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The Roles Of Governments In The Open Data Ecosystem

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THE ROLES OF GOVERNMENT IN THE OPEN DATA ECOSYSTEM

INTRODUCTION

Open Government Data (OGD) ecosystem enables the use of data to a broad range of potential users, which includes the government and all stakeholders (Ding et al., 2011). Policymakers, specialists, independent developers, service providers, academics, private organizations, as well as citizens, have a potential interest in OGD (Erickson et al., 2013). The motivations to the use of open government data have been attracting les attention than those of providing them. This situation becomes more pronounced when approaching the use of OGD by the government and public organizations, even if the audience of OGD includes government employees (Smith & Sandberg, 2018; Davies, 2010).

Studies have been demonstrated that the main interesting subjects in OGD are professionals and citizens (Heise & Naumann, 2012), focusing respectively on the development of innovation based on OGD and its transparency and accountability. However, the use of OGD by the public sector is not explicit in the literature. OGD is open to both the public and the private sectors (Jetzek, Avital e Bjorn-Andersen, 2014). Consequently, it makes sense that public organizations also use OGD (from other OGD public providers) in decision-making and innovation, as well as that the literature covers this topic.

Studies by Vieira and Alvaro (2018), Zhu (2017), Léveillé and Timms (2015), and Parycek, Höcht, and Ginner (2014) investigate users of OGD with multiple stakeholders, including government. However, the literature about the specific use of OGD by the government is not common. The use of OGD by government needs more attention than just the data disclosure because the government has an essential response to create public value (Ruijer et al., 2017; Pereira et al., 2017). Governments can use OGD to improve public services, decision-making, and define and monitor public policies implementation (Gascó-Hernández et al., 2018; Susha, Grönlund & Janssen, 2015). Public organizations need to pay special attention to improve cooperation between government organizations and stakeholders involved in producing useful OGD (Yang, Lo & Shiang, 2015). Based on the aspects discussed, this paper aims to discuss the twofold role of government in the open government data ecosystem (provider or user).

This article is organized in five sections. In this section, the motivations for the study are presented, and the research problem and objectives are defined. Section 2 discusses the theoretical elements guiding the study. Section 3 describes the operationalization of the study, and section 4 presents the data analysis. The concluding remarks are set forth in Section 5.

2 THEORETICAL BACKGROUND

Open Data (OD) is the one that is free for use, without copyright restrictions, available for anyone, and machine processable (Zhang, Hua & Yuan, 2018). Open Government Data (OGD) is the OD that comes from public sector (Saxena, 2017). Around the world, governments enable open data and create expectations to transform the data into social benefits, when data generate knowledge or ideas to create public value (Ruijer et al., 2017). OGD can improve open government (Yang & Wu, 2016) because data disclosure creates a set of public sector information useful for all stakeholders, including the government itself (Galiotou & Fragkou, 2013; Linders, 2013; O'Riain et al. 2012). The information obtained from OGD can produce knowledge or ideas to be used in initiatives aiming to increase public value, which can benefit all stakeholders (Lourenço, 2015).

The effective use of OGD depends on how data are disclosed and also the objective of using them (Attard et al., 2015). Transparency itself is not the only objective of OGD, which is relative to the data usefulness and demands strategic decisions before its disclosure (Dawes,

2010; Ball, 2009). The use of is a central challenge for all stakeholders (Ubaldi, 2013) and requires adequate knowledge and training (Gascó-Hernández et al., 2018; Sadiq & Indulska, 2017).

OGD usefulness can generate social and economic benefits for the entire society (Lee & Kwak, 2012). For governments, OGD has the potential to help them to identify failures and inconsistencies in public services (Dawes, Vidiasova & Parkhimovich, 2016). For that purpose, OGD is essential to public policies (Janssen, 2011) and for improving public services (Zuiderwijk, Janssen & Dwivedi, 2015). Navigation systems, financial services, or previsions of weather conditions, for instance, can be good examples of the use of OGD (Klein, Luciano & Macadar, 2015). The use of OGD contributes to democracy provided it contributes to more transparency, active citizenship, social control (Thorsby, Stowers, Wolslegel, & Tumbuan, 2017), and public administration improvements (Gascó-Hernández et al., 2018). This might redefine the role of government in society because it provides a new stage for social participation (Scholl, 2013).

