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A Socio-Technical Model for Open Government Data Research

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ABSTRACT

National and local governments around the world have been allowing access to administrative data to increase transparency, motivate civic engagement of citizens, and improve collaboration between the public and the government. This study reviews and classifies existing literature on open government data (OGD). To create a structure to organize the existing studies, the researchers devised a framework based on socio-technical theory and summarized the significance of studies along four major points: (1) readiness, (2) implementation, (3) emerging effects, and (4) actors of open data. Studies in OGD have been growing steadily in the recent years because of the rapid development of adoptable technologies that have enabled easier access to government data. Nonetheless, an examination of existing research not only shows a disparity in research and development of OGD across countries in the Open Government partnership program but also reveals pertinent issues that have arisen in different stages of the OGD initiative. The growing number of studies and expanding body of knowledge show the importance of organizing existing literature. This step is timely and significant to map out the current breadth and depth of OGD research. According to existing research, current open governments fall short in encouraging citizen participation and collaborations among citizens and the government. This study pointed out how studies on OGD actors might be the reason as well as the solution to existing findings. This paper aims to provide a framework for organizing OGD studies, present the status of OGD research, and provide recommendations on current gaps that must be addressed.

Keywords: Open Data, Open Government, E-Government, E-Governance, Transparency

Ⅰ. Open Government and Open Data

In 2009, a new wave of evolution brought about by technological, social, and demographic influences emerged through the so-called Open Government (OG) (Veljković et al., 2014). The Open Government movement was initiated by the United States of America through the Memorandum on Transparency and Open Government. The memorandum cited the

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establishment of a system of transparency, public participation, and collaboration between the government and its citizens to ensure public trust (The White House, 2009a). Shortly after, President Obama issued another Memorandum on the Freedom of Information Act. The said act is said to be the "most prominent expression of a profound national commitment to ensuring an open government" (The White House, 2009b). The path towards the creation of the opportunity for Open Government to develop included the construction of crucial legal platforms. Mcdermott (2010) the legal history that lead to the growth of open government, starting with "The Paperwork Reduction Act" in 1980 towards the 2010 memorandum "Information Collection under the Paperwork Reduction Act", in relation to the "E-government Act" issued 2001 to "The Freedom of Information Act". Moreover, the penetration of communication technologies in the public's lifestyle has made it possible for governments to put the new and innovative OG idea into practice (Parycek and Sachs, 2010).

The establishment of an effective open data initiative has become one of the highest priorities of governments to date (Linders, 2013). The emergence of Open Government Data (OGD) in 2009 is a consequential development of e-governance models aiming to harness the benefits of ICT (Pudjianto et al., 2011) while promoting transparency and collaborative economy. Since then, the potential annual value enabled by open data has grown to an estimated $3 trillion dollars across seven sectors (Mckinsey Global Institute, 2013). Moreover, the European Commission have estimated the direct market size of OGD, from 2016-2020, to be at € 325 billion for the 28 European member states and ETFA countries (Carrara et al., 2015). However, in order to realize these projected values, OGD initiatives should be steered in the right direction.

On this note, the success of open government data initiatives does not solely depend on the information technology available in building the OGD infrastructure but also on the social aspect involved. Social factors refer to the people in the government who enforce the initiatives, the intermediaries, and the citizens— who are expected to ultimately benefit from OGD. A closer look on the actors involved in open data might be able to shed light on current issues why certain policies and implementation plans do not work as expected.

Open data, in its broad sense, is defined as data that are freely accessible online, without any technical restrictions, available for re-use and provided under open access license, can be re-used without limitations for commercial and non-commercial purposes (Gray and Darbishire, 2011). On the other hand, Open Government Data refers to government data that is "data and information produced or commissioned by government or government controlled entities" that are published for use and re-use of private and public entities (Gray and Darbishire, 2011). The OECD definition of Open Data in the context of public and government data is, "information, including information products and services, generated, created, collected, processed, preserved, maintained, disseminated, or funded by or for government or public institutions" (Ritter, 2014).

