Electronic Government and Electronic Participation
E. Tambouris et al. (Eds.)

doi:10.3233/978-1-61499-570-8-91

Delivery of Public Value to Multiple Stakeholders through Open Government Data Platforms

Gabriela Viale PEREIRA [a,1], Marie Anne MACADAR [a] and Maurício Gregianin TESTA [a]
[a] *Pontifical Catholic University of Rio Grande do Sul*

Abstract. Governments around the world are trying to realize the benefits of technology to make a real difference in people's lives. The use of data provided by open government data platforms has a great potential to enable new services, improve the lives of citizens and make government and society work better. This research proposes a conceptual model to explain how open government data platforms are used to enhance the access to and delivery of government information and services in order to make a real difference in people's lives. This study explores and illustrates the model by taking the perspective that Open Government Data (OGD), as a platform, influences the way city agencies are delivering information and services to increase feedback for stakeholders, including citizens, government agencies and employees. To analyze the impact on citizen's lives, government agencies and employees we used the public value perspective that can helps to determine the value of government activities from multiple stakeholders' perspectives. Specifically, this working paper presents preliminary results of our analyzes from the NYC Open Data portal. We aimed to understand how citizens, employees and other agencies are using OGD to improve their activities, the impact of that and unintended consequences.

Keywords. Open Government Data, e-government, Public Value.

1. Introduction

In the last decades the use of information and communication technologies (ICT) has made significant advances into diverse aspects of social life [1]. The application of ICT to government – or electronic government – has been considered a driver of social, economic, political and developmental changes such as government administrative reform, social transformation, organizational change and economic growth [1, 2]. However, the impacts and results associated with electronic government projects, including the organizational transformation capacity, are still not clear and well known [1].

The use of ICT in government is an innovative way for governments to offer rich opportunities for governments that significantly improve the delivery of services and to interact more openly with the stakeholders [3, 4, 1]. E-government can be defined as the transfer of government information and services among governments, their customers and suppliers [5].

[1] Corresponding Author.

Future research in this area might make the connection between e-government and the traditional concerns of public administration [5] including the improvement of citizen's lives.

One important way to improve the quality of services that governments provide to business and citizens is by a customer-orientation [6]. This focus on customer/citizens-orientation are shared by many researches to analyze user perceptions of e-government projects and intentions of use or expectations [7, 8, 9] or to focus on the relationship between the e-government stakeholders [1] and the coordination and connectivity between them [7, 10]. However, it's not clear how governments interact with the stakeholders to provide services and information that fits with what people really want. Helbig et al. [6] emphasizes the lack of attention on citizens' needs and questions if users actually want, or could they use, what government were given.

New technologies are making it possible to use data generated by public organizations and build services that automatically answer questions related to public administration issues. In this case, despite the fact that data required is not always available in a form which is easy to use, it has a great potential to enable new services, to improve the lives of citizens and to make government and society work better [11].

Considering the latest trends in technology (cloud computing, big data, mobile), future referrals in federal governments should embrace a digital strategy that comprises the opportunity to innovate more with less, and enables stakeholders to better leverage government data to improve the quality of services [12, 11]. Governments around the world are trying to realize benefits of technology to make a real difference in people's lives. The use of data provided by open government data platforms have a great potential to enable new services, improve the lives of citizens and make government and society work better. Government as platform is a model that democratizes the real time exchange of information and services, allowing people to use information to make important personal decisions, but also is increasing the quality of weather forecasts, transit information, and health alerts which are all generated from government data that further improve people's quality of life [13].

Open data is a way to mend the common separation between government and users, and is helping public organizations act as an open system that interacts with its environment [14]. However, due to the early stage of Open Government Data (OGD) initiatives, their impact and ramifications are still debated in professional and academic circles [15]. Existing research enrolls public value through open government and emphasizes the necessity of an analysis of government activities from multiple stakeholder perspectives [16], the public value resulted from e-government initiatives [17] and the generation of value from OGD initiatives [15, 18]. However, is not clear how government agencies are using OGD to increase the delivery of government information and services to other stakeholders; the feedback of this process; or the overall impact of it.