Governments need to create conditions for possible use of the data, for example, in decision-making processes (Zuiderwijk, Janssen, Kaa, & Poulis, 2016; Graves & Hendler, 2014). It has the potential to generate public value with more information and knowledge about the social environment. Governments produce OGD, and the effective use of that can create value for society (Attard et al., 2015; Linders, 2013). The opening of government data is increasing the generation of new ideas, transforming society and contributing to its development (Attard et al., 2015). Although the primary function of government is not to generate data for multiple stakeholders, this data consequently improves the government managerial practices (Vieira & Alvaro, 2018). Rarely, however, the research about OGD demonstrates the use of data in improving public services (Gascó-Hernández et al., 2018; Smith & Sandberg, 2018). However, the OGD is available for the government, private sector, or citizens (Jetzek, Avital & Bjorn-Andersen, 2014), and evidences in the literature of open data use by the government are limited.

The use of OGD for the government can produce social benefits such as improving cities' smartness, which benefits the whole society (Pereira et al., 2017). The growing body of research on OGD in the last few years demonstrates the importance of open government data disclosure for stakeholders. Government will not be a simple provider of open government data. The government can use the data to improve public policies, decision-making, public services, or even the evident lack of knowledge found in the literature.

3 RESEARCH METHOD

A systematic review of literature was performed in order to examine the role of government in past investigations. Two distinct roles were found, namely OGD provider and OGD user, which were the focus of this research. Two main phases were carried out, namely systematic literature review and case study. These phases turn possibly to approach the theoretical research gap, primarily because of the reasons mentioned in the introduction (government is a primary generator of public value).

The systematic literature review was carried out as a way to identify what has been researched on government as an OGD user. Papers' timelines, main journals, authors, countries prominent in the literature, and most cited articles were identified. The search and analysis of articles was executed in five steps between September and December of 2018:

a) Search of papers on Scopus (90 articles), Web of Science, Science Direct, and Scielo, using the keywords "open government data" and "users" – 132 papers complied with the aforementioned criteria, with 90, 26, 13, and 3 papers respectively for each database;

b) Removal of 35 duplicate articles;

c) Preliminary analysis: verification of the alignment of the papers with the subject of this research - 94 articles out of 97 mentioned government as a user or provider of OGD);
d) Selection of evidences (excerpts from text) related to the role of government;
e) Evidence analysis, aiming to show evidence of government as an OCD, using categorical content analysis;
f) Theoretical discussion about the role of government and development of propositions for future studies. Not all articles were cited in the paper (a full list can be obtained from authors). Examples from papers were selected in order to achieve the paper's objective and to integrate the theoretical discussion.
The case study was performed at the Government Agency for Law Enforcement and Prosecution of Crimes of one of the Brazilian states. Five key-informants were interviewed in February of 2019. Document analysis was also used as a way to understand the data used as a source for some data in reports. Non-participant observation was performed through the participation in some meetings of groups of prosecutors related to some investigations. Preliminary data were analyzed through content analysis, with a posteriori categorization. This technique consists of a qualitative content analysis approach followed by three necessary steps: extraction of a set of codes from the interviews and documents, code grouping to generate categories and interpretation of the set of categories. The next section presents the results of data collection and analysis.

