bank, Statistics portal, and the United Database of the Ministry of Justice. However, the quality of the data is inadequate.

> The Central Bank has databank.cba.am. But they share statistics of macroeconomics, it is impossible to use this data to build some data-driven service. Even this portal does not work properly. You cannot find detailed information [Armenia: 2-NGO].

In many cases, sensitive and publicly interesting government information such as government officials' travel spending or public procurement plans of governmental organizations are published in non-machine-readable file formats in Armenia. The latest OGP action plan (November 2018) which covers the period 2018- 2020, includes a commitment to publish the asset declarations of high-ranking officials as open data by August 2020.

While Azerbaijan has a central open data portal, several open data initiatives and national open government action plans, the country has left major transparency and open government initiatives such as the Extractive Industries Transparency Initiative and Open Government Partnership. The Azerbaijani Government has adopted the Promotion of Open Government for 2016-2018 National Action Plan, which mainly covers the improvement of electronic service delivery. With the support of the government, a few conference and data competitions have been organized. However, for any open data initiatives to have an impact, the issues of data quality and sustainability must be adequately addressed.

> The Ministry of Communication, Transportation and High Technology organized the open data conference. Therefore, they updated the open data portal and published several datasets. But this is an imitation, no one thinks the quality of data, sustainability of open data adoption. All these challenges are connected to a lack of policy and strategy [Azerbaijan: 4-Journalist].

The government sector in Azerbaijan expects the economic outcome from open data adoption to be greater than its good governance and societal impact.

> If there is an economic value of released data, we can go further and promote this field. Government is not

a driver of the IT sector. We expect initiatives from communities and the business sector [Azerbaijan: 3-PA].

In the Promotion of Open Government for 2016-2018 National Action Plan, several commitments to increase transparency, public awareness by supporting communities and NGOs have been included. However, except for preparing a report about the open data activities of government institutions, NGOs have made no fundamental contribution to increasing public awareness of open data in Azerbaijan.

Belarus. For the Belarussian government, traditional public administration services are more important than finding new solutions and implementing innovations such as open data [Belarus: 3-NGO, 5-journalist, 6-business]. Belarus has no dedicated freedom of information nor data protection legislation. The country does not participate in the Open Government Partnership framework.

> As there is not a legal basis for opening data, it fully depends on the intention of the organizations. Some institutions are good to share information, at least statistical level. For example, The National Statistical Committee is relatively good to share data. The Ministry of Internal Affairs, on the other hand, shares aggregated data which limits to produce good story [Belarus: 4-NGO].

Unlike in the other EaP countries, the presence and impact of external actors, donor and international organizations on the implementation of innovations, particularly open data in the public sector, is negligible in Belarus. As an NGO representative says:

> Comparing to Ukraine, there is little even sometimes not any external pressure and support to implement innovative solutions in Belarus. International organizations have very little space to survive in our country. USAID and the Eurasia Foundation provide some assistance to develop civil society. But their activities are limited. In Ukraine, they are very active, and the Ukrainian government supports them to

work. In Belarus, it is not like this. If I remember correctly, USAID operates its Belarussian activities from Ukraine [Belarus: 1-NGO].

The Information, Informatisation and Protection of Information Law of Belarus distinguishes between publicly available information, government information, and information requiring restricted distribution, but does not endorse freedom of information regime in the country.

In conclusion, Armenia, Azerbaijan and Belarus all lack a strong open data-related policy and strategy. As a result, the initiatives are few and scattered. According to the focus group discussion results, the most critical issues are policy and strategy, together with public support and awareness. These should be addressed first in Azerbaijan and Belarus. The lack of policy and strategy manifests in a different way in each country. The absence of policy and strategy in Azerbaijan and Belarus translated to the narrow scope and poor quality of open data implementation although both countries have a supervisory organization to administer open data activities. Armenia, on the other hand, lacks proper organizational support and supervision.

5.3. Comparative overview

To understand the relationship between institutional dimensions and open data adoption, we first present an overview of the institutional dimensions in the region under discussion. We then briefly look at the most important factors that determine the performance of the implementation of open data practices. Table 4 and Table 5 present the comparative evaluation of the institutional dimensions and open data implementation respectively in the countries under review. We close with a discussion of the impact of institutional dimensions on the implementation of open data principles.

Open data adoption in this region is viewed in a narrow context, with successful projects started by non-governmental organizations targeted at achieving more transparency in the government sector. The key success factor for these projects is better organizational and

international support. The open data initiatives mentioned, i.e., open spending data (Ua, 2018c), open contracting data (Ua, 2018a) and the open parliament initiative in Ukraine; the open company data portal (Md, 2018a) and open contract beneficiary data (Md, 2018c) in Moldova; open company data (Ge, 2018a) and open contracting data (Ge, 2018b) in Georgia, have a team and organizations that maintain the projects. These are frequently used by journalists and third-party users.

Fear of mistakes, a lack of resources and transparency, and the additional workload anticipated with open data are seen as influential factors hampering the opening up of more government data in a broad range of public activity areas [Belarus: 2-journalist; Armenia: 2-NGO; Azerbaijan: 5-Journalist; Ukraine: 3-NGO]. A good example is the open data portal that the Belarusian government started to develop in 2016, and which has still not been implemented. Institutional challenges act as an impediment to open data implementation in the region.

Policy and strategy and legislative foundations are two of the most important institutional dimensions that significantly differ between the developed countries and the transition countries under review. While all six EaP countries (except Belarus) have freedom of information and data privacy legislation, dedicated open data legislation is absent in all. All have appointed a supervisory institution to coordinate and control open data activities, however, these lack sufficient authority and representation on open data activities. Obviously, the quality of institutional dimensions in Georgia, Moldova and Ukraine are better than in Armenia, Azerbaijan and Belarus, despite the fact that the institutional dimensions have not been established and well institutionalized in the studied region. Relevant skills, educational and public support and open data awareness are particularly low in the region, the only exception being Ukraine, which has better NGO participation and coordination of the open data activities.

		Ar	Az	By	Ge	Md	Ua
Policy and strategy	Open data focus on OGP action plans	Weak	Absent	Absent	Weak	Moderate	Moderate
	OGD strategy	Absent	Absent	Absent	Absent	Weak	Moderate
	Open data guidance	Absent	Absent	Absent	Absent	Moderate	Strong
Legislative foundations	Dedicated open data legislation	Absent	Absent	Absent	Absent	Absent	Moderate
	FOI and personal data privacy legislations	Moderate	Moderate	Weak	Moderate	Strong	Moderate
Organizational arrangements	Supervision and coordination	Weak	Weak	Weak	Moderate	Moderate	Moderate
Relevant skills and educational support	A systematic approach to education and skill development	Absent	Absent	Absent	Weak	Weak	Weak
	Courses and training programs	Absent	Absent	Absent	Weak	Weak	Weak
Public support and awareness	Participation of NGOs	Weak	Weak	Absent	Moderate	Moderate	Strong
	Coordination of the activities	Absent	Absent	Absent	Weak	Moderate	Strong
	Role of public institutions	Weak	Weak	Weak	Moderate	Weak	Moderate

Table 4. Institutional dimensions' overview.

As in more developed countries, the EaP countries commenced the implementation of open data with a central data portal. Except for Belarus and Armenia, all the countries studied have a portal which is maintained by e-government agencies or information technology ministries. The quality of facilitation, however, varies among the countries. In the Ukrainian central open data portal (Ua, 2018b), more than 48 thousand datasets have been published; in Georgia, 171 datasets (Ge, 2018c) and in Moldova 1109 datasets (Md, 2018b). The publication of many non-machine-readable files (e.g. PDF, DOC) as open data in these portals is a systemic phenomenon. The portals of Ukraine and Moldova provide information about recent changes in the dataset, update frequency, format, description of data, the term of use, information and the contact details of the responsible contact. A feedback tool to communicate with the operator of the portal is also included. Users have the option to rate the published datasets. The quality of the datasets, however, is not properly maintained. Many datasets are general statistics rather than open data presenting a single datum and subject. Other open data projects such as open spending data and open contracting data in Ukraine, Georgia and Moldova are systematically updated and well-maintained. Table 2 summarizes the most important components of open data implementation in the countries studied.

	Ar	Az	Be	Ge	Md	Ua
Central open data portal	Absent	Weak	Absent	Moderate	Strong	Strong
Specialized open data portals	Absent	Absent	Absent	Weak	Absent	Weak
User-friendly tools	Absent	Weak	Absent	Weak	Moderate	Moderate
Quality control	Absent	Absent	Absent	Weak	Weak	Weak
Participation mechanisms	Weak	Weak	Absent	Moderate	Moderate	Moderate

Table 5. Open data implementation overview

In general, the quality of the datasets has not been well maintained. Many datasets were published but have since not been updated. Furthermore, the datasets have not been provided with complete metadata, which reduces the possibility of effective re-use. The open data portals of Moldova and Ukraine provide several user-friendly functions such as searching, categorizing and filtering datasets,

providing feedback, commenting and ranking datasets. Azerbaijan's open data portal (Az, 2018) offers several API services but lacks downloadable open datasets. Although the portal has very few JSON or XML files, the services provided are mostly informative.
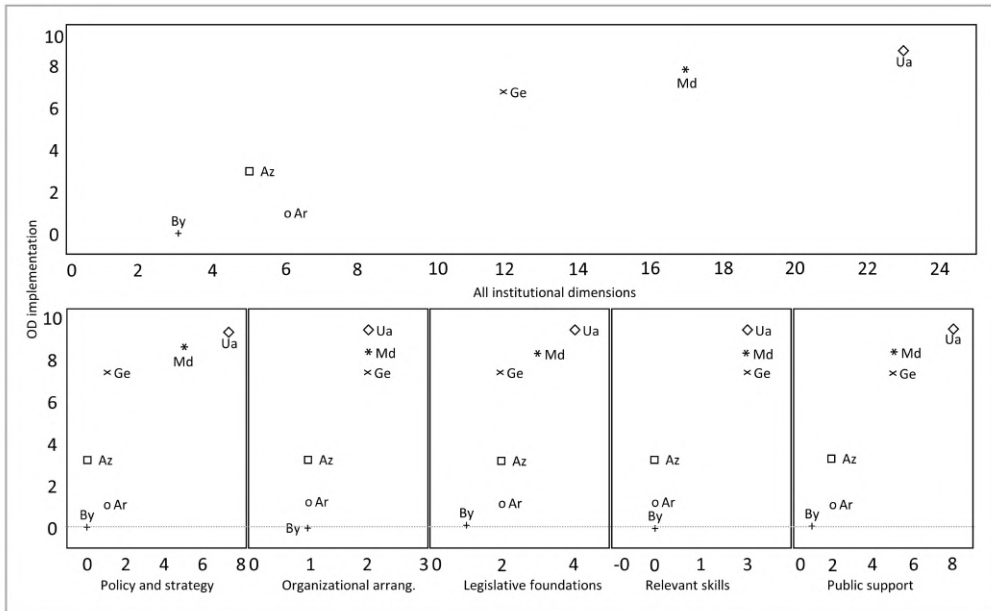

Figure 2. Country positions considering the institutional dimensions and OD implementation

Figure 2 shows a clear relationship between the quality of institutional dimensions and the level of open data implementation in the countries reviewed. "Absent", "Weak", "Moderate" and "Strong" measures, which were presented in Table 4 and Table 5, are quantified as 0, 1, 2, and 3 respectively to position and compare the countries (see Figure 2). Better institutional dimensions are associated with a better implementation of open data. For example, the presence of high-level support for open data along with policy and strategy results in better implementation of the central open data portal, open data services and the level of data openness in Ukraine, and to a lesser extent, in Georgia and Moldova as well. Due to the impotency of the organizational arrangements and the lack of policy and strategy, the open data portals of Azerbaijan, Georgia and Moldova are not well maintained nor are the published datasets up

to date. Failing high-level support and appropriate open data policy and strategy, the open data projects are poorly facilitated or even absent in these countries. The politicization of open data implementation, however, increases the chances of a sham, rather than an actual impact of open data. In the Ukrainian case, many non-machine-readable files and unimportant statistical information have been published as open data. Although this increases the number of open datasets published on the central data portal, there are few, if any, use cases for such datasets.

The countries with better open data implementation experience also have notable support from international funding organizations which mobilize civic sector. A better example is the TAPAS consortium developed by the non-government sector of Ukraine and donor organizations to promote open data, electronic services and transparency. Despite the tension between the government and the civic sector, the institutionalisation of open data activities leads to more involvement of government institutions. Accordingly, many open data projects that were initiated by non-governmental actors, are maintained and well facilitated by government intuitions (e.g. open spending data portal of Ukraine).

In sum, the EaP countries have started to implement open data initiatives with little attention for the institutional dimensions. All six countries have a coordinating organization, but without the authority to monitor the quality of data, maintain sustainability and better facilitate open data initiatives. More resources need to be allocated to relevant skills and educational support, to remedy deficiencies in these areas in both the public sector and among open data users. Although the public support for open data by NGOs is considerable, specifically in Moldova, Ukraine and Georgia, general public support and awareness could still be improved to encourage more data requests, openness and usage. Open data is perceived as a transparency and accountability tool in the region, although its economic and social effects such as innovation creation, better public services, data-driven decision-making are not yet mature. This explains why nearly all successful open data initiatives are related to open spending, budget, open parliament and open contracting data.

6. Conclusion

This paper explains the relation between institutional settings and open data implementation in transition countries on the basis of the results of focus group discussions and document analysis in six Eastern Partnership countries. Specifically, this study sought to explain the extent to which institutional dimensions impact open data implementation in transition countries. To clarify the role of institutional dimensions, four major findings of this study can be highlighted. First, the empirical results of the study confirm that, just as in developed countries (Safarov, 2019), the institutional dimensions can also explain the degree of open data adoption in the transition countries. The availability of systematic policy and strategy, legislation, organizational, educational and public support enable the successful open data adoption in a country.

Second, although similar institutional dimensions play a role, the specific institutional configurations that affect open data adoption in transition countries differ from developed countries. We observed an extra institutional dimension – international aid - not discussed in previous studies performed from an institutional perspective. While the transition countries share a similar historical background and public administration model, the level of open data implementation varies. However, international aid and the involvement of donor organizations are distinguishing factors in the countries with a better open data implementation experience, namely Georgia, Moldova and Ukraine. The majority of open data initiatives are funded by international organizations and aid programs run by developed countries, with a primary aim to increase citizen engagement in the process of democratic transition. Therefore, such projects are focused on enhancing transparency and accountability in public administration. These international stakeholders have limited activities in Armenia, Azerbaijan and Belarus, which is reflected in the inactive status of open data implementation in these countries. In their study on the implementation of e-participation, Åström, Karlsson, Linde and Pirannejad, (2012) found that patterns of e-participation reform are a product of international factors, particularly of economic globalization in

non-democratic countries. Similarly, international factors influence the direction of open data adoption in transition countries.

Third, the disparity between countries is evident in fundamental factors such as political will, the level of public support, and anti-corruption/transparency intentions of the countries. In Georgia, Moldova and Ukraine, the approach to institutional dimensions is relatively clear and appreciated by the government, even though the dimensions might not be completely fulfilled. In Armenia, Azerbaijan and Belarus the institutional dimensions are more blurred with significantly weaker open data implementation. While systemic causes such as the Soviet legacy of public administration, a pervasive bureaucracy, the maturity level of democracy and the techno-economic capacity are part of the explanation, the root of the problem lies in the lack of understanding and failure to appreciate the value of open data, both in the policies and actions - considered to be a precondition for the better performance of open data adoption policies (Zhao & Fan, 2018).

Fourth, good interaction between governmental organizations and the presence of an open data community, including NGOs, enhances the process of open data implementation. The availability and performance of policy and strategy are more effective in Moldova and Ukraine, resulting in a relatively healthier level of engagement between governmental organizations and in a well-functioning community. In the remaining countries, such interaction is sluggish, and there is little evidence of an open data community, mainly due to government resistance to open data adoption. While open data implementation should be linked with context and societal issues if the anticipated results are to be achieved (Ruijer, et al., 2017), not one of these six countries has implemented a context-specific open data policy. In terms of educational support, this institutional dimension is neither systemic nor effective in the region.