This paper addresses the following question: To what extent Open Government Data are helping governments' agencies to enhance the delivery of public value to multiple stakeholders? Therefore, this article aims to develop a conceptual model including a stakeholders' perspective of OGD in aspects such as application, contribution and impact of government information and services. To explore and illustrate it this study takes the perspective that OGD influences how cities agencies are delivering information and services and increasing the feedback for the stakeholders, including citizens, government agencies and employees. To analyze the impact on citizen's lives and on government agencies and employees we take the public value perspective which can help to determine the value of government activities from multiple stakeholders' perspectives [16].

This study partially addresses the gap suggested by Helbig et al. [6] who criticizes the lack of attention on citizen's needs. We argue that citizens are getting involved in

the processes of the government and are creating value for both. Additionally, we analyze how agencies interact with each other and they are using OGD to increase their own processes, as predicted by Goldsmith and Crawford [19]. To achieve this goal, we present preliminary results, based on our propositions and conceptual model, by analyzing the use of predictive policing in the New York Police Department (NYPD) and the New York City (NYC) Open Data Portal.

2. Open Government Data

Moving beyond the application of ICT to government, the Digital Government Strategy has a new key priority area in terms of the use of technology to better serve citizens by innovating ways to deliver better digital services using fewer resources [12]. Open Government Data is related to one of the problems that the Digital Government Strategy sets out to address--unlocking data and improve the quality of services for the people [12]. This means that the government seeks to enable the public, entrepreneurs, and their own government programs to better leverage the richness of federal data through inputs into applications and services by ensuring that data is open and machine-readable by default.

The open data movement has a principle that data should be available to all who have a use for the information and can be accessed and re-used for any purpose [19, 11]. Open data is defined by the Open Definition as "any data and content that can be freely used, modified, and shared by anyone for any purpose" (http://opendefinition.org). It means that open data must be available and accessible, must permit re-use and redistribution and allow universal participation, i.e. everyone can use open data without discrimination by fields, persons or groups [11].

Proponents of Open Government Data believe that the new role of the public sector as an information provider will strengthen democracy and improve the impacts of government work through increased transparency, participation and collaboration [15]. The principles of Open Government are: Efficiency – obtaining increased outputs or goal attainment with the same resources or with lower resource consumption; Effectiveness – increasing the quality of the desired outcome; Intrinsic enhancements – changing the environment or circumstances of a stakeholder in ways that are valued for their own sake; Transparency – access to information about the actions of government officials or operation of government programs that enhances accountability or influence on government; Participation – frequency and intensity of direct involvement in decision making about or operation of government programs or in selection of or actions of officials; and Collaboration – frequency or duration of activities in which more than one set of stakeholders share responsibility or authority for decisions about operation, policies, or actions of government [16].

Some of the areas where open government data is creating value include: transparency and democratic control, participation, self-empowerment, improved or new private products and services, innovation, improved efficiency of government services, improved effectiveness of government services, impact measurement of policies and new knowledge from combined data sources and patterns in large data volumes [11].

3. Conceptual Model and Discussion

To achieve the paper's objective, we have created a conceptual model that shows the relationship between OGP, e-government and its impact in citizens and other govern-

ment agencies. The Figure 1 illustrates the logic of our proposal, based on several different concepts.