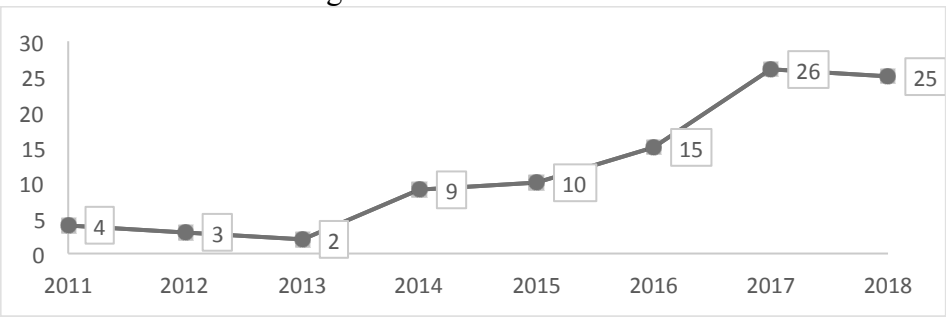
4 RESULTS AND DISCUSSION

This section is organized to demonstrate the evidences and discuss the role of government in the OGD ecosystem. First, the government's potential role as OGD user was evidenced in the literature by the bibliometric analysis and the examination of the evidences from the literature (4.1). The second step discussed studies when government is an OGD user (4.2). Third, possible reasons for lack of knowledge about government as an OGD user found in the literature generated insights for future propositions (4.3). Finally, a report of a case study brings evidence of a government agency, which uses OGD. It is also necessary to understand why in the investigation the role of government is predominantly that of a provider of open data (4.4).

4.1 Bibliometric analysis

The first step of the systematic literature review was a bibliometric analysis, as a way to obtain a broad view about the growth of research, main cited articles, journals, authors, and countries of origins of that research. This data collection is illustrated with figures and tables to make clear the data, making visible the evolution of studies. Figure 1 shows the articles' timeline.

Figure 1: Articles' timeline



OGD is a recent phenomenon in the literature and is the number of articles is increasing in central scientific databases. The theoretical foundation dates back to 2009, and studies about

the government as a user of OGD started only in 2011, even when considering that the studies in this year do not present field studies. The major part of the literature between 2011 and 2018 considers government as a potential user of OGD. However, only in 2017 was an empirical investigation founded (Pereira et al., 2017; Zhu, 2017). One article in 2018 (out of 25) studied cases of government as an OGD user (Gascó-Hernández et al., 2018). Other articles cited the government as a potential user of OGD; however, they did not conduct a field study related to that. It is not a problem itself; it is just a fact that reveals some lack in the OGD approach. The main journals where OGD papers were published are available in Table 1.

Table 1 – Main Journals

Main Journals	**Articles**
1. Government Information Quarterly	17
2. Information Polity	6
3. Digital Policy, Regulation and Governance	5
4. Transforming Government: People, Process and Policy	4
5. Foresight	4
6. Journal of Organizational Computing and Electronic Commerce	3
7. Journal of Theoretical and Applied Electronic Commerce Research	3
8. IEEE Intelligent Systems	2
9. Information and Learning Science	2
10. International Journal of Electronic Government Research	2
11. Journal of Web Semantics	2
12. Procedia Computer Science	2

The journals listed in Table 1 represent the ones with at least two articles. Government Information Quarterly (GIQ) and Information Polity reveal general alignment with the subject, and GIQ stands out for the number of articles. The first journals that published field articles about government as an OGD user were Government Information Quarterly (Zhu, 2017) and Information Systems Frontiers (Pereira et al., 2017). That information can be used for researches in future investigations to choose journals aligned with the subject. Another issue is the opportunity that those journals organize a special issue as a way to stimulate the subject and help the consistency of inquiries with a new discovery in many scenarios.
Figure 2 demonstrates the next step in the bibliometric analysis related to the main authors.