Other than the main findings, the research results indicate that non-government organizations have the most active role in open data movement in all the studied countries. Throughout the focus group meetings, NGO representatives presented a critical impression on open data implementation in their countries. As expected, public officials tried to avoid criticism on the open data policy and implementation of the

government. The feedbacks of public officials were mostly about the implemented open data projects in a positive and informative way without challenging quality and impact of them. Journalists and researchers participated to a lesser extent in the focus groups. Perhaps open data implementation in these regions is not strong enough yet to attract the attention and to be a source for journalistic investigation and academic studies. As there were very few start-up projects using open data, their participation in open data movement and focus group meetings were negligible, too.

The results of this study also provide important practical implications. First of all, policymakers need to consider that institutional dimensions are not static but dynamic. This necessitates a continuous focus on developing and maintaining the quality of open data implementation. In the early stages, it is possible to focus on relatively simple and straightforward components, such as building and facilitating open data portals, improving organizational arrangements and developing open data publishing guidance. As the process of open data implementation advances, the inclusion of new and more complex components should be considered, such as adopting a comprehensive policy, implementing context-specific strategies and quality control mechanisms, educational support, and linking the relevant legislation to open data implementation. Improving user skills and educational supports is particularly important to achieve higher open data use and obtain societal impact. For example, as Gascó-Hernández, et al., (2018) show, activities to increase relevant skills are more effective when complemented with knowledge about context and active communications with government institutions. The transition countries not only require an organized approach to activities aimed at increasing relevant skills and providing educational support; care should be taken to ensure these are reinforced by relevant contexts.

This research has only studied 6 transition countries, and we are aware that exploring the countries with similar socialist background poses some challenges towards scientific generalizability. Furthermore, both the theoretical framework which was tested in this research and open data implementation in the national level remain in an emerging stage. This study can help researchers to consider the institutional dimensions

in the evaluation of open data implementation in different contexts and other developing countries with different historical background to validate the generalizability of the findings of our study. For instance, Latin American countries bear commonalities regarding their developing economies, but do not share cultural aspects. It would be interesting to test the institutional framework in such countries to further validate the generalizability of the institutional dimensions developed here. Additionally, one possibility that warrants further investigation is the possible existence of feedback loops in the open data implementation process (see, e.g. (Ho & Im, 2013)). The mere fact that open data is successfully implemented will reinforce institutional support which will in turn further strengthen OGD implementation. Future research could explicitly address this potential institutional pathway to implementation by taking a longitudinal research design and following the development of specific OGD projects over time.

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Appendix 1

Summary of institutional dimensions

	Belarus	Moldova	Ukraine
Policy and strategy	The country does not have an open data policy, strategy and guidance. Belarus is not a member of Open Government Partnership initiative. Thus, open government action plans are not available. However, some elements of openness are considered in the Government Program covers the development of the digital economy and information society for 2016 - 2020 years.	The country has Open Data Concept (2014) and Open Data Publishing Methodology (2014) which were approved by government resolutions. Furthermore, Moldova published third Open Government Partnership action plan covers 2016-2016. The action plan has several commitments related to open data. Promoting open government and open data implementation is also part of the strategic program for technological modernization of government.	The country has adopted three Open Government action plans and Open Parliament Ukraine action plan. The current action plan has several commitments covering open data activities. Ukraine joined Open Data Charter in 2016. However, Ukraine does not have a comprehensive strategy dedicated to open data.
Legislative foundations	The country does not have a dedicated freedom of information and data protection legislation. However, the Constitution and Information, informatization and protection of information law provide foundations for freedom of information. However, these legal acts poorly cover the	In Moldova, Personal Data Protection law was adopted in 2007 and supervised by the National Centre for Personal Data Protection. Access to Information law was adopted in 2000 and allows the citizens to request public information in written or oral format. Furthermore, Public	The Personal Data Protection Law was adopted in 2010 which is supervised by the department of Ombudsman Institute (Commissioner of the Parliament of Ukraine for Human Rights). Law on Access to Public Information (2011), on the other hand, regulates freedom of information in Ukraine.

	freedom of information and data protection activities.	Sector Information Re-use law (2013) is a significant legal act to push government agencies to publish government information.	It is planned to establish an Information Commissioner Institute which is not available yet. Access to Public Information in the Form of Open Data law (2015) is the primary legislative act regulates open data initiatives. The openness of Public Funds' Use law (2015) is also for publishing information about state and local budgets, property and social insurance funds.
Organizational arrangements	The Ministry of Communications and Informatization has a coordinating role for open data activities. The Ministry started tender procedures 2 years ago to develop open data portal. It is expected that the portal will be functioning by the end of 2018. The country does not have Information Ombudsman organization to supervise freedom of information activities.	E-Governance Agency is a supervisory organization of open data implementation. Open data portal of the country is maintained by the Agency. According to the second Open Data Directive (2012), open data coordinators were appointed in each ministry who is responsible for publishing government data in the portal. The public administration reform was slowed-down open data activities in Moldova.	Open data activities are coordinated by the State Agency for E-Governance of Ukraine. The Agency also maintains open data portal of the country. Several specialized open data initiatives also have been supervised by various organizations, such as open spending portal (Ministry of Finance), open contracting portal – Prozorro developed by Transparency International Ukraine (The Ministry of Economic Development and Trade); open parliament (Parliament of Ukraine).

Relevant skills and educational support	As a focus on open data implementation lacks from the government side, there is not a dedicated educational support to get more professionals for open data use.	Not frequently, NGOs along with government institutions organize corruption hackathons (Hack corruption), training programs and competitions with the support of international donor organizations (e.g. UNDP, USAID, World Bank). There is a short training course for public administration students covering e-government activities. However, there is not a regular training and education program.	Local NGOs with the support of foreign donor organizations organize hackathons, open data day, competitions, conference, training for NGOs and journalists. Majority of the projects are supported by foreign donors. However, there is not a regular training and education program.
Public support and awareness	The country has a well-organized open data community which was developed unofficial open data portal (opendata.by). The community organizes regular events, meetups and discussions regarding open data.	The country has several active NGOs particularly focused on open government and journalism which involve open data support initiatives. With the participation of the public sector, several activities and events were organized to popularize open data in Moldova (e.g. media hackathons, smart city idea competitions, opengov weeks).	Bottom-up initiatives in Ukraine is very strong and there are many non-government institutions that involve open data activities. Nearly all open data projects have been started by the civic sector with the support of foreign donors. Particularly, USAID, UKAID, Eurasia Foundation have supported open data initiatives.
	Armenia	Azerbaijan	Georgia
Policy and strategy	The country does not have a policy and strategy for open data implementation. However, Armenia adopted a third Open	The country does not have a policy and strategy for open data implementation. While several open government action plans	The country does not have a policy and strategy for open data implementation. Georgia adopted a comprehensive Open

	Government Partnership action plan covers 2016 – 2018 years. The last action plan has two commitments related to open data: implementing open budget data and open declaration data.	were adopted, Azerbaijan left the Open Government Partnership and Extractive Industries Transparency Initiative. The last Open Government action plan covers several transparency-related commitments. However open data implementation initiatives have not been considered in the action plan.	Government Partnership action plan covers 2016 – 2018 years. While the action plan has many transparency related commitments, there is little focus on open data and its implementation.
Legislative foundations	Freedom of Information (2003) and the Data Protection Act (2015) are available in Armenia. There is not a dedicated legislation for open government and open data. Furthermore, State Budget Law requires to publish detailed budget and spending of central and local government organizations.	Law on Access to Information (2005) and Personal Data Protection Act (2010) is available in Azerbaijan. The Commissioner for Human Rights (Ombudsman) is a responsible institution to control the implementation of Law on Access to Information. The Budget System Law of Azerbaijan also requires releasing information about budget and spending of government organizations.	General Administrative Code chapter three regulates freedom of information in Georgia. Development of a dedicated Freedom of Information Law is one of the commitments of Open Government Action Plan of Georgia. Furthermore, Personal Data Protection law (2014) is available which is coordinated by Office of the Personal Data Protection Inspector.
Organizational arrangements	While there is not a central open data portal, there are several specialized data portals, such as procurement information (procurement.am), justice information (datastat.am), court cases (datalex.am) statistics	The Ministry of Transport, Communications and High Technologies is an operator of the central open data portal. The Ministry does not have a responsibility to control data quality and sustainability. Many	Central open data portal of Georgia is maintained by Data Exchange Agency under the Ministry of Justice. However, the Agency does not have a responsibility to control data quality and sustainability. State

	(armstat.am) that maintained by various government organizations. These services provide limited open data services.	central executive bodies publish information in their official web page, very few as a machine-readable format.	Procurement Agency also provides open contracting data service (opendata.spa.ge). In general, many central executive bodies publish information on their official web page as a machine-readable format.
Relevant skills and educational support	Rarely, short courses were organized by non-government organizations, such as open data days, open data for NGOs, and open data for journalists.	There were few training programs, hackathons, data training for journalists that were organized by NGOs. However, these initiatives are not sustainable.	There were few training programs, hackathons, data festivals that were organized by NGOs. However, these initiatives are not sustainable.
Public support and awareness	There are several NGOs that work to increase public awareness of open data, such as Kolba Lab, "Journalists for the Future", Ampop Media, Freedom of Information Center. However, open data initiatives are not their core activities and open data projects are not sustainable. There is not a well-organized open data community.	There are very few NGOs that work to increase open data awareness in Azerbaijan such as, Transparency Azerbaijan. Open data community is not available.	There are several NGOs that work to increase open data awareness in Georgia such as, Institute for Development of Freedom of Information, Transparency International Georgia, ForSet, etc. There is not a well-organized open data community.

CHAPTER 5

#utilization

#implementation

#adoption

Chapter 5. Determinants of open data adoption: an empirical cross-national study

ABSTRACT

This research investigates the role of technical, economic capacity, societal and governance factors in national-level adoption of Open Government Data (OGD). First, a theoretical framework is developed which is then quantitatively tested using Open Data Barometer data from 115 countries and seven independent variables. The statistical analysis confirms that OGD adoption is higher in countries that are more democratic and have a higher level of ICT development. Democracy is the only variable which has a significant role in each of the three components of open data adoption: open data readiness, implementation and impact. Surprisingly, economic capacity and press freedom have slightly negative results in the regression analysis. Overall, the results highlight the dominant role of democracy and ICT infrastructure as determinants of open data adoption.

1. Introduction

Since the launch of the open data movement, the number of countries that have adopted open data policies with the aim to extend public transparency and accountability, as well as to foster the development of data-driven services, has increased significantly (*Open Data Barometer*, 2017). The primary reason for governments to consider open data is to deliver better public services, achieve higher transparency and meet citizens' requirements for open data (Pereira, Macadar, Luciano, & Testa, 2016). This has led many scholars to explore aspects such as the benefits, policy issues, OGD infrastructure, availability and quality of data, and the required skills to use OGD (Barry & Bannister, 2014; Brito, Costa, Garcia, & Meira, 2015; Rosnay & Janssen, 2014). The literature also supports the idea that open data initiatives can promote proactive civic engagement, innovation creation and democratic processes (Chan, 2013; Kassen, 2013; Linders, 2013; Temiz & Brown, 2017).

Various determinants of open data adoption, such as the motivation for open data adoption (Altayar, 2018), perceived barriers (Wirtz et al., 2015), open data usage (Ruijer, Grimmelikhuijsen, van den Berg, & Meijer, 2018), open data policy (Zuiderwijk & Janssen, 2014), institutional, technical capacity and public pressure (Fan & Zhao, 2017) have been extensively studied. Yet, such studies typically define institutional/organizational level prerequisites for open data adoption. Despite a comprehensive body of literature dedicated to explaining the determinants of open data adoption, little is known about the role of fundamental national-level factors that determine open data adoption specifically at the national and cross-national level. Such knowledge is important in order to pinpoint why OGD adoption is more successful in some countries than others. Furthermore, understanding the determinants of open data adoption may help in designing effective open data implementation programs. To do so, this research addresses the following research question: To what extend national-level factors of countries explain the differences in open data adoption? To answer these research question, this study has integrated the literature, developed a theoretical framework and then quantitatively tested it.

Much research to date has been qualitative in nature, which makes it difficult to generalize the results (Hossain, Dwivedi, & Rana, 2016; Safarov,

Meijer, & Grimmelikhuijsen, 2017). The complexity of open data adoption represents the main stumbling block in deploying a quantitative approach to study the fundamental factors and preconditions of open data adoption at the national and cross-national level. The complex nature of open data adoption requires the consideration of technical, economic, societal and conceptual dimensions in order to better understand the adoption process (Jetzek, 2016). Previously, the absence of data restricted the investigation of global perspectives of open data adoption. Today, there are several non-government organizations that study OGD adoption and collect data worldwide with the help of surveys and peer-reviewed expert opinions (e.g. the Open Data Barometer, Open Data Index, Open Data Readiness Assessment). Although none covers all countries, such global rankings and indexes do provide a global picture, while allowing OGD adoption to be evaluated and compared across countries.

The aim of this study is to identify the key determinants of national-level OGD adoption. A framework of open data adoption determinants will be developed. The relationships between these factors and OGD adoption will then be tested on the datasets from the Open Data Barometer, which cover 115 countries. In view of the complexity of open data adoption, the theoretical framework consists of various social, technological, economic and governance-related factors. Several measures, rankings and indexes function as independent variables, which will be discussed in the next sections. This theoretical framework enables the factors that determine OGD adoption to be examined in broader detail, thus promoting a better understanding of these determinants.

2. Theoretical overview

Although there is no commonly accepted definition of Open Government Data (OGD) adoption (or open data adoption), scholars have proposed a number of different explanations. Some see this simply as innovation adoption implemented by public institutes (Wang & Lo, 2015), others describe it as a cycle consisting of policy context and content, its output and public impact (Zuiderwijk & Janssen, 2014).

Essentially, in most cases, the reference is to implementing an open data strategy or program (Dawes, Vidiasova, & Parkhimovich, 2016), or to the design and facilitation of open data portals, taking into account societal context and user needs (Ruijer, Grimmelikhuijsen, Hogan, et al., 2017) and developing internal and external innovations as data-driven services (Mergel, Kleibrink, & Sörvik, 2018).

Different country characteristics may affect OGD adoption, such as economic capacity, the level of technological development, the effectiveness of governance or democracy. To develop a comprehensive theoretical framework that explains OGD at a country level, it is important to go beyond the open data literature and to delve into the broader body of knowledge emerging from technology, innovation adoption, open government, transparency and e-government literature.

2.1. Open data as an innovation adoption

In this paper, we define OGD as government innovation. Indeed, OGD adoption is frequently discussed as an innovative process which requires specific efforts from the public institutions to make it successful. Martin (2014) argues that, like an innovation adoption, OGD initiatives trace a path from emergence and co-evolution to transformative impacts on society. As a policy innovation activity, OGD policy adoption tends to be more successful in the government agencies that were quick to take the initiative and have established coordinating units responsible for the diffusion of the policy innovation (Chatfield & Reddick, 2018). Unlike other public innovations, such as e-government services that are wholly introduced and developed by government agencies, open data initiatives necessitate the intensive participation of external stakeholders in the innovation process (Z. Yang & Kankanhalli, 2013).

To learn more about the adoption of innovation and policy, the many dimensions of the adoption process have been the object of study by scholars. Weber & Kauffman (2011) discuss three categories of global technology adoption factors: economic factors, social factors and a combination of legal, environmental and cognitive factors. Wang and Lo (2015) distinguish three groups of factors which they view as significantly

influencing OGD adoption in an organization: technological, organizational and environmental. In a similar vein, Safarov et al. (2017) found three categories of factors determining the level of OGD adoption, namely social factors, techno-economic and governance-related factors.

The present theoretical model describing the economic and technical capacity of countries, governance-related factors and social characteristics is well-aligned with the internal determinants model of Berry and Berry (1990). For government innovation adoption, these authors propose two types of models: the internal determinants model, in which political, economic and social factors cause a country to innovate; and the regional diffusion model, which highlights the role of neighbouring states in encouraging a state to adopt innovation. Considering the fact that open data adoption is a new public innovation and the fact that comprehensive time series data covering a sufficient number of countries is lacking, it is hardly feasible to explore a regional diffusion model of open data adoption. However, the internal determinants and their role in open data adoption can be explored at the country level.