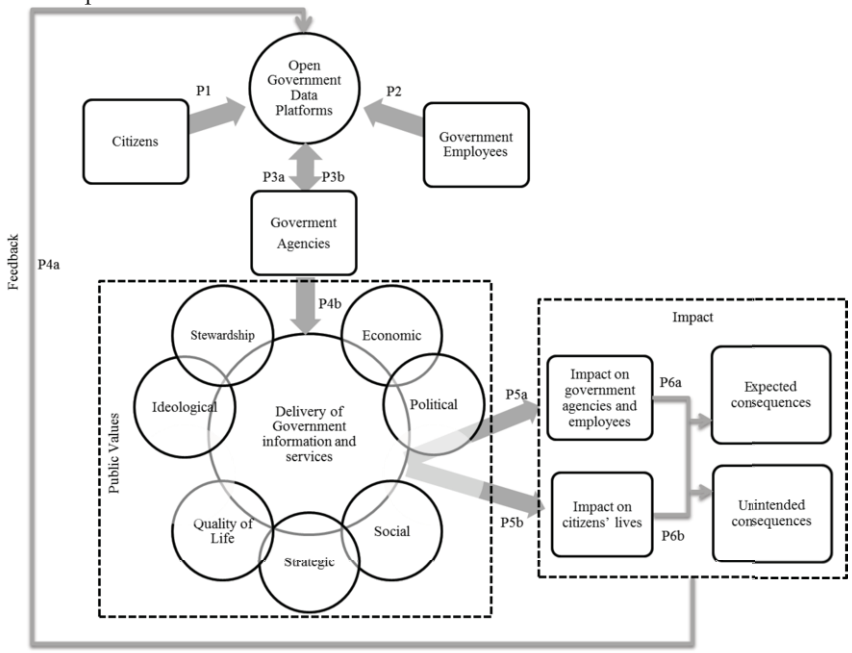

Figure 1. Conceptual model.

3.1. Open Government Data

With an analysis of the supply and demand side of e-government, we can examine the phenomena in terms of open government data initiatives. The supply side of e-government focuses on initiatives that create electronic services (like open government data platforms) and opportunities for participation from citizens, businesses and other stakeholders (government agencies or employees, for example). The demand side includes how people are using these services or other ICT to their advantage within society [6]. In the same way, citizens' demand for information and the role of government responsiveness are considered drivers of open data and represent the demand and supply side of OGD initiatives [20]. Rowley [21] brings the notion of stakeholder benefits and looks at them as consumer-side to try to understand their objectives and interests from e-government. In this way, it is possible to focus more directly on what stakeholders want from an e-government service, allowing governments to compare and integrate the perspectives of all stakeholders.

"Across the globe, people are uniting in a common struggle: to participate freely in the events and processes that shape their lives" [Mahbub ul Haq apud 22]. Open data platforms make it possible for people to get involved in the processes of the government and create value for both [20]. As more information is provided through OGD platforms, citizens will find information about government activities more easily and complain and communicate their opinion, representing an increase in their interest in actively participate in the government process. Thereby, **Proposition 1**: *Citizens are being engaged in the provision of services and getting involved in the processes of government through open government data.*

Digital solutions give city leaders the opportunity to empower government employees to promote better lives for citizens [19]. Departments that use predictive policing, for example, not only enable more efficient management of resources and manpower, but also empower street-level agents to make the best possible decisions. Also, OGD platforms can be used as a tool to search for relevant data, detect relationships, and analyzing millions of lines of data in real-time. This capability helps leaders address many urban challenges and make smarter and earlier decisions. Thereby, **Proposition 2**: *Government employees are working toward better lives for citizens through open government data.*

Local, national and international public and private organizations are publishing their data in open data infrastructures, resulting in OGD [23]. The other opportunities for city leaders through digital solutions are that they can engage with citizens in the provision of services and enable citizens to work with local government on shared solutions [19]. **Proposition 3a**: *Government Agencies are promoting public use of city data through open government data.*

Government responsiveness is the extent to which the government responds to issues raised by citizens [20]. Citizens with diverse social and economic background possess different needs and they pressure their government in distinct ways for new e-government services. Such demands must be controlled by governments to continually improve their services to satisfy all kinds of citizens' needs [24]. Also, the OGD platforms can help governments learn from the experiences of other agencies and city governments in their attempts to improve the way in which governments can deliver better services [4]. Thereby, **Proposition 3b**: *Government Agencies are using open government data to respond to the issues raised by the citizens and to learn from other government agencies and employees.*

3.2. Delivery of Government information and services

"OGD advocates argue that it enables greater government efficiency through an information infrastructure that allows for better data re-use within the public sectors and inter-agency coordination" [15, p.2]. Considering digital government as a system, coordination and connectivity are characteristics which evolve the ways agents in a system connect and relate to each another, forming patterns from the interactions and connections [10, 7]. The same relation can be applied to analyse the relationship between the stakeholders in e-government initiatives and how they interact through OGD. Also, considering that there is often a gap between what government officials initiate, what they expect, and what is really delivered to the citizens, government officials need external and objective feedback on their e-government efforts and effects [24].