Figure 2 – Main Authors

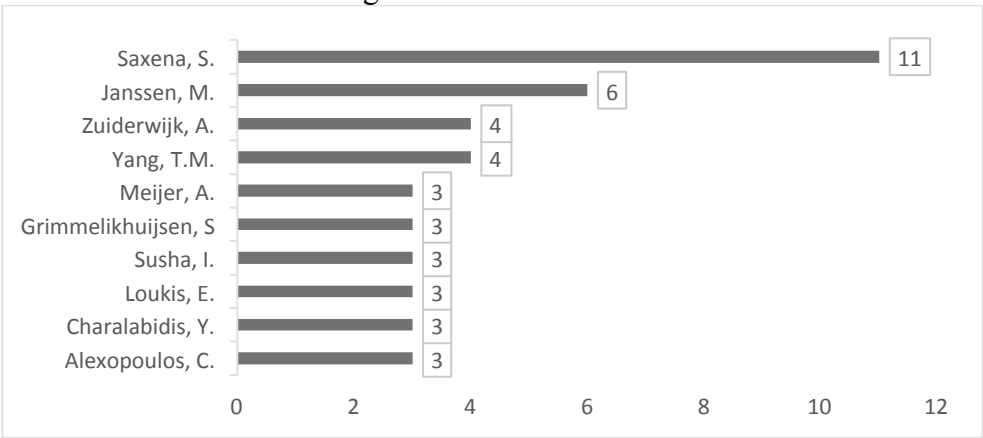


Figure 2 shows a set of specialists around the globe on the subject. The data reveal prominent authors that are contributing to the open government data ecosystem.
The next analysis covers issues related to the concentration of authors and their universities' home countries in which the authors are working (Figure 3).

Figure 3 – Countries when authors with more than two articles work

Taking into account the concentration of the main research publications by a small group of authors, it is expected that a small group of countries host these authors. Figure 3 illustrates a similar concentration of countries that hosted the authors and the context of investigations. That distribution expresses a concentration of works on Europe, USA, and BRICs. However, many governments around the world open the data (OECD, 2019), so why is the literature so concentrated? Many reasons can explain that question as lack of research interest, lack of development of OGD ecosystem in many countries, or the low maturity of the sub-field of OGD used by governments. None of the explanations is however adequately proved empirically and may represent some challenge to the research field. The investigation is incipient, and a conjoint work of universities and governmental agencies is necessary as a way to amplify the research in this field. The subject is new and can be a reason of an undesirable concentration. It is therefore essential to explore new contexts and discover new variables to construct a general theory about OGD. Table 2 illustrates the most cited articles.

Table 2 – Most cited articles

Title/Authors	**Citations**
Linked open government data: Lessons from data.gov.uk (Shadbolt N. et al., 2012)	113
TWC LOGD: A portal for linked open government data ecosystems (Ding L. et al., 2011)	92
A classification scheme for open government data: Towards linking decentralized data (Kalampokis E., Tambouris E. e Tarabanis K., 2011)	63
Acceptance and use predictors of open data technologies: Drawing upon the unified theory of acceptance and use of technology. (Zuiderwijk A., Janssen M. e Dwivedi Y.K., 2015)	57
Planning and designing open government data programs: An ecosystem approach (Dawes S.S., Vidiasova L., Parkhimovich O., 2016)	55
The multiple meanings of open government data: Understanding different stakeholders and their perspectives.	53

(Gonzalez-Zapata F., Heeks R., 2015)	
Data-driven innovation through open government data. (Jetzek T., Avital M. & Bjorn-Andersen N., 2014)	40
Organizational measures to stimulate user engagement with open data (Susha I., Grönlund Å. e Janssen M., 2015)	34
State-of-the-art in open data research: Insights from existing literature and a research agenda. (Hossain M.A., Dwivedi Y.K. e Rana N.P., 2016)	33
Adoption of open government data among government agencies (Wang H.-J. e Lo J., 2016)	30

The purpose of this step is to highlight the main cited articles. These papers are important to guide future researchers to know what the baseline literature is and then inspire other investigators to follow the challenges of a new research subject. That information reveals specific research interest on related themes, such as: linked open government data (Shadbolt et al., 2012; Ding L. et al., 2011); classification of OGD (Kalampokis, Tambouris & Tarabanis, 2011); acceptance and adoption of OGD (Wang & Lo, 2016; Zuiderwijk, Janssen & Dwivedi 2015); planning and designing of OGD (Dawes, Vidiasova & Parkhimovich, 2016); stakeholders of OGD (Gonzalez-Zapata F., Heeks R., 2015); innovation with OGD (Jetzek, Avital & Bjorn-Andersen, 2014); user engagement with open data (Susha, Grönlund & Janssen 2015); and research agenda of OGD (Hossain, Dwivedi & Rana, 2016). The OGD main subjects illustrate a set of possibilities for future investigations.