Innovation adoption is considered a complex and heterogeneous process and the determinants of the adoption process differ across the types of innovations (Walker, 2006). By studying the factors influencing the adoption of 25 different technologies across a number of developed countries, Comin & Hobijn (2004) underline the positive effect of human capital and income per capita for technology adoption. In general, this study also presents evidence that type of regime, degree of economic openness and degree of adoption of predecessor technologies are the most important factors that determine technology adoption in a country.

In sum, three groups of factors are frequently discussed in the literature as dimensions of innovation adoption. First, capacity of countries to adopt innovation which is also significant to keep the adoption process sustainable. Second, governance-related factors which comprise the processes and mechanisms that are realized through the norms, laws and institutions. In the open data adoption, such factors are critical because of the transparency and accountability nature of open data. Third, societal factors which represent the level of knowledge, social and

cultural attributes of societies to be required to achieve objectives, develop and create innovation. The next three sections explore each group of factors separately and provide hypothesis that will be explored in this study.

2.2. The capacity of countries and open data adoption

The development and adoption of innovations such as open data always require technical and economic resources. Hence, understanding the factors that affect the adoption of new technologies and innovations is particularly important for the successful adoption of open data and to foster the impact of such initiatives. Although the use and reuse potential, and the impact of open data have been researched and the economic benefits discussed in the literature, we know very little about how the technical and economic capacity of a country determines open data adoption. However, techno-economic determinants of the technology adoption process have been broadly discussed in the e-government, transparency and innovation adoption literature, which can be used as a theoretical basis for the perspective of OGD adoption.

The economic conditions of a country, measured by GDP per capita, are significantly associated with e-government maturity (Krishnan, Teo, & Lymm, 2017). The results of Srivastava and Thompson's (2006) study indicate that technology (ICT infrastructure) and the quality of human capital significantly determine the development of e-government. Furthermore, wealthier governments have more resources to cover the relatively high costs of data collection, processing, and sharing and consequently, they are more likely to better implement the freedom of information legislation (Grigorescu, 2003). This research result is also applicable to open data adoption, since this, too, requires data to be collected, processed and shared by government institutions. Following this argument, Norris (2001) emphasises that economic factors, compared to political and social factors, are strong predictors of cross-national differences in access to the information society (pp. 62–63). In other words, wealthier societies have access to better information and communication technologies, which is the basis for OGD adoption.

Pudjianto, Hangjung, Ciganek and Rho (2011) argue that ICT infrastructure has the strongest relationship with e-government adoption. The authors also highlight the significance of managerial support, regulation, expertise and competitive environment in technology adoption. Better information technology infrastructure in a country lead to an acceleration of sustainable socio-economic development (Meso, Musa, Straub, & Mbarika, 2009). The study shows that e-governance is more developed in countries that have an advanced competitive telecommunications market and invest more in the information and communication technologies that require economic capacity (Gulati & Yates, 2011).

It is clear from the extant literature that economic conditions and the technical capabilities of countries are strongly interrelated. These factors have therefore been combined into the single category "techno-economic capacity factors". In this study, GDP per capita is used to measure and compare the economic capacity of countries. Furthermore, ICT development measures are used to study the relationships between ICT infrastructure and OGD adoption. In light of the literature discussed, the following hypotheses are proposed:

H1. Countries with higher technical and economic capacity have a better OGD adoption.

> H1a. Countries with higher economic capacity tend to have a high level of OGD adoption.
> H1b. Countries with better ICT infrastructure tend to have a high level of OGD adoption.

2.3. Governance factors and open data adoption

Various open government and e-government studies have explored the relevance of governance factors in facilitating public innovation adoption. In the open data literature, however, these factors are seen as a positive result of open data (Attard, Orlandi, Scerri, & Auer, 2015; Safarov et al., 2017; Temiz & Brown, 2017). While governance factors such as political openness, transparency, freedom of information and anti-corruption motivations have been put forward as facilitating factors for

open data adoption at the institutional level (Altayar, 2018; Gonzalez-Zapata & Heeks, 2015), this remains to be empirically tested.

Open government studies appreciate the availability of democratic practices in the adoption of open government mechanisms. Organizational and technological capacity, innovativeness and external pressure are assumed to be strongly related to the adoption of open government policies (Grimmelikhuijsen & Feeney, 2016). According to Grimmelikhuijsen and Feeney (2016), organisations respond to external pressure for open government in the form of citizens, neighbourhood associations, new media and interest groups taking part in the decision-making processes related to democratic practices. On the other hand, the authors also point to the negative correlation between a culture of job routineness and the adoption of open government.

E-government literature explicitly highlights the importance of democracy and the political will to fight corruption as facilitating factors for e-government adoption. In their cross-national study, Gulati and Yates (2011) used a democracy and political freedom index to show that democratic countries are the most likely to offer information online and to provide e-government services. In the cross-national study conducted by Azad, et al., (2010), a country's e-government performance is reviewed in the light of a number of institutional settings, including democratic practices, transparency, press freedom and corruption perception. Furthermore, it is argued that the anti-corruption efforts undertaken by governments could be more effective with the use of technological solutions such as e-government service delivery (Kim, 2014). It follows, therefore, that increasing transparency, for example by improving information sharing will be more effective in the fight against corruption if there is electoral democracy in a country (Lindstedt & Naurin, 2010).

Nevertheless, some previous studies found that good governance indicators, particularly democracy are not enough to explain e-government adoption in a country (e.g. Norris, 2001; Gulati, Williams, & Yates, 2014). The relationships between democracy, liberties, freedom and technology adoption are highly complex. Not all non-democratic countries discourage technology adoption. Although some authoritarian regimes fear the political consequences of technology adoption and its expansion, they are very keen to obtain its economic

values (Corrales & Westhoff, 2006). New technologies and innovations are not always adopted for their direct purposes but are used as a tool for gaining legitimacy in various countries (Maerz, 2016).

Another influential factor is the freedom of the media, which plays an important part in deriving good governance effects from the usage of transparency tools and public innovations. Media and journalists are a significant user group of open data (Safarov et al., 2017). Relly and Sabharwal (2009) note that the more transparent countries tend to have well-developed freedom of information laws, e-government and a free press. The impact of press freedom is determined by the level of corruption, the political regime in a country and the performance of the economy (Nam, 2012). Press freedom alone does not work successfully but requires the availability and effective use of ICT tools for achieving a positive impact (Dutta & Roy, 2016). In other words, free media supplies information and ICT empowers citizens to access this information and news. Consequently, press freedom and democracy work hand-in-hand to achieve a positive impact, particularly in reducing corruption (Kalenborn & Lessmann, 2013)

In this study, the availability of a free press, the corruption rate and degree of democracy in the countries included are examined to ascertain whether the level of democracy, media freedom and perceived corruption determine the level of OGD adoption in a country. Although a few scholars have found no influence of democratic development on e-government or technology adoption, the evidence of there being such a relationship is quite strong, particularly between democratic practices and open government, transparency and delivery of e-services. This led to the following hypothesis:

H2. OGD adoption is higher in countries with better governance.
 H2a. Countries with a higher level of democracy tend to have a high level of OGD adoption.
 H2b. Countries with less corruption tend to have a high level of OGD adoption.
 H2c. Countries with greater press freedom tend to have a high level of OGD adoption.

2.4. Societal factors and open data adoption

The open data literature discusses many social factors that are part of the OGD ecosystem, such as open data advocacy, open data communities (Dawes et al., 2016), organizational readiness (Wang & Lo, 2015), stakeholders and their perspectives, in terms of their relative power and interests (Gonzalez-Zapata & Heeks, 2015). Organizational capacity, skilled communities and advocacy activities are well-aligned with the human and social capacity of countries, which are considered the strategic assets of organizations (Martens, Bogaert, & Cauwenbergh, 1997). Nevertheless, several difficulties arise in handling all these social factors in this cross-national study. A lack of tangible data rules out any quantitative evaluation of the relationship between OGD adoption and stakeholders, organizational readiness or advocacy groups. Furthermore, these social factors are more suitable for local contexts rather than cross-national comparison.

National context, however, requires the evaluation of more fundamental societal characteristics of countries to understand and explain innovation adoption, including quality of education and research, literacy rate, personal relationships, social norms, civic participation, etc. For the purpose of understanding societal factors and their role in OGD adoption, societal factors are operationalised as human capital and social capital. While there is no universally accepted definition, Putnam (1995) describes social capital as "the features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit". On the other hand, human capital is defined as the combination of knowledge, skills and reasoning capabilities of the workforce which has a significant role in the performance and competitive advantage of formal organizations (Carnevale, 1996).

A high level of social capital means a high level of trust and this is essential for governments to be responsive to the idea of adopting open data. Where there is distrust, there will also be a fear of data misuse or abuse. Furthermore, a lower level of trust in the government will lead to lower usage of open data, as citizens will not trust the quality of the data. In a study covering over a hundred regions in the EU, it was also demonstrated that a higher level of social capital yields more innovation (Akçomak & Weel, 2009). The primary reason is that innovation creation

is a risky activity in which a higher level of trust among investors and innovation creators is needed to make inventions successful. Stronger social capital is also beneficial for the quality of public service delivery (Andrews, 2012), which OGD adoption depends on. Social capital, and particularly its influential component – social networks - is a predictor of users' decisions to adopt new technology (Hunecke, Engler, Jara-Rojas, & Poortvliet, 2017).

The role of social capital was tested and confirmed in a study on new technology adoption in agriculture (Micheels & Nolan, 2016). That said, Kaasa (2009) has shown that despite the strong influence of social capital on innovative activity, the different dimensions of social capital have a different impact on innovation. Civic participation, as one dimension of social capital, for example, has the strongest positive impact on innovative activity, as evaluated by patent applications. Other dimensions, such as social norms have a negative medium impact, while trust and networks have a smaller but positive impact on innovation. The findings of Dakhli and Clercq (2007) also support this finding and show the role of trust as a driver of innovation. Overall, social capital and its dimensions are considered a significant predictor for innovation and technology adoption.

Another frequently discussed societal factor of innovation adoption is human capital. A broad range of studies investigates and confirms the positive association between human capital and economic growth (Faggian & McCann, 2009; Pelinescu, 2015), productivity (Engelbrecht, 1997), transparency and accountability (Harrison & Sayogo, 2014) and innovations (Dakhli & Clercq, 2007). D'Este, Rentocchini and Vega-Jurado (2014) point to the significant impact of human capital on reducing the barriers to innovation. Furthermore, the adoption of new technologies is considered a human capital demanding activity; accordingly, education and knowledge reduce the cost of adopting new technologies and related uncertainty (Wozniak, 1987). From the open data literature, we know that specific legal, technical and domain knowledge is needed to provide the facilitating conditions to be able to utilize open datasets (T. Yang & Wu, 2016). In this regard, a higher level of human capital may be considered a prerequisite for the adoption and effective realisation of open data initiatives. The quality of human capital

has also emerged as a significant facilitator for e-government development (S. Srivastava & Teo, 2006). This positive correlation between e-government and human capital is confirmed by Lee, Chang and Berry (2011), who performed a quantitative analysis of data from the Human Capital Index and the UN's E-Government Survey. Krishnan, Teo and Lymm (2017) have found that the human capital of a country is positively associated with a government's willingness to implement online information sharing, e-consultation, and e-decision-making. More importantly, human capital has a stronger impact on the government's willingness to implement e-information sharing than the implementation of e-consultation and e-decision-making.

Thus, the following hypothesis can be proposed:

H3. OGD adoption is higher in countries with better social conditions.
    H3a. Countries with higher human capital are associated with a high level of OGD adoption.
    H3b. Countries with higher social capital are associated with a high level of OGD adoption.

In sum, based on the literature it may be argued that parallels can be drawn between the adoption of open data and the adoption of technology and innovation, open government and e-government in terms of influential factors. The adoption of such technologies in the public sector appears to be dependent on a complex set of factors, which, in the case of open data adoption, can be classified into three groups: technical and economic capacity, governance and societal factors. While this research framework covers a broad range of determinants, some of the factors that are discussed in the literature cannot be quantitatively measured because of the lack of data.
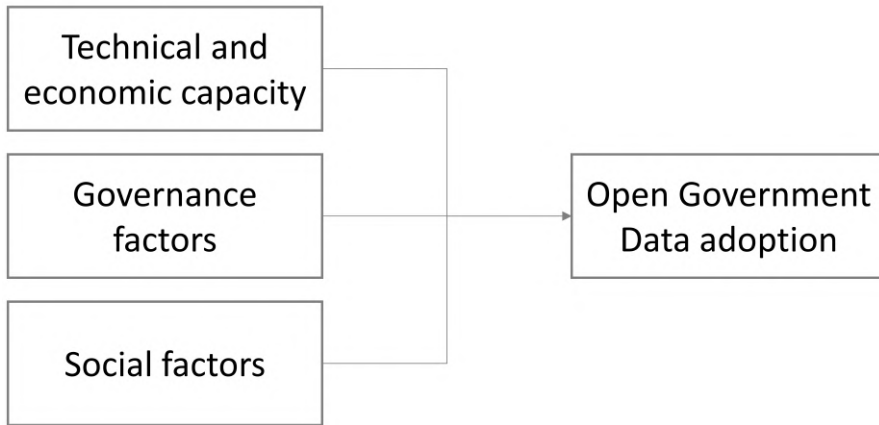
Figure 1. Theoretical model

3. Method

This research seeks to examine the relationship between OGD adoption and several factors that were extracted from the literature. The previous section provided three groups of hypotheses about the determinants of cross-national differences in OGD adoption. To test the hypotheses, global research results and indexes were used as sources of data and multiple regression models. A description of independent and dependent variables is provided in the following sections. The dependent variable was composed on the basis of data from 2016, as this data is the most recent and the number of observations is the highest compared with previous editions. The dependent variable describes the most recent status of open data performance in 115 countries. The independent variable was chosen from a year before, which was composed on the basis of data from 2015. The rationale behind this decision is to include data from similar timeframe. Technically, it is possible to analyse Open Data Barometer 2016 data with independent variables covering 2018-2019. However, because of the lack of data, we do not know how open data adoption progressed from 2016 to 2019. We also took into consideration that the selected independent variables are fundamental national factors (e.g. human capital, democracy, ICT development) and do not change significantly within short time of period.

3.1. Variable descriptions

3.1.1. Dependent variable

The dependent variable used in this research is the data from the *Open Data Barometer (ODB)*, which presents the OGD performance of countries in terms of the readiness of a country, OGD implementation and impact of open data. The differences between existing open data benchmarks are considerable, as clearly demonstrated in a study by Susha, Zuiderwijk, Janssen, & Gronlund (2015) in which various open data benchmarks, including the ODB, are compared. Those authors particularly appreciated the ODB benchmark since it presents the entire open data chain including OGD readiness, implementation, and impact, thus offering the most comprehensive perspective of the surveyed countries. Furthermore, the methodology of the ODB emphasizes the importance of major stakeholder involvements including government, public sector and business in all stages of the OGD adoption process (ODB methodology, 2016). While some benchmarks such as the PSI Scoreboard studied only successful European examples, the ODB provides an international overview by measuring the open data experience of successful developed countries and developing countries (Susha et al., 2015), which is particularly interesting for our research.

In contrast to the other open data benchmarks, the ODB is based on peer-reviewed expert surveys, which makes the results more reliable. The ODB covers 115 countries, assigning each a score that ranges from 100 – indicating the country has been highly successful in OGD adoption - and 0 – a ranking indicating no open data adoption (ODB methodology, 2016). In the present study, data is made of the fourth edition of the ODB, containing the results of the survey carried out between May and September 2016. A country's final ranking is determined on the basis of the Open Data Barometer score generated from the weighted average of the three sub-indexes: readiness for open data initiatives, which counts for 35% and covers government policies, government actions, open data related activities of business, citizens and civil society; open data implementation, which covers the availability of datasets and has a weighting of 35%; and the impacts of open data,

which covers political impact, economic and social impact, with a weighting of 30%.