"Public value focuses attention on the collective and societal interests that are served by particular institutional arrangements and actions by government" [16, p.2]. The seven types of value that capture the range of possible results of government actions are: economic, political, social, strategic, quality of life, ideological, stewardship. Thereby, **Proposition 4**: *Government Agencies are using open government data to enhance a) the access to (feedback) and b) the delivery of Government information and services to the citizens, other agencies, and other Government entities (Public value).*

3.3. Results of the Delivery of Government information and services through OGD

One of the factors for the success of e-government initiatives is the coordination and integration of inter-governmental agencies at all levels, and that roles, processes and policies

are reflected in systems and in the interaction of government with stakeholders [7]. If solutions in terms of e-government are investigated by looking at the context-use-access perspective, it is possible eliminate the unintended consequences of narrowly defining the problem [6]. Technology has dramatically altered the way in which government and citizens relate. Information flow has increased in terms of speed and capacity between the two entities and the expanded use of database and web technologies has changed the horizontal and vertical integration of government and citizens [25]. Thereby, **Proposition 5**: *The more Government Agencies use open government data as inputs to Delivery Government information and services, a) the greater the results on the way that government agencies and employees work (government-to-government/employees); and b) the greater the results on citizens' lives (government-to-citizens).*

3.4. Expected and unintended consequences

The changes faced by governments as a result of the digital revolution may result in a number of possible negative effects, such as information misuse, information inequity, and privacy violations, all enabled by the increasing use of advanced information technologies [25]. Regardless of the change of focus in e-government efforts, the e-government phenomenon can also present some pitfalls which should be known by the public, such the incompatibility between a security-oriented perception of e-government and at least three of the original founding principles of the e-government phenomenon:, open government, transparency and responsiveness [5].

Just two of the concerns regarding the topics of security and privacy consider the privacy impact of constantly increasing amounts of information available online and, consequently, the possibility of misuse of this information or in a security breach resulting in the loss of confidential data [25]. Because of the complexity involved with the publication and use of open data, is not easy to predict who, how and when users use open data [23]. Due to this uncertainty, some agencies avoid publishing open data to prevent unintended consequences of OGD. An especially prominent topic is the use of government databases to centralize medical and criminal records, in order to maintain data consistency and web technology to facilitate data transfer, but also presents issues such as safety, convenience, and security for citizens [25].

Finally, considering the knowledge citizens needs to have the ability to use this technology [7] and access to data might be limited, [10] OGD programs can further contribute to the digital divide. Thereby, **Proposition** 6: *The results on (a) the way that government agencies and employees work and (b) the results on citizens' lives from the use of open government data as inputs to Delivery Government information and services by Government Agencies may result in unintended consequences rather than the expected results.*

4. Research Strategy and preliminary results

This section aims to test the conceptual model previously proposed, based on e-government and OGD literature and secondary data based in city governments' agencies in United States; We collected secondary data from an open government data initiative in United States: The NYC Open Data Portal and we analyze how the NYPD are using to become more responsive.

New York City has a thriving data community and one of the strongest open data portals in the nation. "A comprehensive data strategy would build on past successes,

improve the city economic and social well-being, and help city government better meet the needs of its citizens" [26]. The Mayor's Office of Data Analytics (MODA) worked to provide insight to NYC leadership and agencies, to lead the City's expansion of the Open Data Portal, and to liaise with outside data organizations [27]. MODA continued to focus on its greatest legacy to NYC operations, DataBridge, the City's single repository of operational data, integrating the data in a way that makes it accessible to analysts across the City, as well as to the public through the Open Data portal [28].

4.1. Open Government Data

In NYC, new directions in terms of OGD will allow new employees to assume the processes of collection of data, service delivery portals and automated licensure processes to personalize and improve the quality of services [19]. In this case, the data are being used to solve problems nominated by the cities, helping other government employees to see the benefits of sharing what they know in digital formats, enhancing the data-drive solutions [19].