4.2 Some thoughts about government as an OGD user

The literature recognizes the government as a potential OGD user. Table 3 highlights citations that corroborate this statement. However, just a few studies found between 2009 and 2018 really address it. Those articles mentioned that the primary users of OGD are citizens (67), private organizations (39), researches (18), government (15), journalists (15), IT developers (15), non-specific audience (14), activists (10), and in-governmental organizations (10). Just 25 out of 203 (or 12%) mentioned users related to government. This demonstrates the incipiency of research about government as an OGD user, and a critical issue emerges: do the governments possess the necessary skills, techniques, technical resources, and expertise to use OGD? It is not a simple answer, and some possibilities to address this issue are discussed.

Table 3 – Government as a potential user of OGD

"An effective LOGD [linked open government data] ecosystem serves a wide range of users including government employees who curate raw government data, developers who build applications consuming government data, and informed citizens who view visualizations and analytical results from government data (Ding et al., 2011, p. 2)".
“Apart from data consumers within government organizations, we distinguish two types of users with a special interest in such data sets: on the one hand, professionals including data journalists and employees of (non-government) organizations, and on the other hand interested citizens (Heise & Naumann, 2012, p. 1)".
“The significant growth in number and size of open government data catalogs since 2009 has been made possible by the emergence of an open government data ecosystem consisting of policymakers, agencies (as providers and consumers), data experts, independent software developers and service providers, academia, and citizen stakeholders (Erickson et al., 2013, p. 1)".
“Open Government Data (OGD) has brought a remarkable set of opportunities and challenges

to many stakeholders. Among these stakeholders, it is possible to include journalists, researchers, scientists, and government employees. In general, we can classify as stakeholder any person interested in using data provided by governments to accomplish a task (Graves & Hendler, 2014, p. 1)".
“Governments around the world have become active participants in this evolution, opening up their data for access and re-use by public and private agents alike (Jetzek, Avital e Bjorn-Andersen, 2014, p. 1)".
"The make-up of the government data user community is equally as diverse (Léveillé & Timms, 2015, p. 7)".
“Two groups of users were involved in the evaluation: internal target groups (employees and heads of department in the City of Vienna’s public administration departments) and external stakeholders (citizens, business representatives, science and research journalists) (Parycek, Höcht & Ginner**,** 2014, p. 1)".
“While consistent with law and policy, each government agency should disclose the information that it possesses in such forms that the public is able to access and use (Yang, Lo & Shiang, 2015, p. 2)".

The citations of Table 3 reveal which government is a potential user of OGD. Notwithstanding that, the investigations do not mention a practical or empirical analysis that demonstrates government using open data to improve public services or obtain efficacy (Léveillé & Timms, 2015; Jetzek, Avital & Bjorn-Andersen, 2014; Erickson et al., 2013; Ding et al., 2011). The immaturity of the OGD ecosystem (Erickson et al., 2013) justifies the incipience of studies at that moment. It is corroborated by Graves & Hendler, 2014), which addressed which the application of OGD as an "uncharted territory" because of the lack of knowledge of the effective use of OGD for all stakeholders - especially the government.

4.3 Government as an OGD user

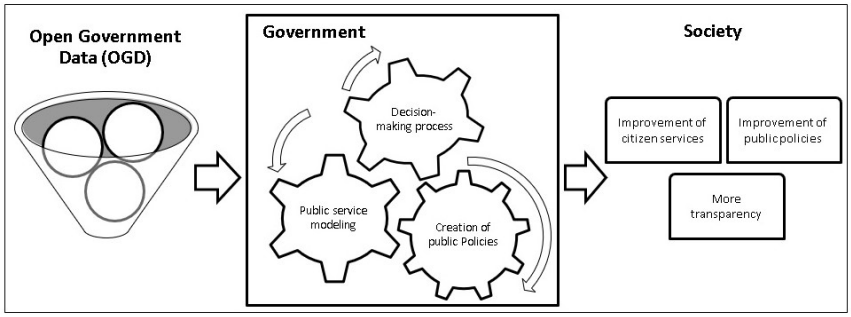
The research about the use of open data by the government is incipient (Smith & Sandberg, 2018), and only recently (in 2017) an investigation in the public sector was found. Zhu (2017) analysed the case of a justice department, with jurisprudence and other legal documents in the USA was analyzed. Other two recent studies investigated the use of OGD in smart cities’ context (Pereira et al. 2017, p. 8) found practical implications for use of OGD in smart cities: "Technology has dramatically altered the way government and citizens relate; help in daily activities; and increase transparency, participation, and collaboration." Vieira and Alvaro (2018) developed an experimental platform using OGD to gain productivity for development of solutions for smart cities.