The barometer benchmarks OGD availability in 15 fields of government activity (healthcare, transportation, spending, budget and etc.) for each country. The barometer methodology evaluates each data set, assessing whether the data is machine-readable or not, whether a government agency publishes bulk data, metadata, and the quality and timeliness of the data sets. The licensing, pricing and sustainability policy of each data set are also considered in the methodology. In general, data availability yields better results at a national level, although data formats, bulk data availability, pricing policy, licensing and data accessibility factors also have a significant impact on the final results.

3.1.2. Independent variables

To measure economic capacity, the *Gross Domestic Product (GDP) per capita* data which is shared by the World Bank is used to evaluate the role of economic capacity. GDP per capita is used to measure the first hypothesis (H1a), namely countries' economic capacity in the regression model. GDP purchasing power parity takes into account the living cost and inflation rates per year, which makes this indicator relevant for depicting the level of economic development of countries. The *ICT development Index* is used to understand and measure the development level of the technical capacity in a country. This variable is used to test the next hypothesis - H1b. This index is published annually by the International Telecommunication Union. The ICT development index is a particularly valuable indicator to estimate the global digital divide and benchmark information technology development over time in the world (Ayanso & Lertwachara, 2015). The index is a composite of three sub-indicators: ICT access, use and skills. The ICT access sub-index indicates the level of fixed-telephone subscriptions, mobile telephone subscriptions, international internet bandwidth, households with a computer, households with internet access. ICT access is 40 percent of the overall value of the ICT development index in a country. ICT use measures the percentage of individuals using the internet, fixed-broadband subscriptions and active mobile-broadband subscriptions.

This sub-index is also 40 percent of the overall ICT development index value. The third sub-indicator, ICT skills, measures years of schooling, secondary gross enrolment ratio and tertiary gross enrolment ratio. Because education level is measured separately as a part of human capital, ICT skills, as part of ICT development, are not included in the present study.

Three measures are used to evaluate the governance performance of a country. The *Corruption Perceptions Index* (CPI), published by Transparency International, measures perceived levels of corruption on the basis of expert assessments and opinion surveys. This variable is used to test the next hypothesis - H2b. Along with survey results, this indicator uses 13 data sources to construct the results, among which sustainable governance indicators, the transformation index, the Rule of Law index and more. CPI data has been extensively used in cross-national studies (e.g. Kim, 2014; Treisman, 2000). Second, the *Democracy Index* is used to evaluate the degree of democracy in a country. This variable is used to test the hypothesis - H2a. The Democracy Index is published by the Economist Intelligence Unit. The index is measured by the result of surveys covering the electoral process and pluralism, civil liberties, government effectiveness, political participation, and political culture. The third index used is the *Press Freedom Index,* a yearly measure prepared by Reporters Without Borders. This indicator measures the press freedom available to journalists in a country on the basis of expert survey results which is used in this study to test the hypothesis H2c. In the survey, pluralism, independence of the press, media environment, legislative framework, transparency and news infrastructure are evaluated by experts. The Index also uses quantitative data on abuses and violence against the media.

Social factors and their impact on OGD adoption are evaluated with the help of human capital and social capital indicators. *The Global Human Capital Index,* which is published annually by the World Economic Forum, is used to consider and compare the level of human capital across countries. This variable is used to test the hypothesis - H3a. The index covers a broad range of indicators of societies and generalizes these into four thematic components: capacity, deployment, development and know-how, each of which accounts for 25 percent of

the Global Human Capital Index value. In this index, capacity reflects the literacy rate and the primary, secondary and tertiary education attainment rate per country. The deployment component quantifies a country's active labour force, the employment gender gap, unemployment and underemployment. The development component covers the primary education enrolment rate, quality of education system, the gender gap in education, skill diversity, enrolment rates and staff training. The know-how component measures high and medium-skilled employment share, economic complexity and the availability of skilled employees in a country. Finally, to measure social capital for testing the hypothesis H3b, the social capital sub-index of *The Legatum Prosperity Index* (LPI) is used, which calculates a country's prosperity using 104 indicators to capture both wealth and wellbeing. According to the methodology of the LPI, social capital is a combination of social norms in society, personal relationships, social network support, and civic participation. To construct a social value sub-index, 10 of the variables in the index were used, including donations, informal help, trust in local police, volunteering etc.

Several data sources used in this research are based on expert survey, opinions and questionnaires. Particularly, data sources that will measure governance and social factors are generated with qualitative research methods. Global Human Capital Index is the only exception which is developed by using quantitative data sources from UN institutes such as International Labour Organizations and UNESCO together with survey results. In Democracy Index, public-opinion surveys are used together with expert assessments to answer 60 questions about different components of democracy. Social capital sub-index of The Legatum Prosperity Index is not well-known data for cross-national studies. However, this is the only source that uses multiple data sources such as Gallup World Poll data components, survey results about donations, informal help, opportunity to make friends, volunteering to compare the performance of social capital in more than hundred countries. World Press Freedom Index is the only comprehensive and international measurement that evaluates the level of media freedom based on 87 questions. There is a mixed opinion about Corruption Perception Index which is frequently used in academic studies but also criticized because of its methodology and capability of capturing

corruption level in a country (Bill, 2008; Heywood, 2015; Warren & Laufer, 2009). This index is derived from the expert judgments which obviously can be biased. Furthermore, changes of experts may cause a difference in the country results in corruption. Although several alternatives were developed such as the Global Corruption Barometer, the Bribe Payers Index, Control of Corruption Index, none of them covered the weaknesses of CPI. A recent study highlights the shortcomings of corruption measurements by comparing Control of Corruption Index and CPI nevertheless, the results suggest a preference for CPI (Qu, Slagter, Sylwester, & Doiron, 2019). In general, the academic studies about CPI and other measurements demonstrate the challenges to assess the level of corruption, level of democracy, press freedom and social capital. The selected data sources are still the most reliable and largest data sources for cross-country studies. These data sources also well-define the factors presented in the theoretical part.

Independent variables	Measurement	Source of data
Capacity factors	GDP (PPP) per capita 2015	World Bank national accounts data, ranks 186 countries and regions. Source for methodological explanation: ("World Bank, International Comparison Program," 2015)
	ICT Development Index 2015	ICT Development Index published by the International Telecommunication Union, ranks 176 countries. Source for methodological explanation: ("Measuring the Information Society Report," 2015)
Governance factors	Corruption Perceptions Index 2015	Corruption Perceptions Index data published by Transparency International, ranks 180 countries. Source for methodological explanation: ("Corruption perception index," 2015)
	The Democracy Index 2015	The Democracy Index compiled by the Economist Intelligence Unit, ranks 167 countries. Source for methodological explanation: ("The Economist: Democracy Index," 2015)

	World Press Freedom Index 2015	The Press Freedom Index published by Reporters Without Borders, ranks 180 countries. Source for methodological explanation: ("World Press Freedom Index," 2015)
Social factors	Global Human Capital Index 2015	The World Economic Forum's Human Capital Report, ranks 130 countries. Source for methodological explanation: ("The Human Capital Report," 2015)
	Social Capital sub-index 2015	Legatum Prosperity Index published by Legatum Institute, ranks 149 countries. Source for methodological explanation: ("The Legatum Prosperity Index, Methodology Report," 2016)

Table 1. The summary of factors and source of data

Table 1 presents a summary of the indicators for the independent variables used in this paper and their data sources. Since the ODB data covers only 115 countries, the independent variables are also used from the same 115 countries. Although the ODB aims to cover as many countries as possible, the sparse availability of resources, secondary data and local researchers reduces the coverage of the study. It does, however, include low, middle and high-income economies and ensures sufficient coverage of the world to allow open data practices across the countries to be evaluated.

3.2. Data analysis

Multiple linear regression is used to test the hypotheses that are provided in the previous section. As was explained, there are several factors that are associated with OGD adoption. As the aim of this study was not to present the underlying causal connections among OGD adoption and independent variables, but to explain the relationships between dependent and independent variables, multiple linear regression was chosen.

There are no systematic differences between dependent and independent variables in terms of a number of observations, which could bias the estimation results and robustness of the regression

model. All the independent variables are scaled to present a similar relationship with the dependent variable. A higher value of the variable indicates higher results in the respective field. Four countries were excluded from the regression analysis because of a lack of data: Palestinian Territory, Saint Lucia, Swaziland and Kosovo. In each case, four or more variables were missing.

4. Results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of all variables defined in the previous section. The descriptive statistics show no significant difference in the number of observations. At 98 countries, this number was the lowest in the Global Human Capital Index. The missing values are the developing countries with lower results for many independent variables (e.g. Zimbabwe, Lebanon, Bosnia and Herzegovina, Sierra Leone, Belarus, Congo, Montenegro, Togo, Georgia). Except for Georgia, all the missing countries have ODB scores under the global average (the global average of ODB is 33.3). The descriptive statistics indicate that the countries considered in this study cover diverse groups. Both the countries with high and medium level of GDP and lower GDP are included. Minimum, maximum and mean values of the independent variables demonstrate that sample data does not present only higher or lower values. To understand the spread out a data points, high standard deviations of both dependent and independent variables show that the presented observations are distributed over a wider range of values.

The performance of developed countries and developing countries are significantly different. 31 countries which are considered as developed countries by World Bank, International Monetary Fund and Organisation for Economic Co-operation and Development have average 62.7 ODB score (Lithuania, Luxembourg and Slovenia are developed countries but not included to ODB research). Among the developed countries, only the UK, Canada, France, the US, Korea and Australia have more than 80% score. Four developed countries, namely Greece, Iceland, Estonia and Latvia have ODB results below 40. Among the developing countries, the average score is 23.9. Mexico and Uruguay

are the only developing countries with more than 60% results. The lowest results are in Mozambique, Mali, Zimbabwe, Myanmar and Yemen.

	N	Range	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Open Data Barometer	111	100.00	0.00	100.00	33.27	2.26	23.76
GDP (PPP)	111	126782.95	865.10	127648.05	21766.63	2017.56	21256.32
ICT Development Index	107	7.48	1.45	8.93	5.42	0.21	2.21
Corruption Perception Index	111	74.00	17.00	91.00	47.14	1.91	20.08
Democracy Index	110	8.00	1.93	9.93	6.20	0.19	1.95
World Press Freedom Index (rev)	111	66.03	26.45	92.48	69.67	1.32	13.93
Global Human Capital Index	98	45.06	40.72	85.78	68.33	1,02	10.14
Social Capital sub-index	108	33.60	34.84	68.44	51.37	0.74	7.69
Valid N (listwise)	95						

Table 2. Descriptive statistics

Table 3 presents correlation coefficients for all variables. As the Press Freedom indicator was the only variable in ascending order (minimum is better; maximum is worse), this was transformed to descending order in the correlation to keep the data consistent throughout the variables. All correlations were significant at $p < 0.001$ level. The correlation matrix in Table 3 shows that the correlation coefficients behave relatively diverse in terms of the dependent and independent variables. Overall, the correlations between the variables is fairly strong. In particular, the Global Human Capital Index and ICT Development Index has the strongest correlation (0.917). Global Human Capital Index, in general, has stronger correlations with other variables. The Corruption Perception Index is also highly correlated with other variables. This is unsurprising, however, as countries with low levels of corruption tend to countries that have high economic development, stronger democracy and press freedom. Furthermore, Table 3 shows weaker correlation between World Press Freedom Index and other variables. Comparing with the dependent variable, Global Human Capital Index has the highest correlation level (0.739) which is followed by ICT Development and Corruption Perception Index. The rest of the independent variables have moderate correlation with ODB data. Based on the strength of these correlations we have a moderate concern about multicollinearity.

		1	2	3	4	5	6	7
Open Data Barometer	1							
GDP (PPP)	2	0.556						
ICT Development Index	3	0.714	0.782					
Corruption Perception Index	4	0.708	0.776	0.767				
Democracy Index	5	0.707	0.370	0.557	0.675			
World Press Freedom Index	6	0.474	0.304	0.419	0.594	0.772		
Global Human Capital Index	7	0.739	0.662	0.917	0.735	0.658	0.519	
Social Capital sub-index	8	0.56	0.571	0.515	0.672	0.584	0.522	0.538

Correlation is significant at the 0.01
level (2-tailed).

Table 3. Pearson Correlation

Except for ICT development and Global Human Capital Index, all correlation values were below the value of 0.800. However, some variables, including the dependent variable, corruption perception and ICT development had higher coefficients. Correlations higher than 0.800 among variables are one of the causes of multicollinearity, but this is not a necessary condition (Myers, 2000). Multicollinearity tests were therefore conducted to evaluate the variance inflation factor (VIF), the result of which are presented in Table 4 and 5.

4.2. Regression analysis

As expected, based on the high correlations between some variables, a number of multicollinear relations occurred in our model. For this reason, the Global Human Capital Index (VIF >5.0) was excluded from the regression analysis. A VIF value of higher than five, depending on the variables and research, is considered a sign of multicollinearity, which may present a problem in interpreting regression results (Mason, Gunst, & Hess, 2003). In the statistical model presented in Table 4, all the variables have VIF values that are under five, rendering multicollinearity concerns in the regression analysis negligible.

$$ODB_i = \beta_0 + \beta_1 GDP_i + \beta_2 ICT_i + \beta_3 CPI_i + \beta_4 DI_i + \beta_5 WPI_i + \beta_6 SCI_i + \varepsilon_i \qquad (1)$$

In the multiple linear equations, ODB_i represents the dependent variable, namely Open Data Barometer score of "i"th country, "i" parameters refer to a particular country that are measured, "β" values represent each measure associated with the respective independent variables (listed in Table 1), and ε_i value describes the random error measure related to each country value.

Table 4 shows the regression model results. In this model, all the independent variables present a strong relationship with the Open Data Barometer, which has an R^2 of 0.656 and adjusted R^2 of 0.634. Such results indicate that the model can explain 63% of the open data performance of the countries. Analysed. In other words, the model shows that the countries with a better ICT infrastructure, higher level of

democracy, a lower corruption rate and social capital are more likely to achieve a better adoption of open data practices.

	Un.st.B	St.B	Sig.	VIF
(Constant)	-25,703			
			0.05	
GDP (PPP)	-9,45E-05	-0.086	0.485	4,271
ICT Development Index	4,342	0.405	0.001	3,697
Corruption Perception Index	0.228	0.192	0.138	4,645
Democracy Index	5,958	0.477	0.000	3,990
World Press Freedom Index	-0.363	-0.214	0.036	2,845
Social Capital sub-index	0.304	0.098	0.262	2,140
R Sq.	0.656			
Adj. R Sq.	0.634			

Table 4. Regression results (Dependent Variable: Open Data Barometer)

In the regression results, ICT development and the Democracy Index had the highest standardized beta values (β=0.405 and 0.477), which implies that if all the other variables are held constant, a 0.1 unit increase in a country's ICT development results will increase a country's score on open data adoption by 4%. Both the ICT development and Democracy indexes have statistically significant coefficients at the 0.001 level. In general, this means that countries with a higher level of ICD development and democracy are more likely to be successful in open data adoption. On the other hand, the Social Capital sub-index and the Corruption Perception Index have lower statistical significance but are still statistically relevant in the 0.05 alpha value. Two variables, GDP per capita and World Press Freedom Index have lower, but negative results. These variables have lower statistical significance as well.

The Democracy index had the highest standardized beta value in all regression models. The value of the ICT Development Index varied: it had a higher standardized beta value with a statistically significant role in the open data readiness (β=0.438) and open data implementation (β=0.457) components, and a lower value in the open data impact model (β=0.198) with slightly lower statistical significance. This result shows that for open data initiatives, the technological background is not enough to achieve a better impact; advanced democratic conditions are also

required. Nevertheless, technological requirements are needed for open data readiness and the implementation of open data initiatives. The Press Freedom and Social Capital measures had lower standardized beta values in all three regression models with lower statistical significance.

In order to better understand the position of these two independent variables in terms of explaining open data performance, the difference between ICT development and democracy was then explored. The aim was to discover whether one of these independent variables alone could explain open data adoption. Contrasting İCT development and democracy data demonstrates that there were seven countries with a higher ICT development level, but a lower level of democracy (e.g. Saudi Arabia, Bahrain, Qatar, Russia). On the other hand, there were nine countries with a higher level of democracy, but a lower ICT development rate (e.g. India, Zambia, Botswana, Malawi). Both groups of countries demonstrate a relatively low level of open data adoption. In the majority of the cases, there is very little variation between ICT development and democracy. Hence open data adoption seems to be explained by ICT development or democracy alone.