International attention on open data is quite extensive. OGD has been recognized as a modern method of governance for its several abilities, such as; provide a new space of openness between government and the public (Parycek and Sachs, 2010), increase transparency (Bertot et al., 2010), increase citizen participation (Mcdermott, 2010). It has also been identified to be capable of increasing democratic accountability (Veenstra and Broek, 2013) and im-

proving government and non-government value-added services (Blakemore and Craglia, 2006; Neuroni et al., 2013; Zhang et al., 2005). On the economic side, open data has been considered as a valuable and powerful resource for business innovation (Cruz and Lee, 2015). Researchers have studied the power of open data combined with social media engagement (Lee and Kwak, 2012) and the collaboration between private and public sectors to develop new business models (Janssen and Zuiderwijk, 2014). A number of countries across the globe, such as the United States, United Kingdom, Australia, have lead the way in facilitating immediate and effective collaboration between government and its citizens (Lee et al., 2005).

However, implementing countries, especially developing countries, encounter barriers in succeeding in their own open data initiatives. This is because publishing open data is complex and involves consistent political commitment. Moreover, it also requires appropriate organizational structures and proper resources, and technical competence in government organizations (Janssen et al., 2012). Open data initiatives usually come in the form of government portals and electronic systems. These are used to publish basic information, create, and follow-up specific requests between government departments and between the government and its citizens. Moreover, current trends on open government data encourage information sharing of open standards and machine-readable formats for the utilization of published data in creating public value. However, this paper shows that OG is more than web publishing of government data.

Currently, published research, case studies, and reports on open data initiatives globally can be classified into these four broad groups: open data readiness assessments, implementation studies, and impacts studies (Davies, 2013; Davies et al., 2013; Iglesias and Robinson, 2015), and actors studies. Despite the growing number of literature in the area of open government data, a comprehensive metadata study that organizes available literature into a clear framework is still non-existent. This paper serves to augment that deficiency by presenting the status of open government data research using a solid framework.

The primary purpose of this study is to provide a structure of research to frame the current knowledge on OGD using the socio-technical perspective. This is significant because despite the topic being one of the priorities of governments today, a comprehensive resource organizing what has been investigated so far is still non-existent. This paper aims to present the status of open government data literature available in the academic, government, and social (NGOs and advocates) sectors. These studies are then classified into four approaches namely: readiness, implementation, impacts, and actors. The socio-technical theory is used to provide a frame of inquiry to present the contribution offered by each article in the development of a comprehensive body of literature on OGD research accurately. To add to that, the socio-technical theory clearly highlights how OGD initiatives are composed of interactions between humans, machines, and their environment.

An exploration of existing literature and their underlying themes in OGD research can serve to extend the body of knowledge in the field because insights from the past can provide specific directions to future studies in the said area. Moreover, this study can assist experts and other scholars in investigating whether the goals of open data - to achieve transparency, participation, and collaboration are being achieved. Lastly, a solid framework classifying existing literature can guide scholars in identifying current gaps and issues in research and address them.

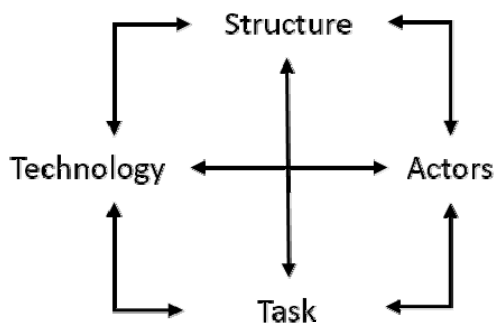
Addressing gaps in existing research will provide governments the right insights to steer OGD initiatives towards effectively harnessing the potential value enabled by open data.

By classifying the existing knowledge on open government data research, we found out how the gaps in OGD research not only vary between developing and developed countries but also within different sectors in the respective countries. The framework shows how classifying readiness, implementation, impacts, and actors studies presented an organized way of looking at current literature and revealed the different complex issues under these topic areas.

Ⅱ. Research Framework and Methodology

The socio-technical theory systems research came from the early studies of the disruptive influence of new technology in coal mining and weaving mills (Rice, 1958; Trist et al., 1963). Today, socio-technical systems research emphasizes the interaction of two important parts of the organization – the social network and the technological network. The field of socio-technical systems is highly multidisciplinary. The definition most in line with the information communications technology (ICT) field is "systems that involve a complex interaction between humans, machines, and the environmental aspects of the work system"(Baxter and Sommerville, 2011). Furthermore, Lee (2001) emphasized that what sets research in the information systems field apart from other disciplines is that it must examine the socio-technical phenomena that emerges when social systems and technological systems interact. This aspect is significant to our study because we are emphasizing how OGD initiatives are composed of interactions between governments, government policies, ICT infrastructures, and the society. Today, socio-technical systems theory is being used to support user-centered designs and implementations.