Theory mentioned a set of resources or activities necessary to the use of OGD, transforming OGD in actions, and measurable results to create public value: technical knowledge (Gascó-Hernández et al., 2018; Graves & Hendler, 2014), motivation of public employees, abilities to transform open data in useful information (Gascó-Hernández et al., 2018; Sadiq & Indulska, 2017; Jetzek, Avital & Bjorn-Andersen, 2014), strategies, and strong policies directed to the use of OGD by government, promotion to use of OGD by government agencies (Hermanto, Solimun, Fernandes, Wahyono, & Zulkarnain, 2018; Zuiderwijk et al., 2018; Hellberg & Hedström, 2015; Susha, Grönlund & Janssen, 2015; Léveillé & Timms, 2015), long-range plans (Kaschesky & Selmi, 2014), change the organizational cultures of public sector (Yang, Lo & Shiang, 2015), valuable platform design for users (Ruijer et al., 2017), user training (Gascó-Hernández et al., 2018; Parycek, Höcht & Ginner, 2014), and contextual factors (Zuiderwijk et al., 2016b).

Although there are many contributions, only one paper exemplifies the use of OGD by the government effectively. Gascó-Hernández et al. (2018) propose three dimensions in which

OGD will be used: Decision-making process, Public service modeling, and Creation of public policies (Figure 3 illustrated).

Figure 3 - Dimensions of the use of OGD by government



Source: Based on Gascó-Hernández et al. (2018)

Two main aspects improve the capacity of the use of OGD: knowledge about the existence of data, and training to acquire new skills. The article evidenced how the government could use OGD with specific training programs and motivation to use the data. It is a single empirical discovery that will be replicated in many scenarios, adapting the methodologies to specific contexts. That is the central contribution of this paper because they demonstrate a practical solution to improve the use of OGD when the public employees do not have adequate skills to meet this challenge. In another vision, it is possible to investigate new cases in which public employees do not have specific training or motivation after training, to elucidate if the training and motivation themselves are the only sources of effective use of OGD by the government.

The literature about the use of OGD by governments is surprisingly incipient. Governments are responsible for several public services, and OGD helps the improvement of these services (Zeleti, Ojo & Curry, 2016). Specific abilities are required to transform open data applicable information, and it is possible that government may be very little prepared for this development (Klein, Klein & Luciano, 2018; Elgendy & Elragal, 2016; Zuiderwijk, Janssen & Dwivedi, 2015). That explanation partially answers the question formulated above because scarce empirical discovery exists today. A new inquiry, therefore, emerges in regard to future studies: Are motivation and training critical to the use of OGD by the government? To contribute to this discussion, a preliminary data of the case study is presented in the next section.

4.4 Report of a case study

An in-progress case study is reported, illustrating the use of OGD by a governmental agency in Brazil (justice prosecutor). Key-informants were interviewed in February of 2019 to preliminarily understand how that governmental agency uses the data. The informants identified their positions: two public prosecutors of education area (lawyers), one public prosecutor of the criminal area (lawyer), one project coordinator (manager) and one strategic management coordinator (manager). Both public employees have worked in the institution for 15 years or more and are graduates.

The internal office that performs activities related to data analysis to support strategies and projects for the Government Agency for Law Enforcement and Prosecution of Crimes, based on the full knowledge of the institution, noted the need for more people within the organization to have at least the basics theoretical and practical knowledge of the use of open data. This finding was based on two different circumstances. The first one is the movement on private sector in investing significantly in data analysis and data science of internal or open

data, aiming the generating economic value. The second is that the Agency did not always have sufficient data to decide what prosecution processes should be opened, or even data supporting the operations during a prosecution. Several gaps have been identified, ranging from reading a chart to understanding a study based on that. Thus, along with the top management of the Agency, a basic training trail was designed for internal servers and prosecutors, ranging from basic to advanced use of data, in order to disseminate knowledge. The main objective is that in a few years the use of OGD from other agencies, governmental levels or branches becomes part of the institution's culture, as a way to increase public value to society.