We then tested the same independent variables with the three components of the Open Data Barometer, namely readiness, implementation and impact. This model allowed us to observe whether individual components of the ODB could explain the difference in open data adoption. The strength of ODB readiness and implementation, with an adjusted R^2 of 0.627 and 0.661 respectively, is significantly higher than the adjusted R^2 of 0.452 found for the ODB impact model. The results show that the statistically significant independent variables, namely ICT Development and Democracy Index explain open data readiness and implementation better than open data impact. Although democracy has the highest value in open data readiness, ICT development plays the most important role in open data implementation. Overall, the social capital indicator has a lower value in all open data adoption components.

	ODB Readiness		ODB Implementation		ODB Impact	
	Str. β	Sig.	Str. β	Sig.	Str. β	Sig.
GDP (PPP)	0.038	0.766	-0.155	0.207	-0.095	0.540
ICT Development Index	0.354	0.004	0.495	0.000	0.247	0.090
Corruption Perception Index	0.177	0.188	0.205	0.111	0.144	0.377
Democracy Index	0.515	0.000	0.412	0.001	0.432	0.005
World Press Freedom Index	-0.252	0.018	-0.147	0.145	-0.218	0.089
Social Capital sub-index	0.014	0.878	0.058	0.505	0.212	0.056
R Square	0.627		0.661		0.452	
Adjusted R Square	0.604		0.640		0.418	

Table 5. Standardized beta coefficients for ODB sub-sections (VIF values are below five in all variables).

Table 5 presents the summary of the hypotheses. Except for human capital, all the variables were tested with the linear regression model. Two hypotheses out of seven were accepted; the rest were rejected because of the lower standardized beta value and statistical significance. However, in comparison with the other rejected hypothesis, support for H2b (corruption) and H3b (social capital) was especially low. In general, the strongest relationship was seen between the state of democracy in a country and open data adoption, which can be explained by the fact that open data is significantly related to public transparency and accountability.

Factors	Hypotheses	Results
Capacity	H1a. Countries with higher economic capacity tend to have a high level of OGD adoption.	Rejected
	H1b. Countries with better ICT infrastructure tend to have a high level of OGD adoption.	Supported
Governance	H2a. Countries with higher democracy level tend to have a high level of OGD adoption.	Supported
	H2b. Countries with a lower corruption rate tend to have a high level of OGD adoption.	Rejected
	H2c. Countries with a higher degree of press freedom tend to have a high level of OGD adoption.	Rejected
Societal	H3a. Countries with a higher level of human capital are associated with a high level of OGD adoption.	Untested

	H3b. Countries with a higher level of social capital are associated with a high level of OGD adoption.	Rejected

Table 6. The research hypotheses

5. Conclusion

This research aimed to identify the primary factors of open data adoption to answer the main research question of to what extend national-level factors of countries explain the differences in open data adoption? The literature review shows that the majority of existing studies tends to explore organizational level factors within one or several countries. Furthermore, very few assumptions in the open data literature have been empirically tested using a quantitative research methodology. This study fills these gaps by developing a theoretical model and testing the relationship between OGD adoption and several societal, governance and capacity factors with cross-national data. We tested seven hypotheses concerning determinants of OGD adoption on the basis of Open Data Barometer data from 115 countries grouped into three categories of determinants: capacity, governance and societal factors.

For the *capacity factors*, we had mixed findings: the ICT infrastructure of a country is a determinant of OGD adoption but GDP is not. The first hypothesis was partially supported: the ICT Development Index, which represents technical capacity, played a significant role in determining OGD adoption in a country. GDP per capita, as part of the capacity measure, had both a statistically less significant and a slightly negative role in OGD adoption. This result can be explained, at least up to a point, by the findings of Ross (2011) who uncovered the negative relations between economic wealth (oil revenues in this study) and transparency in the non-democratic countries. The research findings of Harrison and Sayogo (2014) also did not confirm the positive relations between GDP and transparency, participation and accountability: dependent variables with a strong correlation with open data adoption.

For the *governance factors*, we also had mixed findings: democracy is a determinant of OGD adoption but a low corruption rate and a high degree of press freedom are not. The hypothesis about governance

factors was supported in a way that identified democracy as a determinant of OGD adoption. Compared with other variables, the Democracy Index has the strongest relationship with the level of open data adoption in a country. Democracy is the only indicator that determines the level of open data readiness, impact and implementation with high statistical significance. This result tracks well with prior open data studies that discuss the positive relations between open data and democracy level (e.g. Brito, Costa, Garcia, & Meira, 2015; Janssen et al., 2012).

Surprisingly, however, the second and third hypothesis in this category were both rejected. Press freedom has a negative correlation with open data adoption. Consequently, the results could not support the importance of press freedom level for OGD adoption. We know that many top performers in open data adoption do not perform well in the press freedom space. For example, while the UK, France, the United States, South Korea, Australia are among the top ten countries in open data adoption, their performance regarding press freedom is less than stellar (Press Freedom Index, 2015). This may indicate that such countries prefer "safe" supply type open data about politically harmless topics, rather than the "riskier" demand type transparency tools that may foster press freedom. On the other hand, countries such as Finland, Norway and Denmark, which share the first three places in press freedom in the world, have slightly lower scores in open data adoption. This can be explained by the fact that these countries have no extra motivation to adopt new transparency tools, as they already have well-functioning press freedom mechanisms.

None of the social factors was identified as a determinant of OGD adoption: the two hypotheses were rejected. Despite the fact that social capital strongly influences innovative activity, the different dimensions of social capital (e.g. trust, norms, social interactions, network resources) have a different impact on innovation (Dakhli & Clercq, 2007; Kaasa, 2009). Therefore, more studies are needed to investigate the relations between social capital, its dimensions and open data adoption. While there is significant theoretical support for relations between technology adoption, transparency, innovations and human capital (e.g. Wozniak,

1987; Pelinescu, 2015; Dakhli & Clercq, 2007), this relationship could not be tested because of the multicollinearity in data.

There are a number of limitations in the research design and the results. First of all, the dataset used to present the dependent variable is limited to the number of observations. Only half of the world's countries were studied in ODB research. Second, it would be more interesting to conduct a longitudinal study to understand the dynamics in the relationships of dependent and independent variables. However, the data from the ODB has only one data point that covers more than a hundred countries. Third, while open data literature describes the potential role of various factors including stakeholders and their perspectives, organizational capacity, skilled communities, advocacy activities, it is very hard to find relevant data to test the relationships with such independent variables. Therefore, future studies could add more variables to the proposed research framework. Finally, the influential independent variables, for example, Democracy Index represents a generic class of indicators such as the electoral process and pluralism, civil liberties, government effectiveness, political participation, and political culture. Not all of these indicators may be equally related in open data adoption. Future research may investigate democracy at a more detailed level to see which components of democracy (e.g., political participation, civil liberties, etc.) are more influential than others.

To the best of our knowledge, this study is the first to explore the relations between open data adoption and technical, economic capacity, societal and governance factors on global scale. While prior open data literature has demonstrated that national-level open data adoption may relate to factors such as democracy, this did not present empirical evidence to what extent such factors have relations with open data adoption. The results demonstrated that national-level factors indeed have a strong relationship with open data adoption. Furthermore, the developed theoretical framework can be implemented to study a particular group of countries and open data domains to understand better the dynamics of open data adoption. Future studies may target to explore additional factors that could either enable or limit the potential of open data adoption.

The results also have several implications for policymakers, open data practitioners and activists. This study provides empirical evidence of the relationship between open data adoption and the level of democracy and ICT development. The finding suggests that open data policies of countries should consider the maturity of democratic institutions. As many research results confirm, open data itself can help to improve democracy through citizen participation, transparency and accountability (Ruijer, Grimmelikhuijsen, & Meijer, 2017). Such effects of open data may be diminished by weak ICT development and democracy. Customizing open data policies with the existing democratic settings and ICT capacity can help the government to be more successful in terms of open data adoption. In sum, open data policies should consider the local qualities and policymakers should avoid imitating the implementation of successful open data experience of other countries that do not have similar characteristics. This is also true for open data practitioners and activists. Open data projects that initiated or funded by non-government organizations and activist groups should be well-aligned with the democratic settings of a country and the level of ICT maturity.

Overall, this study highlights the pivotal role of ICT infrastructure and democracy as determinants of OGD. The availability of existing infrastructure and a focus on democratic development were identified as the key determinants of OGD.

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CHAPTER 6

#utilization

#implementation

#adoption

Chapter 6. Conclusion

6.1. Introduction

The number of countries adopting open data policies, the maturity of open data adoption, the number of open data portals and the amount of government data released all have shown significant growth in recent years (*Data Portals*, 2019; *Open Data Maturity Report*, 2019). Yet open data projects still struggle to achieve the expected outcomes (e.g. Alaouie, 2019; Wang & Shepherd, 2019). The experience of many open data initiatives shows that starting new projects and publishing thousands of open datasets do not automatically lead to more societal effects and a higher rate of data usage. Academics and the open data community alike have pointed to the many conditions that mediate data openness and open data adoption. Until now, these conditions had not been systematically explored at the cross-national level in either the academic literature or in practice.

Studies examining the conditions influencing open data implementation and adoption had hitherto been mainly focussed on the technical aspects. In practice, it has been the open data activists and interest groups who have supported the idea of launching open data portals and sharing more data. However, having arrived at the close of this study, it has become clear that achieving a better process of open data implementation and adoption depends on more than technical conditions alone. In many cases, social conditions determine the sustainability of open data implementation and adoption. Open data implementation will fail, or fail to yield the expected effects if the social conditions have not been considered. While fulfilling the technical conditions establishes a basis for open data utilisation, an approach in which the focus is on these conditions alone is one that betrays multiple weaknesses. In the first place, doing so implies concentrating on short-term and immediate results. Secondly, it merely addresses the tangible side of open data adoption. If the technical conditions are all that count, the mere act of launching a data portal and publishing ten thousand open datasets may be considered a success.

The aim of this book was to explore and synthesize the conditions influencing open data utilisation, thereby focusing on the institutional

dimensions of open data implementation and the fundamental factors of open data adoption at the national scale. To that end, the conditions of open data utilisation were explored in four empirical chapters, where the institutional dimensions and national-level factors are analysed that need to be addressed or established in order to accelerate the utilisation of open data. In this way, this thesis aimed to contribute to the academic debate in the fields of public administration, open government and open data on precisely what conditions are those that serve to enhance open data utilisation.

This final chapter summarises the main results discussed in the thesis. The following subsections review each research question and the research findings presented in Chapters 2, 3 and 4. The overarching conclusion advanced in section 6.5 recaps all the results of the empirical studies by addressing the main research question of this dissertation. In the final sections, the academic relevance and future research prospects and practical relevance are presented.

6.2. Understanding open data utilisation

Research sub-question	1	What are the factors and categories of open government data utilisation and how are they connected?

The first research sub-question aimed to systematically explore the open data literature to identify the factors and categories of open data utilisation (Chapter 2). This research helped us to understand and combine the various components of the open data utilisation framework. Over a hundred open data studies were reviewed, from which four factors - types of utilisation, effects, conditions and open data users - were extracted to build the open data utilisation framework. While the literature discusses dozens of categories of factors, only those factors recurring in several studies were considered in the framework:

1. Types of open data utilisation - data analytics, anti-corruption, decision-making, research, innovation creation, smart city implementation, new service building and hackathons/competitions;

2. Effects of open data utilisation - creating social value, improving public services, economic development, transparency and accountability, the trust of citizens, citizen participation;
3. Users - citizens, developers, business, researchers, NGOs, journalists;
4. Conditions - quality of data, availability of right data, open data infrastructure; relevant skills, open data legislation, policy and consideration of privacy issues.

The two *types of open data use* classified in Chapter 2 are an analytic and synthetic use of data. The analytic use of data is the use of data for understanding and explaining a particular activity of public organisations and their features. The synthetic use of open data involves creating tools and intermediary mechanisms to reach objectives. Thus understood, the categories of analytic use that are frequently discussed in the open data literature are data analytics, anti-corruption, decision making or conducting research with the help of open data (e.g. Kalampokis, Tambouris, & Tarabanis, 2013; Murillo, 2015; Power, Robinson, Rudd, & Reeson, 2015; Rajshree & Srivastava, 2012). Frequently discussed synthetic uses of open data are its use for innovation creation, data use for smart city implementation, new service creation or organizing competitions to solve a societal challenge (e.g. Chan, 2013; Johnson & Robinson, 2014; Kitchin, 2014).

The systematic literature review concluded with three groups of *effects* emerging from the literature on open data: social, economic and good governance. Janssen et al., (2012) discuss three categories of open data benefits: political and social; economic; and operational and technical benefits. The authors list more than 30 benefits of open data, ranging from transparency, accountability and citizen participation to the stimulation of innovation, improvement of public policies and fair decision making. A systematic review of open data initiatives revealed a good governance impact of open data in the shape of democratic governance, accountability, transparency and access to information (Attard, Orlandi, Scerri, & Auer, 2015). Hence open data can generate social, economic and good governance effects. Social effects are realized by implementing innovative, data-driven services. Economic effects can be achieved by creating new commercial services and data-driven

decision-making based on the use of open data. Good governance effects, the effects most frequently discussed, manifest themselves through granular transparency and accountability in public organisations.

Compared with the freedom of information, open data limits the scope of *users* because of the required data processing skills. However, nearly everyone can become a customer and user of the data-driven services developed by using open data. In this regard, open data users can be divided into two groups: direct users, such as journalists, developers, or researchers who reuse data to obtain positive effects; and indirect users, such as citizens, NGOs and businesses, who use the results of the direct open data users. Smith and Sandberg (2018) describe three archetypes of users: employees, entrepreneurs and hobbyists. According to this classification, employees do not directly reuse data but facilitate the utilisation of data by entrepreneurs and hobbyists. While entrepreneurs aim to develop commercial services and create commercial opportunities, hobbyists dedicate their efforts to exploring data and solving problems, without any particular agenda.

Chapter 2 demonstrated that a broad range of technical and social *conditions* have an impact on the types of open data use and expected effects. Depending on the approach, these conditions can promote or hinder many types of open data use. Ma and Lam (2019) identified 20 barriers, which cover legal, technical, operational, institutional and economic domains. Similarly, Janssen et al., (2012) recognised a range of hindrances, from institutional (policy-oriented), complexity, use related and participation to legislation, quality and other technical barriers. In general, the conditions influencing open data utilisation are organised into two broader domains: technical conditions and social conditions. Technical conditions cover direct open data implementation mechanisms, such as open data facilitation, quality of shared data and infrastructure. The quality issues, for example, are considered a threat to the value creation expectations (Sadiq & Indulska, 2017). Social conditions impacting open data use, on the other hand, are more institutional in nature and tend to relate to aspects such as the skills and data processing knowledge required to be able to use data; the relevant

legislation, the availability of a dedicated open data policy, and privacy issues are the most frequently discussed conditions of open data use.

The results also revealed the links between the factors. Of those links, four offered significant challenges, as well as opportunities, for the further development of an open data utilisation framework. The *link between the type of utilisation and type of user* provides insight into who uses open data and how it is reused. Each user group has a particular expectation from open data use. That is why investigating the *link between the type of user and effects* allows us to better understand the expectations of users and the expected effects. Another link is the *causal connection between the type of open data utilisation and its potential effects.* Does good governance create open data adoption or does open data adoption create good governance? Is economic wealth needed to adopt open data or does open data adoption create economic wealth? The fourth connection, which is explored in the following chapters concerns the moderating conditions that facilitate the different types of open data utilisation and reuse effects.

The conclusion in Chapter 2 was that both the types of open data use and the expected effects depend on certain conditions. These conditions have been divided into technical and social conditions in the open data utilisation framework. Low-quality data, for example, cannot be used as a source on which to base business decision making. Data-driven services, on the other hand, require more granular data with a live connection to data sources. In sum, the absence of certain social and technical conditions were shown to limit the possibilities of open data use. The importance of such conditions is the primary reason why this research has focussed on further unravelling the role they play. To extend our understanding of the conditions at the institutional and national levels, the following research sub-questions were formulated.