Mike Flowers as MODA's chief analytics officer and chief of open platform officer lead the effort on open data to make government data available to the people. But more than publishing open data for public use, his focus is especially in how these data can be used for internal government operations, considering that at the same time that data are being released to the public, is being released to sister agencies [19]. According to Flowers, to increase the platform and make it became more valuable, at some point agencies will have to feeding the platforms with its own data to be able to take advantage of the other agencies data [19].

4.2. Delivery of Government information and services

The NYPD is completely joining the open data movement, sharing data in more usable formats with city agencies and incorporating many other data streams to give partners more clarity concerning what's really going on in underreported crime-prone environments [19], i.e., delivering better services to the society. The use of analytic capacity crosswise agencies to solve big issues are increasing and making cities getting close to the ideal of responsive government [19].

This case clearly generates at least two public values: stewardship and quality of life. The first one enhances the public's view of government officials as faithful guardians of the value of the government in terms of public trust, integrity, and legitimacy because of the greater responsiveness of government [16]. The second one impacts individual and household health, security, satisfaction, and general well-being [16].

There are many ways that cities are using data to create a better city and delivery better services to the citizens, especially in NYC. According to The New York City [29], the MODA, the Department of Information Technology and Telecommunications (DOITT), and NYC Digital are working together to collect, analyze, and share NYC Data, to create a better City supported by data-based decision making, and to promote public use of City data. Among other things, they are collecting data to measure government performance, creating a comprehensive City-wide data platform that serves as a record of City activity, and a foundation for NYC Open Data and using the DataBridge platform to reduce safety risk in the City, deliver daily services more efficiently, and enforce laws more effectively.

New York City government, as a pioneer in OGD, has unlocked important public information, enabling technologists to build tools that help citizens in daily activities [30]. The idea is that NYC will further expand access to services, which will enable

innovation that improves the lives of New Yorkers, and, also, increase transparency and efficiency. Among the proposals previewed in the Roadmap for the digital city in 2011, is the development of the NYC Platform, an Open Government framework featuring APIs for City data, engaging and cultivating feedback from the developer community and introduce visualization tools that make data more accessible to the public. One example of that is this data visualization which displays vehicle collisions aggregated by time of day using recently released NYPD motor vehicle collision data, which, according to Mayor de Blasio, help to achieve the goal of eliminating traffic fatalities in New York City [29]. New directions in NYC include plans to expand the use of data in several areas, from policing to reduce traffic fatalities [19].

4.3. Results of the Delivery of Government information and services through OGD

The NYPD and other police departments around the world are embracing the use of data to, among other things, use maps to track crimes by neighborhoods [19]. The second step is apply predictive analytics (the use of past data to forecast future developments) to solve or prevent future urban issues. Also, the use of data-driving policing could help to deal with real-time concerns of crime or safety, make employees work smarter, allowing a better alignment between mission and resources, including community support in the fight with crime [19].

NYC Open Data makes the wealth of public data generated by various New York City agencies and other City organizations available for public use. This catalog offers access to a repository of government-produced, machine-readable data sets which anyone can use them to participate in and improve government by conducting research and analysis or creating applications, thereby gaining a better understanding of the services provided by City agencies and improving the lives of citizens and the way in which government serves them [29]. The Figure 2 summarizes the preliminary results of initially analyzes based on secondary data from this case study. In future studies, besides improving the data analyses we also intend to bring to light primarily data from stakeholders' interviews.