The initiative to use the data identified by public employees (bottom-up) in a data analysis sector corroborates the intent. Some public training for using the data was developed. However, three employees started the use of data without training and two intertwined training and providing courses for their colleagues.

The source of data cited from interviews and identified on documents analysis contemplates areas such as education, environment, human rights, civil rights, and criminal rights. The data was extracted from many public providers in Brazil, namely: Rio Grande do Sul State Institute (FEE-RS), Brazilian Institute of Geography and Statistics (IBGE), National Healthcare Agency Data (DataSUS), National Institute for Educational Research (INEP), Rio Grande do Sul State Office of Public Security (SSP-RS), Superior Electoral Court (TSE), Atlas Brazil, Federation of Industries of Rio de Janeiro State (FIRJAN), Rio Grande do Sul State Accounting Courts (TCE-RS), SES-RS, Rio Grande do Sul State Traffic Authority). The motivation to use the OGD was to fundamentally improve public management and contribute to solving social problems. Interviewee mentioned that the data were used to create indicators such as accessibility and quality of public education, crime status, causes of unidentified social problems, social problem solving, social reality, and internal efficacy (new processes).

The results of the use of OGD reported by interviewees are related to their area and do not necessarily integrates the same project or initiative. Two public prosecutors from education area reported the identification of lack of vacancies in school and school evasion. Projects and public actions were developed to mitigate the problems identified in education. A public prosecutor of the criminal area described improving the quality of policial information to support criminal proceedings. The project coordinator of the institution mentioned social problem identification using the OGD and projects developed based on the information of OGD. The strategic management coordinator referred to better quality in internal processes to optimize institution management.

The practical results or benefits of these actions and projects to society are not possible to determine at the moment, and the five interviewed people recognize this fragility. It is not simple to measure because multiple factors take place, and indicators that demonstrate useful results are not available. The impacts of actions and projects in the institution will be analyzed in future data collection.

The preliminary result of the case study identifies the strategic use of OGD by a public institution and evidences the use of data to qualify management and to pay attention to social problems. In part, the studies of Gascó-Hernández et al. (2018) and Graves & Hendler (2014) corroborate these results. Technical knowledge, the motivation of public employees and their abilities to transform open data in useful information were discussed during in the interviews. Decision-making process and public service modeling, as cited by Gascó-Hernández et al. (2018), were the targets of the projects developed by the interviewees. Other aspects demonstrated were the use of OGD without specific training, a bottom-up initiative to use OGD, and the existence of data analysis sector. That aspect involves issues to be investigated in many contexts in order for a new direction to theory and practice in the use of OGD to emerge.

5 FINAL REMARKS

This research demonstrates the role of government in the literature about the open government data ecosystem as a provider, and rarely has the literature analyzed government as a user of OGD. It is not clear why the investigations contemplate less the government as a user of OGD. The explanation from the literature is not complete, because the literature does not converge. The literature recognizes the possibility of government as a user of OGD, but nevertheless, most empirical investigations do not study the role of government as a user of OGD.

This preliminary research founded a case in Brazil that evidenced the use of OGD without training and initiated from self-motivated public employees. Contributing to this evidence are the scarce empirical investigations, which do not rebound the possibility of the existence of several similar cases around the globe.

The main suggestion for further studies is to broad the view about the use of OGD, contemplating public organizations. It will be observed for the origins of initiatives, the actors involved, type of actions or projects, and the challenge of measuring the social and internal impacts of actions. Other case studies might be developed in the Brazilian scenario as a way to understand the role of cultural and political barriers on the use of OGD as part of the daily routine. Cooperation is not the standard in Brazilian government and public organizations, especially when it evolves different branches. Considering the autonomy that characterizes the Brazilian government structure, sometimes it is wrongly used to act as each office is the owner of data, not the whole government or citizens. Based on this scenario, aspects such as sociocultural aspects of the use of open data need to be approached, addressing issues related to social and cultural barriers that prevent the use of data by governments. It also important to discuss technical issues related to usability and interface regarding the ways in which open data are disclose also need to be considered, as well as its impact on non-technical decision-makers in public organizations

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