6.3. Understanding open data implementation

| Research sub-question | 2 | How do institutional dimensions impact open government data implementation? |

Having clarified the open data utilisation framework and the position of the conditions in Chapter 2, an investigation of the impact of social

conditions, within an institutional context, and their impact on the technical conditions followed in Chapters 3 and 4. Technical conditions were operationalised as the availability of central and specialised open data portals, user-friendly tools (e.g. data visualisation tools), quality control and participation mechanisms. The development of data technologies over the past 10 years has made data collection, storage and sharing easier and cheaper. Furthermore, tens of countries have implemented e-government solutions, thus enhancing the opportunities for collecting and processing data in machine-readable formats.

The performance of e-government implementation and the quality of electronic services have increased throughout the past decade everywhere in the world (UNEGS, 2018). That technological shift allowed open data projects to be implemented with relatively less effort. The support of international institutions, communities and open source technologies (e.g. CKAN data-sharing portal, Open Contracting Data Standard) is another contributing factor: technical conditions are easier to accomplish given a situation of strong institutional maturity. Considering these realities and the fact that these technical challenges have been extensively studied in the literature on information technology, innovation implementation and open data, this research paid more attention to institutional and national-level conditions.

The most important institutional dimensions extracted from the innovation and open data literature were used as a theoretical framework to explore the performance of open data implementation in the best-performing countries and in a group of transition countries. This dual approach allowed us to observe the setting and impact of institutional dimensions in different contexts. For this reason, even among the group of countries with the best track records in terms of open data implementation, the specific public administration systems of each served as background criteria in selecting the countries to be included in the study. Likewise, although the second group of countries were all transition countries sharing similar historical backgrounds, each has a different public administration approach, economic and democratic performance.

Five institutional dimensions were extracted from the literature. This was the first attempt to conceptualize the institutional dimensions playing a role in open data implementation:

1. Policy and strategy - operationalized as an open data focus on Open Government Partnership action plans; availability of open data strategy; availability and comprehensiveness of open data guidance;

2. Legislative foundations - operationalized as the availability of specialized open data legislation; Freedom of Information and personal data privacy legislation;

3. Organisational arrangements - operationalized as the availability of supervisory organisations and organisational coordination;

4. Relevant skills and educational support - operationalized as a systematic approach to education and skills development, the availability of dedicated courses and training programs;

5. Public support and awareness - operationalized as the participation of non-government organisations, coordination of the activities, the role of public institutions in open data implementation.

While the same theoretical model was used to explore the research questions in Chapter 2 and 3, the methodological approach employed differed between the best-performing and the transition countries. The group of best-performing countries was selected on the basis of the Open Data Barometer and multiple data sources were used to explore the research questions. In the best-performing countries, Open Government Action Plans and other documents were analysed in order to acquire an understanding of the open data initiatives, policies and expectations in these countries. Furthermore, 32 expert interviews were used to collect data and understand the settings of institutional dimensions in each country. By contrast, focus group discussions with 89 open data stakeholders as participants were used in the transition countries as the primary data source. To increase the reliability of the data and for triangulation purposes, 31 documents and open data reports prepared by the government and non-governmental institutions were analysed.

6.3.1. Best performing countries

Chapter 3 concluded with the idea that, although the countries had different patterns of open data implementation, whether or not this was successful depended strongly on the quality of the institutional dimensions. Adopting a systematic approach to the selected five institutional dimensions could help the countries to achieve a higher level of open data utilisation. A centralized and more coordinated approach to open data implementation was found to yield better results. By taking the institutional dimensions into account, many implementation challenges, such as data quality, metadata, availability and sustainability data, can be solved.

Three case studies from the countries of the Netherlands, the United Kingdom and Sweden were presented in Chapter 3, in the light of which the role of institutional dimensions in open data implementation was examined. The Netherlands, as an example of a "decentralized unitary state" was an interesting case because of its government transparency and openness history.   Sweden presented as a case with a highly decentralized government structure and advanced freedom of information practices. The United Kingdom represented an example of a less decentralized public administration model, that was nonetheless shown to have the most advanced open data initiative in the world.

The experience with the implementation of open data differed significantly in the three countries discussed. All three countries had developed a national open data portal with CKAN – an open-source data-sharing platform with different levels of facilitation and maintenance. The UK had more than 40 thousand datasets and a relatively better metadata coverage, data quality and portal functionality. The Ministry of the Interior and Kingdom Relations, which maintains the national open data portal of the Netherlands, has published more than 10 thousand datasets in the portal, with a functionality similar to the UK. The facilitation level was the lowest in Sweden. There were fewer than a thousand datasets in the central open data portal. Moreover, maintenance of the central portal was relatively poorer than in the other discussed countries.

The results of this study confirmed that the institutional dimensions indeed help to explain the performance of open data implementation. Nevertheless, a diversity of open data implementation arrangements emerged across different settings of institutional dimensions. According to the Open Data Barometer study, the UK is the best-performing country in the world. This result can largely be explained by the strong open data policy, strategy and organisational arrangements. Unlike in the Netherlands and Sweden, institutional support is provided by a higher level of government body in the UK: the Data team of the Cabinet Office of the Government coordinates open data activities. The UK also has a stronger focus on open data on Open Government Partnership actions plans, a more comprehensive open data strategy and data guidance. No similar high-level support for open data implementation is seen in Sweden, and only to a certain extent in the Netherlands.

Although thousands of open data sets have been published, few were found to have actually been reused. This is a pattern that is repeated in all three countries. A lack of relevant skills, educational and public support and awareness were the main reasons for the lower levels of open data reuse reported in these country case studies. Systematic training programs addressing open data implementation are unavailable and plans to increase public awareness are lacking. The lower level of reuse can be explained by the reusability of shared governmental data. In the interviews with open data experts, the quality of data, availability of the right data and the quality of the data sharing infrastructure were pointed to as constituting significant barriers to obtaining value from open data. Many such challenges have been solved with effective collaboration among the open data stakeholders and data owners, better communication mechanisms and public support. Many countries simply fail to consider the development of public support, awareness and communication.

6.3.2. Transition countries

After exploring the experiences in the best-performing countries, Chapter 4 introduced the institutional dimensions of open data implementation in the transition countries. This study is the first to use a

more or less single methodological framework to explore open data practices in different countries characterised by different levels of economic and public administration development. The studies found in the open data literature moreover were primarily aimed at the experience of developed countries. However, there are several studies that investigate open data, including the institutional context of open data implementation, in developing countries, but nearly all are based on a specific methodology, designed and tested in a particular context. This limits both our understanding of the overall role of the institutional dimensions and the generalizability of research results. To understand the broader context of institutional dimensions, these needed to be empirically tested in both developed and developing countries.

To that end, 6 post-Soviet countries – Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine - were selected as country case studies. These countries form the members of the Eastern Partnership (EaP) initiative, which aims to provide a platform to discuss collaboration and economic cooperation between the European Union and the EaP member countries. The most important aim of the EaP initiative, in the context of open data, is the harmonisation of the digital markets between the EaP countries and the EU and the commitments of these countries to the development of the digital economy. Although these countries share a similar socialist background and public administration heritage, they each followed a different path in terms of institutional reforms after the collapse of the Soviet Union. Furthermore, all the selected countries have implemented open data projects, that differ in terms of scope and level of success. Other than that, Chapter 4 also discussed why these countries are relevant cases to be explored in terms of open data implementation.

Open data implementation in this region is significantly weaker compared to the three western countries. Regarding the technical aspects, the transition countries, except for Armenia and Belarus, have launched a central open data portal based on technologies and functionalities similar to the CKAN platform. The results of the global Open Data Barometer 2016 show Georgia in the 40th place, with Moldova ranking 31st and Ukraine 44th. Hence these three have a relatively better performance in this area than the three other group

members. Ukraine has the most facilitated central open data portal with more than 40 thousand datasets, yet the quality of datasets is highly questionable. Moldova and Georgia have published a few hundred datasets which have a better data usage due to several functioning open data projects. Armenia, Azerbaijan and Belarus, however, lack any such strong open data facilitation.

Chapter 4 clearly demonstrated that weaker institutional dimensions led to poor open data implementation. Based on these results, a distinction could be made between the so-called early adopters – Georgia, Moldova and Ukraine and the laggards – Armenia, Azerbaijan and Belarus. The early adopters had a relatively better institutional performance and thus a more advanced open data implementation process. Nevertheless, only a very of their few open data projects were successful. These projects either initiated or financially supported by international donor organisations and developed countries. In the group of laggards, insufficient open data policy and strategy, organisational and public support was shown to result in a meagre open data implementation. Organisational arrangements and the availability of relevant skills and educational support were the main challenges in these countries.

In general, the research results confirmed that similar institutional dimensions play a significant role in open data implementation across both the developed and the transition countries. International institutions and their support are the main drivers in the transition countries to implement and realise open data projects. Soviet legacies and the immaturity of the government institutions threatened the sustainability of open data implementation. National-level factors, such as political will, anti-corruption and transparency intentions of governments, emerged as the predictors of the institutional dimensions. Non-governmental institutions and transparency activists, on the other hand, were the main supporters of open data projects, particularly in the case of early adopters.

6.3.3. Comparative overview

The multiple case-study approach was helpful in identifying the conditions influencing open data implementation in three Western countries and six post-Soviet transition countries. These different implementation contexts made it possible to pinpoint the similarities and disparities in the institutional dimensions influencing the implementation of open data in these contexts. The selected cases were also chosen for logical reasons: the European countries, because of their diverse public administration practices and the transition countries because of their similar historical backgrounds, yet different transition pathways.

The comparative country analysis of the best-performing and the transition countries provided insight into the sheer variety of open data practices of governments. The findings of this assessment are presented in Chapters 3 and 4. The results of the studies highlighted the diversity of institutional settings, open data practices, the motivation of governments, the degree of political will and the challenges. First, the motivation of the governments was different in the various cases. In the best-performing countries, the motivation for implementing open data initiatives was mostly a desire to facilitate data-driven innovations and extend the scope of open government. In the transition countries, however, such implementation was promoted by external actors, such as funding institutes and international organisations, or took place as a result of social and political support given to bottom-up open data projects. Many of the top-down open data projects in the transition countries were imitative and non-sustainable because of the lack of institutional support.

The primary conclusion, based on the studies conducted in these two groups of best-performing countries on the one hand, and transition countries on the other, is that institutional dimensions indeed determine the success of open data implementation. The results uncovered relatively similar patterns in terms of the institutional dimensions impacting open data implementation. The lack of relevant skills and adequate educational support emerged as a strong barrier to the utilisation of open data in both the best-performing countries and in the transition countries. And although this may be more specific to the

domain of open data, in many fields the lack of public support and awareness impeded the implementation, or at the very least delayed the advancement of the open data implementation process. This was true in both the best-performing and the transition countries.

The next finding of the comparative overview was that the immaturity of the institutions and Soviet legacies significantly impacted the differentiation of institutional dimensions in the transition countries compared with best-performing countries. In the transition countries, many open data projects are initiated and funded by international aid organisations and developed countries. This institutional difference increases the vulnerability of open data implementation, as open data projects are then dependent on external support. The lack of political will and concerns about the transparency effects of open data are the reasons why the transition countries lacked strong open data policies and strategies, and supportive organisational arrangements.

These results therefore show that institutional dimensions can be said to play a significant role in the implementation of open data in both developed and developing countries. National-level factors and specific country characteristics can explain the differences among the countries in terms of open data practices. In some countries, open data implementation is circumscribed by economic and technical capacities, in others, corruption and transparency demotivate governments to open public data. To better understand these dynamics, the factors impacting open data adoption on a global scale were examined in Chapter 5.

6.4. Understanding open data adoption

Research sub-question	3	To what extent do national-level factors of countries explain differences in open government data adoption?

Chapters 3 and 4 defined the role of institutional dimensions in open data implementation. Furthermore, the results portrayed significant differences between countries, their experiences in terms of institutional dimensions and open data implementation. The countries with similar backgrounds were shown to have chosen different routes in order to

obtain better value from open data. Although it was not the objective of Chapters 3 and 4, the studies allowed us to observe the influence of national-level factors - such as the political will of governments, transparency and anti-corruption intentions, financial resources to develop and maintain the projects - on the adoption of open data. Lack of financial resources, for example, created a strong dependency on international aid institutions in the transition countries.

Such results created new puzzles which need to be solved to understand not only the performance of open data implementation but also the setting of the institutional dimensions. The literature on innovation and e-government adoption would benefit from a broader list of the national-level conditions that influence the adoption process and its sustainability. The open data literature has hitherto paid very little attention to such issues, mostly because of its emergent nature. Most studies confine themselves to investigating the organisational level factors within one or more countries. To cover this gap, a theoretical framework needed to be developed to understand the national-level conditions that influence open data adoption. The dearth of quantitative studies comprising a higher number of countries in the open data literature also motivated us to employ a quantitative method in this study.

In Chapter 5, we therefore developed our theoretical understanding of the national-level conditions through the analysis of an extensive range of publications, including technology adoption and e-government studies, open government, open data and innovation adoption studies. This theoretical overview uncovered 7 national-level factors, presented in Chapter 5, that could possibly determine the success of open data adoption in a country:

- Economic capacity – operationalized as the wealth of the country, namely gross domestic product purchasing power parity;
- Information technology capacity – operationalized as the level of ICT development;
- The level of democracy - operationalized as the maturity level of pluralism, civil liberties and democratic institutes;
- The level of corruption - operationalized as the perception of corruption in a country;

- The level of press freedom - operationalized as media independence, censorship, transparency for media and availability of legislative framework;
- Human capital - operationalized as literacy rate, quality of education, skill diversity and availability of skilled employees;
- Social capital - operationalized as social norms, personal relationships, social network and civic participation.

These factors were broadly divided into capacity, governance and societal factors. Multiple linear regression was used to gain insight into the impact of these factors on open data adoption. The starting point was the Open Data Barometer 2016, with its ranking of the open data performance in 115 countries. This study produced the most comprehensive and reliable data for understanding open data adoption around the world. To represent the independent variables, 7 indexes and measures, one for each factor, were used. Because of the multicollinearity effects in the Global Human Capital Index, which represents the human capital factor, this was excluded from the regression analysis.

The results confirmed that indeed, the performance of open data adoption and the differences seen between countries can be explained by some of the national-level conditions. More specifically, ICT development and the level of democracy were found to play a significant role in open data adoption. The regression analysis showed that ICT development and the Democracy Index had the highest standardized beta values (β=0.405 and 0.477). To further understand and explain the role of democracy and ICT development, the countries' performances in both areas were examined in the light of open data adoption. The results confirmed that neither of these two factors could separately explain open data adoption. In the majority of the cases, the countries with a higher level of ICT development, but without a system of democracy did not demonstrate a higher rate of open data adoption. However, neither did the more democratic countries with a lower level of ICT development. In sum, only the countries with both a higher level of ICT development and democracy successfully achieved an advanced level of open data adoption.

Although press freedom and the level of corruption are both perceived as being closely related to transparency innovations, the results showed this was not the case. Why this should be so is a question that was beyond the scope of this study. However, exploring the countries with higher levels of open data adoption but a lower degree of press freedom - and vice versa - could provide some insights. It might be expected that such countries (e.g. the UK, France and the US) would prefer "safe" supply type transparency tools such as open data rather than "riskier" demand-type transparency tools like press freedom. On the other hand, one of the best-performing countries with respect to press freedom was, as Chapter 2 showed, Sweden, yet it was not among the best-performing countries in respect of open data adoption. In other words, well-functioning press freedom mechanisms are not a motivation to adopt new transparency innovations.

In sum, the results demonstrated that open data is a democratic innovation which also requires technical maturity. This fact provided a clear answer to the research question of why open data adoption is more successful in some countries than others. None of the societal factors were supported by the results of this study. However, this is the first attempt to quantitatively test the role of national-level factors in open data adoption. More data and a more detailed approach to societal factors are needed to understand a possible relationship between social factors and open data.

6.5. Overarching conclusion: multilayered conditions and their interaction

Research question	What conditions are associated with higher open government data utilisation?