Figure 2. Preliminary results

Dimension	*Variable*	*Findings*	*Indicators*
Open Government Data	Citizens	As more information is provided through OGD citizens will find information about government activities more easily and complain and communicate their opinion, representing an increase in their interest in actively participate in the government process	Access to information Communication Participation
	Government Employees	Empower government employees to work seeking to promote a better live for citizens	Tool that help making smarter and earlier decisions
	Goverment Agencies	Local, national and international public and private organizations are publishing their data in open data infrastructures	Data can be used for internal government operations
Delivery of Government information and services	Use of OGD	Seven types of value that capture the range of possible results of government actions: economic, political, social, strategic, quality of life, ideological, stewardship	NYPD case resulted values: Stewardship Quality of life

Dimension	*Variable*	*Findings*	*Indicators*
	Feedback	Engaging and cultivating feedback from the developer community and introduce visualization tools that make data more accessible to the public	The NYPD is completely joining the open data movement, sharing data in more usable formats with city agencies
Results on government agencies and employees	Expected consequences	Are useful to help city governments to become more responsive Can be spread for cities around the world, allowing governments to learn from one another Can help to solve basic urban issues	Greater responsiveness of government Reduce safety risk in the city Deliver daily services more efficiently Enforce laws more effectively
	Unintended consequences	Misuse of data by government employees (privacy)	Capacity to use data with good judgment Preserve primary human values Maintain human dignity and autonomy
Results on citizens‘ lives	Expected consequences	Context-use-access perspective Technology has dramatically altered the way which government and citizens relate	Help in daily activities Increase: transparency, participation and Collaboration
	Unintended consequences	Misuse of data by citizens (criminals or terrorists)	Maintain human dignity and autonomy

Source. [19, 16, 29].

5. Concluding Remarks

The purpose of this exploratory study is to capture, describe, document and conceptualize the open government data phenomenon as well as explain how government are using OGD to enhance the access and delivery of information and services and impact on citizens' lives. Considering the emergent nature of the field, we start our study with the identification of definitions and relevant concepts and preliminary analysis of the case. Then, based on e-government and OGD literature we propose a conceptual model to understand how open government data platforms are being used to enhance the access to and delivery of government information and services in order to make a real difference in people’s lives. We analyze secondary data and show preliminary results, based on the NYC Open Data portal, to understand how citizens, employees and other agencies are using OGD to improve their activities. Also, we discuss some of the public values resulted from e-government projects, as well as unintended consequences of that, especially the misuse of data, considering that agencies does not know what people are doing with open data or can do in the future.

For future research we must explore deeply practical implications of the conceptual model. To that end, at the beginning, considering the richness of the case study, we will continue studying the case, specially including primary data from stakeholders by making deep interviews that could allow us understand in a global view the NYC Data portal and other city agencies. Also, we aim to analyze the conceptual model in different contexts, comprising cities around the world which presents innovative cases of OGD.

Acknowledgements

This research was supported in part by the CAPES Foundation, Ministry of Education of Brazil, Brasília – DF 70.040-020, Brazil (Process number 99999.014692/2013-09), as well as by a FAPERGS/CAPES scholarship and FAPERGS Edital 02/2014 PqG (Process number 2341-2551/14-3).

References

[1] Luna-Reyes, Luis Felipe, J. Ramon Gil-Garcia, and Georgina Romero. "Towards a multidimensional model for evaluating electronic government: Proposing a more comprehensive and integrative perspective." *Government Information Quarterly* **29.3** (2012): 324-334.

[2] Faik, Isam, and Geoff Walsham. "Modernisation through ICTs: towards a network ontology of technological change." *Information Systems Journal* **23.4** (2013): 351-370.

[3] Halchin, L. Elaine. "Electronic government: Government capability and terrorist resource." *Government Information Quarterly* **21.4** (2004): 406-419.

[4] Irani, Zahir, Peter ED Love, and Ali Montazemi. "E-government: past, present and future." *European Journal of Information Systems* **16.2** (2007): 103.

[5] Yildiz, Mete. "E-government research: Reviewing the literature, limitations, and ways forward." *Government Information Quarterly* **24.3** (2007): 646-665.

[6] Helbig, Natalie, J. Ramón Gil-García, and Enrico Ferro. "Understanding the complexity of electronic government: Implications from the digital divide literature." *Government Information Quarterly* **26.1** (2009): 89-97.

[7] Irani, Zahir, Tony Elliman, and Paul Jackson. "Electronic transformation of government in the UK: a research agenda." *European Journal of Information Systems* **16.4** (2007): 327-335.