Sawyer and Jarrahi (2013) introduced three socio-technical premises relative to the study of information systems (IS): "(1) the mutual constitution of people and digital technologies; (2) the contextual embeddedness of this mutuality; and (3) the importance of collective action." To further illustrate the interaction between humans and technology, Leavitt's socio-technical model (<Figure 1>) views organizational systems as multivariate systems of four interacting and aligned components, namely – task, structure, actor, and technology (Leavitt, 1965). Technology includes software and hardware technology, tools, and ICT infrastructure used to develop and implement the information system. Next, project management frameworks, methodologies (work organization and workflow) and communication frameworks define Structure. Actors are individuals or groups of stakeholders who can set forward claims or benefit from system development. Actors include customers, managers, maintainers, developers, and users. Lastly, task describes the work goals and purpose and the way in which the work is done within



<Figure 1> Leavitt's Socio-technical Model and Building System Activities

the organization. The theory emphasizes the importance of a systems perspective in its approach— that to enact change within an organization, each factor should be considered as a part of a system as opposed to taking each one in complete isolation (Leavitt, 1965).

2.1. Research Framework

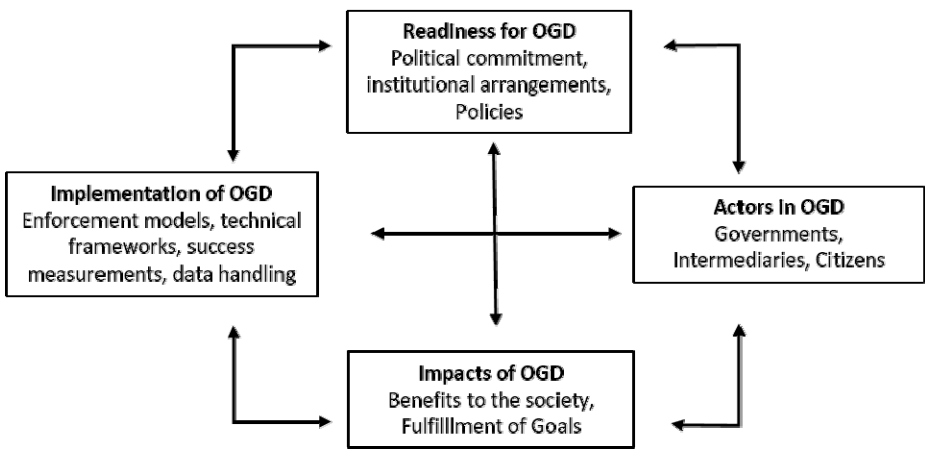
For the reasons mentioned above, the researchers identified socio-technical theory as an appropriate model to explain the interactions between open data policies, implementation structures, authorities, citizens, and impacts in an open government initiative. This paper adopts Leavitt's socio-technical model to classify the studies for Open Government data to explain the current situation of Open Data research, and describe existing research topics. Published research, case studies, and reports on open data initiatives among countries can be classified into these four broad factors: open data readiness assessments, implementation studies, and impacts studies (Davies et al., 2013),and actors studies. In line with Leavitt's theory, this paper proposes that the factors previously mentioned work interdependently with each other. The framework highlights how these four factors influence each other in building an effective OGD initiative. Moreover, each aspect of research has an impact on the others, directly or indirectly.

In the proposed framework, Readiness covers political commitment, proper resources, policies, and critiques on open data, issues, definitions, and technical preparedness. Studies about readiness tackle the institutional arrangements needed to be in place in order to implement an OGD initiative successfully. This concept is similar to Leavitt's Structure system activity. Implementation, on the other hand, stands for ICT structures, enforcement models, and success measurements. This area covers topics on current open data practices, frameworks and models for enforcement, current measures for evaluation of datasets, data handling, and the entire open data initiative. Implementation studies investigate the actual execution and technical arrangements of the OGD program, which also include possible issues, conflicts, and problems encountered. Implementation is related to Leavitt's Technology system activity. Next, impacts deal with the consequences, benefits, results, dataset utilization, and how the goals of OGD— transparency, participation, and collaboration is being achieved. Impacts embody Task in the socio-technical model. Lastly, Actors involve governments, independent IT developers, intermediaries, and citizens – all stakeholders that carry an interest in OGD. Literatures that focus on the actors of OGD discuss perceptions and roles of the human factors involved in the initiative. <Table 1> summarizes the characteristics of Leavitt's model and compares it with the current study's framework to organize existing OGD research.