This research focused on the idea that the relationship between opening data and obtaining positive effects from doing so is not a linear one, but instead one in which the conditions influencing this must be improved and numerous obstacles removed. To that end, the institutional dimensions of open data implementation and national-level factors for open data adoption were analysed. This section summarises the work and provides the overarching conclusion of the empirical studies. Two

conclusions are explicitly highlighted. First, multilayered conditions are presented to understand what makes open data implementation and adoption successful and sustainable. Second, these conditions are strongly related to each other.

Chapter 2 introduced an open data utilisation framework comprising open data users, types of open data use, conditions and effects. The rest of the book explored and extended the conditions that were initially introduced in the open data utilisation framework. As discussed in the four empirical chapters of this thesis, the conditions that impact the effects of open data can be classified at three levels: national-level, institutional and implementation-level conditions. Implementation-level conditions relate to the technical components of open data projects. Institutional conditions represent the institutional dimensions, including the involvement of both governmental and non-governmental institutions. National-level conditions are fundamental factors that have an impact on open data adoption.

Focus of this thesis

National-level conditions — Maturity of democracy and ICT development

Institutional-level conditions — Strategy, policy, organizational arrangements, skills, awareness

Implementation-level conditions — Open data portal, tools, quality control, participation mechanisms

Open Government Data Utilisation

Social effects   Economic effects   Good gov. effects
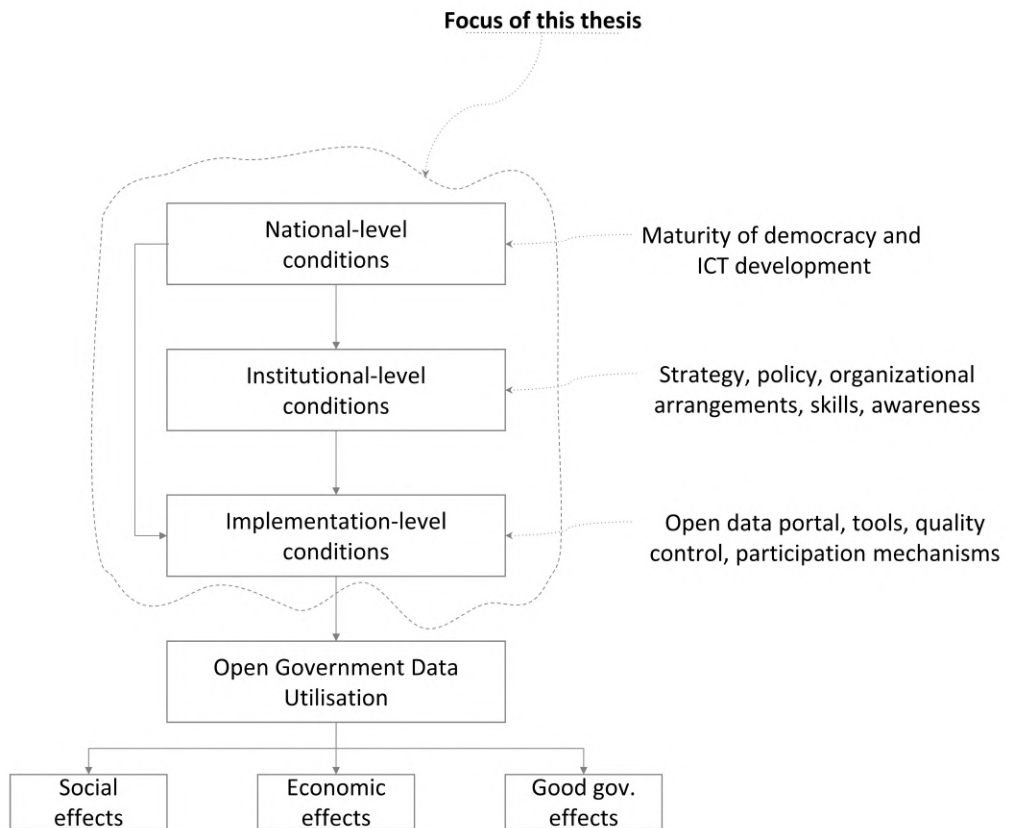
Figure 1. Research conclusion

This thesis is the first to explore the interaction between implementation-level conditions and comprehensive institutional dimensions. Implementation-level conditions were not new in the open data literature. Both the open data and the innovation literature frequently discuss various implementation-level conditions to explain the level of open data utilisation (Afful-Dadzie & Afful-Dadzie, 2017; Chatfield & Reddick, 2017; Machado & Oliveira, 2011). In this thesis, the availability of open data portals, user-friendly tools to find and use open data, quality control, and user participation mechanisms were operationalised as open data implementation. Such conditions are the basis for open data utilisation. However, advanced technical facilitation does not guarantee the longevity and adoption of open data projects. The conclusion of Chapters 3 and 4 confirmed that to achieve the

sustainability of open data implementation, the institutional dimensions should be well considered in open data adoption. This idea was also supported by several open data studies (Altayar, 2018; Fan & Zhao, 2017).

Institutional conditions are frequently discussed in the literature on innovation adoption, e-government and open data (Conradie & Choenni, 2014; Jetzek, 2016; T.-M. Yang, Lo, & Shiang, 2015). Institutional conditions, operationalized as institutional dimensions, are the most essential elements on which this study focused, for three reasons. First, institutional dimensions guarantee the sustainability of open data initiatives. Second, such dimensions are relatively easily established, measured and improved, compared to the national-level conditions. Third, better institutional dimensions mean that projects are not dependent on people and individual characteristics. However, institutional conditions have not yet been systematically explored in the open data literature. Until now, such conditions were studied either separately at the organisational level, or within a country or a few similar, for the most part developed, countries. The present study covered this gap by combining institutional dimensions and testing them in both developed and in transition countries.

At the third and highest level are the national-level conditions, which were operationalized as national characteristics of countries and cover the level of democracy and ICT development in a country. Considering the fact that open data is a new phenomenon and national-level conditions are difficult to improve in a short time, such factors have not been studied so far. This research was the first attempt to quantitatively test national factors such as economic and technical capacity, societal and governance factors, and open data adoption. The empirical results supported a role for several national-level factors in open data adoption, to wit the maturity level of the democracy and level of ICT development.

The findings presented that the role of each level of conditions has different dynamics in the performance of open data utilisation. Implementation-level conditions are short term, volatile and superficial. It is not a significant challenge to improve such conditions for a short time of period. Improving implementation-level conditions depend on persons or activists if it is not supported and initiated by institutions. Institutional-level conditions are medium-term, changeable but

relatively stable and determine the success of the implementation. Such conditions are depended less on a single person. National-level conditions are long-term, stable, shape the overall boundaries of OGD adoption. Instead, it is rather hard to improve such conditions for a short time of period.

As the experiences of the three developed and the six transition countries demonstrated, there is a strong interaction among implementation-level, institutional and national-level conditions. The empirical results of Chapters 3 and 4 confirmed that implementation-level conditions have already been established in the studied countries. Nearly all the countries studied (except Belarus) were found to have introduced a central open data portal with a varying degree of functionality and facilitation. However, in many cases, this has failed to led to open data utilisation because the other conditions remained unmet. Even in the developed countries, which have advanced transparency mechanisms, open data infrastructure and higher-level open data facilitation, open data utilisation was shown to be constrained by a similar failure to fulfil several other conditions. This argument aligns with the results of a recent study, which reported that although the UK is the most advanced country in terms of open data, the majority of published data does not contribute to open data utilisation (V. Wang & Shepherd, 2019).

The findings of Chapters 3 and 4 confirmed that the presence of implementation-level conditions alone is insufficient to generate any positive effects of open data. That is the reason why open data adoption requires both implementation and institutional-level conditions to be taken into account. Open data utilisation is contingent on a successful and effective open data adoption process. In general, value creation with open data is not only about data, but also about the involvement of stakeholders, organisational and legislative support, and proper communication, as a recent open data study has confirmed (McBride, Aavik, Toots, Kalvet, & Krimmer, 2019).

The important interaction is between the national-level conditions on the one hand, and institutional and implementation-level conditions on the other. The results demonstrated that without a well-established system of democracy and supportive ICT development, open data

adoption cannot happen. The maturity of the democratic system determines the quality of the institutional dimensions. The degree of ICT development, on the other hand, explains the quality of the implementation-level conditions. The findings of Chapter 5 also made it clear that ICT development or democratic maturity alone do not lead to a better process of open data adoption. This is why both democracy and ICT development are prerequisite for open data adoption.

The interaction between national-level conditions and institutional and implementation-level conditions was more visible in the transition countries. In Chapter 4, it was seen that the existence of democratic institutions enabled public organisations to put a sustainable open data implementation process in place. Open data implementation, facilitated to varying degrees , was initiated in short order throughout the studied region. However, over the course of time, many open data initiatives were either not well-maintained or abandoned completely. This can be explained by the role of national-level conditions and their interaction with the institutional and implementation-level conditions. In developed countries, the extent of open data utilisation was primarily influenced by institutional conditions. In other words, the institutional dimensions of open data implementation were what explained the utilisation of open data in the developed countries. The reason is that the developed countries in the study had advanced democratic systems and ICT development. The differences between these countries were due to the settings of the institutional dimensions.

In sum, open data is a complex public sector innovation that requires the close consideration of multilayered conditions. More than anything else, open data is democratic innovation. Both the level of democracy and ICT development in a country and the maturity of the country's institutions determine the success rate of open data adoption. Considering the multi-layered and interrelated nature of the conditions, open data cannot be easily implemented and adopted if the fundaments are lacking.

6.6. Academic relevance and research agenda

This research contributes to the literature on public sector innovations and specifically to the open data literature. Until now, the debate about opening government data and open data utilisation has primarily focussed on technical factors, organisational determinants, adoption barriers and assumed benefits. The open data literature reveals that some conditions significantly influence the reuse of open data. In turn, neglecting these conditions has been shown to limit the utilisation of public data. Although many conceptual studies have looked at the role of these conditions within organisations, there was a need for an empirical study combining these conditions and testing their role in open data utilisation.

So far, the majority of the open data studies were conducted using qualitative research methods. This book moved from qualitative methods to a multi-method approach, as was proposed in a recent systematic literature review about innovation in the public sector as a direction for future research (De Vries, Bekkers, & Tummers, 2016). The authors of the systematic literature review also highlighted the need to conduct more cross-national studies to link different governance traditions, in order to explore the effects of public sector innovation.

At the beginning of this book, three research gaps were introduced:

1. Fragmentation in the literature on open data utilisation
2. No in-depth understanding of institutional dimensions of open data implementation
3. Lack of understanding of the national-level conditions and their impact on open data adoption

Addressing the first gap is the conceptual contribution of this study, which introduced a theoretical framework for understanding the factors, including the influencing conditions, of open data utilisation. In the extant open data literature, scholars focus mostly either on one or a few technical or social conditions such as organizational arrangement and capacity (Zhao & Fan, 2018), socio-technical determinants in the organizational level (H. Wang & Lo, 2015; T. Yang & Wu, 2016) and technical components such as open data portals (de Juana-Espinosa & Luján-Mora, 2020) and metadata (Křemen & Nečaský, 2019). This

research, however, contributes to the literature by defining open data utilisation and linking together four factors impacting the utilisation of this data: types of open data use, its effects, users and conditions. The conditions frequently discussed in the open data literature are positioned within the framework, thus integrating both the technical and the social components.

To cover the second gap, this study explored the impact of institutional dimensions on open data implementation at a country level. What the systematic literature review showed was that the social conditions discussed in the literature are primarily institutional challenges. For this reason, they were treated as the institutional dimensions. As an empirical contribution to the open data literature, this thesis developed a theoretical framework to understand the institutional dimensions of open data implementation. More importantly, that theoretical framework was tested in both developed countries and in a group of transition countries. So far, institutional dimensions were explored separately (e.g. the role of training and engagement (Gascó-Hernández, Martin, Reggi, Pyo, & Luna-Reyes, 2018), legal framework (K. Janssen, 2011)), and within a country or few similar countries (e.g. in Taiwan (T.-M. Yang, Lo, Wang, & Shiang, 2013; T. Yang & Wu, 2016), Australia (Hossain & Chan, 2016) and Netherlands (Zuiderwijk, Volten, Kroesen, & Gill, 2018) in the open data literature.

Finally, to address the third research gap, this research discussed the national-level factors that determine both the social and technical conditions. The international ozzpen data benchmarks show that very few countries achieved higher-level open data adoption (e.g. *Open Data Barometer*, 2017). Using a quantitative method, this research attempted to explain such variances based on national-level factors such as the technical and economic capacity of a country, social and governance factors.

This study employed a combination of qualitative and quantitative methods to explain the impact of national-level and institutional conditions. While many studies have investigated open data in various countries at the organisational level, there was little empirical evidence to comparatively observe the manifestation of these conditions in countries with similar and with different backgrounds. The majority of

the studies to date have explored the open data performance of organisations within the context of developed countries. We did not know whether the conditions that promote or hamper the utilisation of open data were similar or different in developing countries. Furthermore, because of the emergent nature of open data and the dearth of data, many studies presented assumptions rather than empirical results.

Considering the results of the empirical studies, this book proposes three future directions for further research. First, the theoretical framework of institutional dimensions developed in the present work could be tested in a larger number of both developed and developing countries. To date, it has been tested in 3 developed and 6 transition countries. It would be useful to test the same framework in, for example, the countries of Latin America, Middle East or South-East Asia. Such studies would enable this theoretical framework to be further validated and allow us to observe the differences and similarities between the different country groups.

A second suggestion would be to test the theoretical framework in a specific context. The results suggest that open data implementation is strongly influenced by five institutional dimensions (Chapter 3 and 4) in both developed and transition countries. Yet, these empirical studies were targeted at open data implementation in general, without focusing on any particular field. Future studies could explore the role of institutional dimensions in a particular context, such as open contracting data, open spending data, open education data etc. and specify the limitations of this theoretical framework. Such studies can also reveal the opportunities for accelerating open data implementation in a particular field.

A third recommendation would be to conduct longitudinal research to evaluate whether the role of national-level factors changes through time. This study confirmed the impact of democracy on open data adoption. Scholars and open data practitioners assume a positive impact of open data on democracy. Longitudinal research may extend our understanding about the causality and direction of impact between democracy and open data. Furthermore, longitudinal research is required to evaluate whether open data adoption is indeed taking place,

thus enhancing our understanding of the impact of national-level factors in strengthening the adoption process.

6.7. Practical relevance

The results of this thesis have created new insights to understand open data implementation and adoption conceptually and practically. That knowledge has not only generated new questions and the topics for future study presented above, but also practical implications.

The findings of this research contribute to a better understanding of the institutional dimensions to be taken into account to achieve better open data utilisation results. The countries studied within the scope of this research aim to effectively implement open data projects in order to improve the quality of public services and facilitate data-driven innovations. Sustainable open data utilisation requires the consideration of numerous implementation, institutional and national-level conditions. The research questions that have been investigated in this dissertation are relevant for the policymakers and activist groups in the countries studied; first, to see how their performance compares with the others and second, by pointing out the need to customise their open data implementation and adoption processes, taking into account the conditions that are of influence on whether or not the expected effects will be achieved.

The major contribution of this thesis in practical terms is the proposed framework of institutional dimensions that define open data implementation. Although a limited number of countries were used as case studies, the results are relevant to other countries. Since other countries also encounter challenges in realising the full potential of open data re-use, these challenges are also likely to have institutional roots. It may be assumed that public administration models, cultural differences or the level of democracy create a specific institutional setting for each country. Nevertheless, considering the fact that the research results in developed and in transition countries demonstrate similar patterns to explain open data implementation, the same institutional dimensions can be considered in the policy design to improve open data implementation in other countries.

For example, nearly all the countries explored in this thesis had appointed a coordinating organisation to maintain the open data activities. However, not a single one of these organisations had the legal backing of a regulatory authority. These coordinating organisations typically had an advisory role, which does not allow them to execute the open data programs in full and to maintain the quality of open data. The results show that the governments need to give more authority to the coordinating organisations. Moreover, the legislative environment, and particularly the freedom of information laws, needs to be supportive of open data activities. Extending the freedom of information laws in the direction of open data activities could enhance proactive information openness and sustainability of open data implementation. The results also supported the idea that to increase data use skills, it is important to achieve better collaboration between government organisations and the open data community.