[8] Gil-Garcia, J. Ramon, InduShobha Chengalur-Smith, and Peter Duchessi. "Collaborative e-Government: impediments and benefits of information-sharing projects in the public sector." *European Journal of Information Systems* **16.2** (2007): 121-133.

[9] Verdegem, Pieter, and Gino Verleye. "User-centered E-Government in practice: A comprehensive model for measuring user satisfaction." *Government Information Quarterly* **26.3** (2009): 487-497.

[10] Janssen, Marijn, Soon Ae Chun, and J. Ramon Gil-Garcia. "Building the next generation of digital government infrastructures." *Government Information Quarterly* **26.2** (2009): 233-237.

[11] Open Knowledge Foundation (OKF). *Open Data Handbook* version 1.0.0 (revised November 14, 2012), (2012). Available at http://opendatahandbook.org/pdf/OpenDataHandbook.pdf

[12] Digital Government. *Digital Government: Building A 21St Century Platform to Better Serve The American People*. (2012). Available in: https://www.whitehouse.gov/sites/default/files/omb/egov/digital-government/digital-government-strategy.pdf

[13] Hecth, B. *Big Data Gets Personal in U.S. Cities*. New Cities Foundation (2014).

[14] Janssen, Marijn, Yannis Charalabidis, and Anneke Zuiderwijk. "Benefits, adoption barriers and myths of open data and open government." *Information Systems Management* 29.4 (2012): 258-268.

[15] Jetzek, Thorhildur; Avital, Michel; and Bjørn-Andersen, Niels, "The Generative Mechanisms of Open Government Data" (2013). *ECIS 2013 Completed Research*. Paper 156.

[16] Harrison, T., Pardo, T., Cresswell, A., & Cook, M. *Delivering Public Value through Open Government*. Center for Technology in Government (2011).

[17] Grimsley, Mike, and Anthony Meehan. "e-Government information systems: Evaluation-led design for public value and client trust." *European Journal of Information Systems* 16.2 (2007): 134-148.

[18] Huntgeburth, Jan C. and Veit, Daniel J., "A Research Agenda For Evaluating Open Government Initiatives" (2013). *ECIS 2013 Completed Research*. Paper 112.

[19] Goldsmith, Stephen, and Susan Crawford. *The Responsive City: Engaging Communities Through Data-smart Governance*. John Wiley & Sons, 2014.

[20] Agrawal, Deepti, William Kettinger, and Chen Zhang. "The Openness Challenge: Why Some Cities Take It On and Others Don't." *Twentieth Americas Conference on Information Systems*, Savannah, 2014.

[21] Rowley, Jennifer. "e-Government stakeholders—Who are they and what do they want?." *International journal of Information management* 31.1 (2011): 53-62.

[22] UNDP. *The 2013 human development report*–"The rise of the south: human progress in a diverse world", (2013).

[23] Zuiderwijk, Anneke, et al. "Special Issue on Innovation through Open Data: Guest Editors' Introduction." *Journal of theoretical and applied electronic commerce research* 9.2 (2014): i-xiii.

[24] Huang, Zhenyu. "A comprehensive analysis of US counties'e-Government portals: development status and functionalities." *European Journal of Information Systems* 16.2 (2007): 149-164.

[25] Heinze, Nathan, and Qing Hu. "e-Government research: a review via the lens of structuration theory." *PACIS 2005 Proceedings* (2005): 75.

[26] Korte, T; Misra, J. *Big data can be a big help to city*. CRAIN'S, New York Business (2014). Available in: http://www.crainsnewyork.com/article/20140413/OPINION/140419954/-op-ed-big-data-can-be-a-big-help-to-city#article_tab.

[27] Goldsmith, S. *Digital Transformation*: Wiring the Responsive City. Civic Report 87, 2014.

[28] Bloomberg, M. R.; Flowers, M. *NYC by the Numbers. Annual Report – 2013*. NYC – Mayor's Office of Data Analytics, 2013.

[29] The City of New York (2014). *NYC Open Data Portal*. Available in: https://data.cityofnewyork.us/.

[30] The City of New York (2011). Road Map for the Digital City: Achieving New York City's Digital Future.