The framework (<Figure 2>) attempts to map out existing literature and show how technological and social factors interact and contribute towards the establishment of Open Government Data movements globally. These four classifications function interdependently with each other (as shown by the bi-directional arrows) and contribute in building the body of knowledge about Open Government Data. As with Leavitt's model, the borders for these four areas of study are socially constructed and research usually cover multiple aspects at once. The relationship of each system activity with each other is not the focus of this paper therefore, the strengths of their relationships, as represented by the arrows, are not measured. However, this paper emphasizes how each existing literature may focus on one area but have an effect

<Table 1> Comparison of Leavitt's System Activities and Socio-technical Model for OGD

Leavitt's System Activities		Socio-technical Model for OGD	
project management frameworks, workflow organization, communication frameworks	*Structure*	*Readiness*	political commitment, resources, policies, critiques on principles, definitions, and technical preparedness
software and hardware technology, tools, and ICT infrastructure	*Technology*	*Implementation*	ICT structures, enforcement models, and implementation measures
customers, managers, maintainers, developers, and users	*Actors*	*Actors*	governments, independent IT developers, intermediaries, and citizens
work systems goals and purpose	*Task*	*Impacts*	consequences, benefits, dataset utilization, and achievement of OGD goals－transparency, participation, and collaboration



<Figure 2> Socio-technical Model for Open Government Data

on other factors or include other factors in its study. As what Leavitt (1965) has mentioned, socio-technical systems research considers each factor as a component of a system instead of an isolated part. This study classified existing literature into the topic area it focused on with the socio-technical systems assumption in mind.

2.2. Journal and Article Selection

This study sorts through the latest (v.11.5) list of references about open government data from the E-government Reference Library (EGRL) listing and an additional 16 articles (see <Table 2>) from reports and conference papers funded and published online by other journals, NGOs, and open data experts. EGRL is a comprehensive listing of quality peer-reviewed academic E-government research presented in the English language worldwide[1].

The current EGRL library contains 7,899 academic

<Table 2> Summary of Reference Materials

Reference Type	EGRL Reference	Other Sources
Academic Journals	69	6
Reports	-	9
Conference Papers/ Proceedings	81	2
Book/Book Section	5	-
Total	155	16

peer-reviewed articles published in the proceedings of a conference or in an academic journal. Using the search terms "open government" and "open data" on the EGRL reference list, we found 155 papers out of 7,899 articles on the list that covers open government data and its issues. Published research reports are available online on open government data NGOs' and advocates' homepages.

Analysis of the articles included in this study found 45 articles about Readiness, 63 articles about Implementation, 42 articles about Impact, and 21 articles about Actors.

Ⅲ. Findings and Discussion

3.1. Open Data Readiness

A study on readiness generally requires an existing understanding of "what an open data initiative would consist of, and to decide which factors are important for making an open data initiative a success" (Davies et al., 2013, p. 9). As mentioned in Section II, in order to advance open government initiatives, a number of requirements must be fulfilled; political commitment, organizational structures, proper resources, and technical competence in the government organizations are needed. The body of research on Readiness covers policies, conceptual definitions of the open data movement and its goals, proper resources, technical and political commitment in the establishment of OGD initiatives, and critiques to open data principles.

Following the definitions of the Socio-technical theory, an effective open data initiative requires a combination between technical readiness and work force readiness. The Open Data Barometer Global Report (Iglesias and Robinson, 2015) focused on these aspects of readiness; (1) policies and data management methods, (2) governmental programs across all levels (national to local) (3) civic rights and roles of citizens, (4) business and entrepreneurship. Therefore, readiness transcends technical preparedness to initiate and OGD programs and extends to readiness of all aspects of the society to enforce and adopt OGD action.