The results of the quantitative study in Chapter 5 yielded useful and practical insights regarding the role of national-level characteristics in open data adoption. Understanding the impact of national-level factors, and more specifically, the strong part played by democracy and ICT development in the adoption of open data, will bring about a change in the approach to this public innovation. Open data adoption is not simply a modest operational change in the organisation, but requires the consideration of national-level factors. In many cases, policymakers, activist groups and international organisations try to promote the implementation and adoption of open data policies that worked in well-performing countries in countries for whom the concept is new, without considering the contextual factors. We observe such patterns in the activities of donor institutions in developing countries. Failing to take the national-level factors into account leads to short-lived projects lacking impact on society. These research results support the idea that the policymakers and other interest groups need to map and consider the context of a country in a holistic way in the adoption of open data.

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Epilogue

After the introduction of concept of open data 10 years ago, very little of the ambitions then expressed has been achieved in terms of utilisation level, despite the fact that it has been adopted by tens of countries and that thousands of open datasets are publicly available. Open data adoption in the UK, Canada, South Korea and the Netherlands, countries with long experience in this area, all face more or less the same challenges to achieve more usage and positive impact. Institutional and public support, the availability of relevant skills and supportive legislation continue to be barriers to achieving more impact through the use of open data. I conclude this book with some recent media news about the positive effect of one of the more successful cases of open data implementation. This example of an open contracting data project has gained strong institutional and public support, which also backed by a legal framework and political leadership.

A recent news article reported that for the past three years, Bukovinsky State Medical University, the largest public education organisation in Chernivtsi city (Ukraine), has procured current and capital repair services from a local businessman. In total, 24 contracts have been awarded to the same entrepreneur since 2017. Starting in mid 2018, the University has also awarded an additional 12 contracts, without organizing a tender, to another businessman. Investigative journalists from "Our Money. Lviv" accessed Ukraine's open contracting data and discovered that, weirdly, both entrepreneurs had the same telephone number in the company records [1].

It was one out of hundreds of procurement cases in which regulatory organisations, NGOs and journalists detected "anomalies" thanks to publicly available open data. In Khmelnytskyi, an average size Ukrainian province, 34 risky tenders with an expected value of 350 million hryvnias (about 12 million euros) have been cancelled [2] by law enforcement officials since the beginning of 2019. Analysing the open data revealed that the most common violations were inconsistencies with the tender criteria and the terms of the tender documentation.

In early 2014, immediately after Euromaidan demonstrations in Ukraine, a group of volunteers set out to develop a platform "to change the rules

of the game to restore the country" as they themselves described their mission, by sharing the procurement data of the Ukrainian government. Such a platform could re-establish the relationships among civil activists, business and government. Shedding light on government spending, this data-driven initiative aimed to fight corruption and increase trust in the government.

The volunteer team could not, in their wildest dreams, have imagined that after 2 years, the ProZorro platform, as the project is known, would became mandatory for use by nearly every public organisation - more than 15,000 procurement entities and 25,000 tender commissions - under the Public Procurement Act. Today, the open data in ProZorro is the main source for dozorro.org, where anyone can leave reviews about government tenders, share evidence about corrupt activities and publish risky activities. The State Audit Service of Ukraine monitors the public tender data in the ProZorro system using risk measures proposed by the civic sector. In the beginning, it was hard to envision that independent initiatives and start-ups such as clarity-project.info, would build a business on the use of open data to help companies identify opportunities, find the most relevant contracts and evaluating the possibilities of winning public contracts.

ProZorro, however, is one of the few open data initiatives that have successfully utilized the potential of open data and provided a positive contribution to society. Although there are more than ten thousand datasets on the open data portal of the Ukrainian government, only a handful of datasets have ever been downloaded and used. Most open datasets have never been used by third parties. Many datasets are published for the sake of boosting the numbers rather than for real economic, social and governance impact. On the other hand, there are plenty of high-quality datasets that could be used to understand the operations of government institutions. Even such datasets have failed to find potential users. These challenges hold true, not only for Ukraine but for all other countries that have invested in open data adoption. I hope the results of the empirical studies of this thesis will result in more supportive open data implementation and adoption, which will result in more and more successful open data projects like ProZorro.

[1] http://lviv.nashigroshi.org/2019/06/04/medychnyy-universytet-kil-ka-rokiv-pospil-bez-tenderiv-zamovliaie-remont-uliublenym-fopam/

[2] https://dozorro.org/news/za-pershij-kvartal-2019-roku-pravoohoronci-hmelnichchini-domoglis-vidmini-34-rizikovih-tenderiv

Summary (Dutch)

Het delen van overheidsdata zonder barrières voor hergebruik, ook bekend als Open Government Data (OGD), leek een voorbode voor een meer open overheid. Deze open overheid werd verondersteld proactief te zijn in termen van vrijheid van informatie en het faciliteren van gegevensgestuurde oplossingen en gericht op het leveren van effectieve diensten. Realiseren van de technologische voorwaarden voor open data implementatie is relatief eenvoudig maar deze implementatie is vooral ook in zijn sociale aspecten een moeilijk proces. We weten weinig over hoe de interactie tussen sociale en technische omstandigheden het gebruik van open data beïnvloedt. Dit proefschrift beoogt daarom de institutionele omstandigheden te onderzoeken die van invloed zijn op het gebruik van open data.

In de eerste fase van het onderzoek wordt gebruik van open data geoperationaliseerd, om de verschillende componenten hiervan te begrijpen. Ook wordt bekeken in hoeverre deze door voorwaarden voor open datagebruik worden beïnvloed. Hoewel dergelijke voorwaarden uitgebreid zijn onderzocht door wetenschappers en de open-datagemeenschap, is weinig bekend over het geïntegreerde beeld en over hoe de voorwaarden gerelateerd zijn aan de verschillende componenten van het open-datagebruik. Deze kennis is nodig om te begrijpen hoe deze voorwaarden het succes van de implementatie van open data en de acceptatie op lange termijn bepalen.

In hoofdstuk 2 wordt een uitgebreid overzicht gegeven van de literatuur over de typen, effecten, omstandigheden en gebruikers van OGD. Dit onderzoek analyseert 101 academische studies over OGD die minstens één van de vier factoren van OGD-gebruik bespreken: De verschillende typen van gebruik, de gevolgen van gebruik, de belangrijkste voorwaarden voor gebruik en de verschillende gebruikers. Uit de resultaten blijkt dat de meeste studies zich richten op de voorwaarden voor OGD, waarbij ze verschillende vormen van gebruik van OGD bespreken, maar niet empirisch testen. Aan het eind van het hoofdstuk worden de hypothetische relaties in een multidimensionaal kader van het gebruik van OGD samengebracht. In het hoofdstuk wordt een open kader voor datagebruik geïntroduceerd en de rest van het proefschrift

werd onderzocht en uitgebreid met de voorwaarden die aanvankelijk werden ingevoerd in het kader van het open datagebruik.

In de tweede fase worden belangrijke institutionele dimensies en hun rol bij de implementatie van open data vastgesteld. De open data literatuur richt zich meestal op een bepaalde institutionele context, voornamelijk westerse democratieën. Over het algemeen is de academische kennis over institutionele dimensies zeer gefragmenteerd en ontbreekt er een alomvattend overzicht van de verschillende dimensies die van invloed zijn op de implementatie van open data. Om deze kloof te overbruggen is een theoretisch kader ontwikkeld dat kan worden gebruikt om deze institutionele dimensies uit te leggen en om hun rol bij de implementatie van open data te identificeren. In hoofdstuk 3 wordt dat kader gebruikt en worden de institutionele dimensies die de uitvoering van OGD in drie ontwikkelde landen gestalte geven onderzocht: in Nederland, Zweden en het Verenigd Koninkrijk. Om de implementatiepraktijken van OGD te onderzoeken werden 32 gesprekken met deskundigen en documentanalyses gebruikt. .

De resultaten van het onderzoek in de tweede fase tonen aan dat de implementatie van OGD op zichzelf niet voldoende is om de duurzaamheid en het succes van de adoptie ervan in een land te waarborgen. In hoofdstuk 3 worden daarom vijf institutionele dimensies van open data besproken: beleid en strategie; wetgevingsgrondslagen; organisatorische regelingen; relevante vaardigheden en publieke steun en bewustzijn. De resultaten tonen aan dat de benadering van de institutionele dimensies per land verschilt. Zo blijkt een gecentraliseerd OGD-bestuur betere resultaten en een hoger niveau van OGD-implementatie op te leveren.

In hoofdstuk 4 wordt hetzelfde theoretische kader getest in zes onder bestudeerde landen: Armenië, Azerbeidzjan, Wit-Rusland, Georgië, Moldavië en Oekraïne. Dit onderzoek vergaart uitgebreide gegevens op basis van een analyse van 31 documenten en gesprekken in een focusgroep met in totaal 89 deelnemers. In het algemeen blijkt uit de bevindingen dat in deze landen dezelfde institutionele dimensies als in westerse landen de implementatie van OGD beïnvloeden. Een opvallend verschil is echter dat we vinden dat de implementatie van open data in de transitielanden veel kwetsbaarder is en sterk afhankelijk

is van initiatieven op het gebied van buitenlandse hulp. Dit onderzoek versterkt ook het argument dat institutionele dimensies de prestaties van de implementatie van open data verklaren.

In de derde fase worden op nationaal niveau factoren vastgesteld die van invloed kunnen zijn op de acceptatie van open data door overheden. Aangezien open data een strategisch goed is van overheidsorganisaties en het besluit om data te publiceren wordt beïnvloed door verschillende institutionele factoren, is het belangrijk om de achtergrond en kenmerken van de verschillende landen te begrijpen. Daartoe onderzoekt hoofdstuk 5 de rol van technische, economische capaciteit, maatschappelijke en bestuurlijke factoren bij de nationale adoptie van OGD. Dit onderzoek presenteert allereerst een theoretisch kader. Vervolgens wordt de theorie kwantitatief getest met behulp van de data uit de Open Data Barometer over 115 landen met zeven onafhankelijke variabelen. De statistische analyse bevestigt dat de acceptatie van OGD hoger is in landen die democratischer zijn en een hoger niveau van ICT-ontwikkeling hebben. Democratie is de enige variabele die een belangrijke rol speelt in elk van de drie onderdelen van open data adoptie: open data gereedheid, open data implementatie en de impact. Verrassend genoeg hebben economische capaciteit en persvrijheid enigszins negatieve resultaten in de regressieanalyse. Over het geheel genomen benadrukken de resultaten de dominante rol van democratie en ICT-infrastructuur als bepalende factoren voor de acceptatie van open data.

Zoals besproken in de vier empirische hoofdstukken van dit proefschrift, kunnen de voorwaarden die van invloed zijn op de effecten van open data op drie niveaus worden ingedeeld: nationale, institutionele en uitvoeringsniveaus. Voorwaarden op uitvoeringsniveau hebben betrekking op de technische componenten van open dataprojecten. Institutionele voorwaarden, met inbegrip van de betrokkenheid van zowel gouvernementele als niet-gouvernementele instellingen, vormen de condities voor de implementatie van open data. De omstandigheden op nationaal niveau zijn fundamentele factoren die van invloed zijn op de acceptatie van open gegevens. In de conclusie van dit proefschrift worden deze meerlaagse condities en hun interacties gecombineerd en besproken.

Summary (English)

Sharing government data without reuse barriers, which is known as Open Government Data (OGD), promised a new reality for a more open government, proactive in terms of freedom of information and facilitating data-driven solutions targeted at delivering effective services. Open data implementation is relatively simple in terms of realizing technological conditions, but constitutes a socially difficult process, and we know little about how the interaction between social and technical conditions impact the utilisation of open data. Therefore, this thesis aims to explore the social conditions that impact the utilisation of open data in three phases.

First, the idea of "open data utilisation" is operationalized to understand its components and to position its influencing conditions. Although such conditions are widely, yet separately, explored by scholars and the open data community, we know little about the integrated picture and how the conditions are related to other factors in the open data utilisation framework. Such knowledge is needed to understand how these conditions determine the success of open data implementation and long-term adoption.

Therefore, Chapter 2 presented a comprehensive overview of the literature on the types, effects, conditions and user of OGD. The review analyses 101 academic studies about OGD which discuss at least one of the four factors of OGD utilization: the different types of utilization, the effects of utilization, the key conditions, and the different users.

The results show that the majority of studies focus on the OGD provisions while assuming, but not empirically testing, various forms of utilization. At the end, the chapter synthesized the hypothesized relations in a multi-dimensional framework of OGD utilization. Chapter 2 introduced an open data utilisation framework and the rest of the book explored and extended the conditions that were initially introduced in the open data utilisation framework.

The second phase involves the identification of significant institutional dimensions and their role in open data implementation. Typically, the open data literature focuses on a particular institutional context, mostly in western democracies. In general, our knowledge about institutional

dimensions is highly fragmented and an inclusive overview consisting of the various dimensions influencing open data implementation is lacking.

To cover this gap, a theoretical framework has been developed that can be used to explain these institutional dimensions and to identify their role in open data implementation. Chapter 3 used that framework and investigated the institutional dimensions that shape OGD implementation in three developed countries: the Netherlands, Sweden, and the United Kingdom. 32 expert interviews and document analysis were used to research OGD implementation practices.

The results reveal that OGD implementation per se is not enough to ensure the sustainability and success of OGD adoption in a country. Chapter 3 also discussed five dimensions: policy and strategy; legislative foundations; organizational arrangements; relevant skills; public support and awareness. The results highlighted that the approach to the institutional dimensions differs between the countries. A centralized OGD governance is shown to yield better results and a higher level of OGD implementation.

In Chapter 4, the same theoretical framework was tested in six understudied countries: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine. This research presented rich data based on an analysis of 31 documents and focus group discussions with a total of 89 participants. In general, the findings demonstrated that in these countries the same institutional dimensions influence OGD implementation as in their Western counterparts. A striking difference, however, is that we find open data implementation in transition countries to be much more fragile and highly dependent on foreign aid initiatives. This study also strengthened the argument that institutional dimensions explain the performance of open data implementation.

In the third phase, national-level factors are identified, which can impact open data adoption by governments. As open data is a strategic asset of government organisations and the decision to publish data is impacted by various institutional factors, it is important to understand the background and characteristics of the various countries in order to explain their adoption of open data. To do so, Chapter 5 investigated the

role of technical, economic capacity, societal and governance factors in national-level adoption of OGD.

First, a theoretical framework was presented. Then it was quantitatively tested using Open Data Barometer data from 115 countries and seven independent variables. The statistical analysis confirms that OGD adoption is higher in countries that are more democratic and have a higher level of ICT development. Democracy is the only variable which has a significant role in each of the three components of open data adoption: open data readiness, implementation and impact. Surprisingly, economic capacity and press freedom have slightly negative results in the regression analysis. Overall, the results highlighted the dominant role of democracy and ICT infrastructure as determinants of open data adoption.

As discussed in the four empirical chapters of this thesis, the conditions that impact the effects of open data can be classified at three levels: national-level, institutional and implementation-level conditions. Implementation-level conditions relate to the technical components of open data projects. Institutional conditions represent the institutional dimensions, including the involvement of both governmental and non-governmental institutions. National-level conditions are fundamental factors that have an impact on open data adoption. The conclusion of this thesis combined and discussed the multi-layered conditions and their interactions.

Acknowledgement

About the author

Igbal Safarov (1986) studied Information technology (2003-2007) at Azerbaijan State Economic University. After finishing the bachelor's degree, he completed MSc Engineering economy and management (2008-2010) at Azerbaijan State Economic University. Igbal graduated second MSc Information Systems at the University of Sheffield with Sheffield Graduation Award (2012-2013).

Before starting PhD, Igbal worked as a government officer at various central executive bodies in Azerbaijan in the fields of information society and IT strategy development. He collaborated with international open data research projects and involved Open Data Barometer and The Web Index research for investigating government information ecosystem in Turkey, Estonia, Ukraine, Georgia and other countries.

During his PhD research, Igbal published several articles in different peer-reviewed academic journals such as Information Polity and Public Performance and Management Review. He presented his research at international conferences (EGPA, IRSPM, EaPEC). In 2017, Igbal received EaPconnect 2017 award for his research project. In 2019, he was one of the winners of the 2019 Youth ResearchEdge Competition of OECD.

Notes

Notes