Regarding country readiness, the United Nations and the World Bank published open data assessment tools and guidelines for those interested in analyzing open data efforts (Stott and Kaplan, 2013; United Nations Department of Economic and Social Affairs (Undesa, 2013). These readiness variables also covers the six dimensions of open data readiness: legal, political, social, economic, organizational and technical capacity, in recognition of the required participation

1) EGRL can be accessed at http://faculty.washington.edu/jscholl/egrl/index.php

<Table 3> Overview of Country Open Government Data Programs and Their Motivations (Huijboom and Broek, 2011)

Country	Program	Launch	Key motivations
Australia	Government response to the Gov 2.0 report, Open Gov declaration	May 2010 and July 2010	Public sector information is the key to unlock invention, creativity, and hardwork among citizens, commercial and community organizations. Open PSI is an invitation to the citizens to engage and innovate to create new public value through public information.
Denmark	Open data Innovation Strategy (Offentlige Data I Spil)	July 2010	Opening government data leads to creation of new services to citizens and better analyses for new useful insights. ICT companies can use these data to create new business and develop digital services that can be practical solutions to day-to-day problems.
Spain		July 2010	Data is an important ingredient in the knowledge economy. More economic value can be generated from publishing public sector data. Data is also a way to encourage citizens to stay engaged and informed about the government as part of their democratic rights.
United Kingdom	Putting the Frontline First: Smarter Government	December 2009	Opening data to the citizens strengthens the role of the civic society. Moreover, data can be used to innovate and bring economic benefits by releasing untapped potentials for enterprise and entrepreneurship.
United States	Open Government Memorandum and Plan	January 2009 and April 2010	Openness will strengthen democracy and promote efficiency in the government. Transparency promotes accountability and informs citizens about what the government is doing.
South Korea	Open Data Law	June 27, 2013	Open data to ensure the right to use, access, and commercial use to create virtual goods and services for profit.

of a broad range of actors in the society in order to have an effective open data initiative (Alonso, 2011; Hogge, 2010).

Huijboom and Broek (2011) analyzed the open government data programs of different countries to reveal the motivations behind them. <Table 3> shows an overview of his findings with these three primary motivations— to increase democratic control and political participation of citizens, promote service and product innovations to create new businesses, and strengthen law enforcement by involving citizens in policing local areas. Despite these key motivations being end goals for the OGD initiative, these motivations show how the focus of the programs always has the citizens and entrepreneurs in mind. These insights strengthen the need for readiness of the civil society in utilizing the datasets whether for personal use or entrepreneurial use.

An analysis of existing research on readiness studies show the evident gap between nations showing how only a limited number of nations, mostly developed ones, lead the evolution of OGD policies globally. Additionally, scholars have focused more on policies more than other aspects of readiness. Meanwhile, case studies and reports funded by government and non-government organizations have looked into how citizens and entrepreneurs are prepared for open data (Davies, 2013; Iglesias and Robinson, 2015). <Table 4> shows a summary of results of notable research on OGD readiness.

3.2. Open Data Implementation

The adoption of open data have gone beyond coun-

<Table 4> Readiness Studies

Author/s	Region/Country of study	Results summary
Bertot et al. (2014)	United States	This paper presented the open data policies that serves as a foundation for Big Data initiatives and examined the areas where the current information policy framework fails. Consequently, the paper offers recommendations for a revised policy framework to address current issues in the U.S. Big Data initiative.
Chirchir and Kersting (2014)	Not Specified	This study explored the roles of the government towards initiating a successful OGD program and how an appropriate measure for OGD success is still inexistent.
Dawes (2010)	United States	A conceptual and empirical exploration of the tensions experienced by Data.gov reveals that fundamental information policy principles on stewardship and usefulness can help evaluate efforts on information-based transparency.
Ding (2009)	China	This paper concluded that the new policies of China regarding OG were not designed to "serve the people" but to increase the Chinese Communist Party's legitimacy. Therefore, China has a long way to go before the government can claim transparency and accountability.
Francoli and Clarke (2014)	Azerbaijan, Brazil, Canada, Netherlands, Kenya, United Kingdom, and the United States	This paper compared the content of open government policy documents across seven Open Government Partnership (OGP) member states and itemizes where the term retains and varies from its original meaning.
Frank and Oztoprak (2015)	United Kingdom	A comparison of the different concepts of transparency defined by political scientists and applied to the UK government transparency code is based on a shallow concept of transparency.
Hansson et al. (2015)	Not specified	The paper analyzed open government from the democratic perspective and found that despite the existence of three concepts for OG, most of the focus is on transparency and information exchange.
Khayyat and Bannister (2015)	International	The paper discussed the issue of licensing in the era of open government and examined currently existing licensing frameworks like the Creative Commons (CC) and Open Database Licenses (ODbL).
Matei and Irimia (2014)	United States	The authors proposed Open Governance as a better choice over collaborative governance, open government, and, e-democracy and provided suggestions on why and how to adopt this model.
Mcdermott (2010)	United States	This paper discussed the beginnings and the policies behind the establishment of the Open Government Directive.
Rogerson and Milton (2013)	International	An analysis of 250 information security-related policies globally revealed a conflict for the free flow of information regardless of government types.
Van Der Sloot (2011)	Europe	The paper analyzed the tension between OG policies and the protection of personal information from a legal point of view.
Zuiderwijk and Janssen (2015)	Netherlands	This paper presented a decision-making model to show the positive and negative aspects of making data public to help in decision-making towards opening government data.

try level as individual cities and international organizations start their own open data initiatives (Butler et al., 2004; Carrasco and Sobrepere, 2015; Hartog et al., 2014; Kassen, 2013). Implementation studies tackle existing technical arrangements which involve the current conditions and practices of open government data through the implementation of open data policies (Davies et al., 2013).

Researchers and scholars have adopted varied approaches in studying implementation. These approaches assist in making distinctions about what good open data looks like, which datasets are important, and how implementation should be enforced, measured, and assessed (Alanazi and Chatfield, 2012; Albano and Reinhard, 2014; Alexopoulos et al., 2013; Alexopoulos et al., 2014; Lee and Kwak, 2011; Lee and Kwak, 2012). Some studies focus on the availability of datasets and the proportion of institutions publishing open data while others assess the qualities of datasets of the open data portal itself (Elbadawi, 2012; Gomes and Soares, 2014; Gorelik et al., 2014; Lourenço, 2013a, 2015). Still others focus on effectiveness of appropriate legislation, policies, and regulations for open data to operate properly. A number of papers have attempted to motivate action by seeking to measure implementation through indices and therefore offering the possibility of comparison between the initiatives of different areas (Elbadawi, 2012; Sandoval-Almazan, 2011; Sayogo et al., 2014; Stott and Kaplan, 2013).

The Open Data Barometer project (Davies, 2013; Iglesias and Robinson, 2015) analyzed global trends and ranked countries and regions using an in-depth methodology that considers readiness, actual levels of implementation and the impacts of OGD initiatives. Over the years, OGD policies have witnessed rapid diffusion with varying degrees of implementation – from independent open data portals within e-government frameworks to government-wide implementations. Countries leading in implementation invest in "national data infrastructures" to publish data in an accessible and timely manner for public and private innovation. Among these countries are UK, Canada, Brazil, Denmark, Australia, and the USA. Meanwhile, South Korea ranks 2nd to New Zealand in the East Asia and the Pacific region for implementation. Mid-ranking countries are countries who have started their OGD initiatives but are currently failing in making key datasets available. Low-ranking countries, on the other hand, have not yet started to engage with open data. An emerging problem concerning open data adoption in developing countries is that funding for implementation usually comes from international organizations and therefore efforts eventually cease to exist after the financial support ends.

In academic research, adoption and implementation are often investigated through proposed models or frameworks (Alexopoulos et al., 2013; Charalabidis et al., 2014; Kalampokis et al., 2011; Lee and Kwak, 2012; Lourenço, 2015; Sandoval-Almazan, 2011; Valdés et al., 2011; Veljković et al., 2014). Similar to e-government studies, open data evaluation usually take the form of benchmarking (Veljković et al., 2014), defined as "the measurement of some elements and the comparison of the outcomes to a certain norm, the benchmark" which provides a better understanding of an organization's standing and helps identify growth opportunities (Maheshwari and Janssen, 2013, p. s83). Sayogo et al. (2014) explored the status of open government data worldwide and outlined the progress of OGD efforts at the national government level in order to create a framework for benchmarking open government data efforts. Since an official comprehensive standard in measuring implementation has not been established yet, most stud-

ies remain to be subjective and exploratory. This means that measures are based on different benchmarking standards depending on the country's utmost priorities for the OGD initiative.

Aside from national level examination, a local level analysis is also being done in the recent years. The Chicago Open Data Project (Kassen, 2013) is an example of a local-level study that explored the potential of open data on the local level. The study explored OD as a useful platform for the promotion of public engagement projects. Moreover, Lee and Kwak (2012) proposed an open government maturity model for a social media-based public engagement based on field studies with U.S. Federal healthcare administration agencies. The proliferation of social media and its great potential to promote the participation of citizens to open government is a promising opportunity for governments.

Other notable studies on implementation are outlined on <Table 5>. It is not surprising that implementation studies are more advanced in developed countries than in developing countries. Nonetheless, not all developed countries have fully adopted or fully implemented a useful OGD initiative. Moreover, there are various proposals on a "proper" open government framework that have been tested on actual implementation initiatives but there is still no definite proper implementation framework or measures established globally. Implementations studies also cover data handling and security— issues that emerged as consequences of dealing with data and technology.

3.3. Emerging Impacts of Open Data

Studies on impact tests whether open data has led to any changes in the society, especially focusing on the benefits of opening government data has promised. Davies et al. (2013) identified three broad categories which capture the mechanisms through which open data might bring change; these are Transparency and accountability, innovation and economic development, and inclusion and empowerment.

Currently, there is a limited amount of documentation on the sustainability and initial impacts that OGD initiatives have effected on improving the citizen's access to information and how open data have promoted transparency and improved the delivery of services to the public (Mutuku and Mahihu, 2014). Large-scale and in-depth studies on open data impacts are currently underway but most work remains to be on phase 1 because investigation of impacts take a considerable length of time (Davies, 2014; Open Data Research Network, 2014).

Nonetheless, there is an increasing availability of studies about applications of open data and how the public is utilizing datasets (Cruz and Lee, 2015; Kassen, 2014). In contrast to readiness and implementation studies, which usually focus on the governance side, impact studies tackle the results of OGD efforts in the public side. These includes how the public and the private sectors (entrepreneurs and private organizations) have made meaningful projects out of the data published by the government (Cruz and Lee, 2015). Cranefield et al. (2014) explored the benefits, barriers, and enablers of open data apps – this study is in conjunction with entrepreneurial open data use. Value is created by providing context and meaning to a set of open data that will be relevant to an individual user (Difranzo et al., 2011). Moreover, in Chicago, residents have already created several independent e-government projects based on available open datasets within three years of the data portal launch (Kassen, 2013).

In academic research, the impacts of open data have been investigated in different aspects. Harrison and Sayogo (2014) found that the concepts of democ-

<Table 5> Implementation Studies

Author/s	Region/Country of study	Results summary
Alanazi and Chatfield (2012)	Middle East (Saudi Arabia , Kuwait, Bahrain, Qatar, UAE, Oman, Jordan, Israel, Iran, Syria, Yemen, Lebanon, Iraq)	This paper investigates the implementation of open government data in Middle Eastern countries through the maturity standards proposed by the 2007 Open Data Working group. Researchers found that only 3 out of the 13 countries surveyed had observable open data implementation despite the proliferation of internet and other aspects investigated regarding readiness to initiate open data in this region.
Alexopoulos et al. (2013)	Europe	The paper devised an evaluation framework for open government data infrastructures following both web 1.0 and web 2.0 paradigms. The proposed model for evaluation consists of measurable criteria and dimensions including a comprehensive evaluation procedure for using the model.
Ariunaa (2007)	Mongolia	This book section described the status of the open government website of Mongolia and identified its strengths, weaknesses, and trends for improvements.
Canova et al. (2015)	Not Specified (Linked Open Data Cloud project)	The paper proposed a unified format (RDF format) for published open data to reduce redundant efforts in transforming data and investigated steps needed to implement a distributed RDF-versioning system.
Carrasco and Sobrepere (2015)	Spain	This study evaluated Spanish municipalities' OGD initiative using the following the Organization of Economic Cooperation and Development's (OECD) approach. This resulted in a classification composed of 3 groups – high performing, moderately performing, and low to zero performing municipalities.
Charalabidis et al. (2014)	Europe	This paper proposed a value model to assess a second-generation OGD infrastructure and applied the measures in evaluating the advanced second-generation OGD e-infrastructure, ENGAGE.
Choi et al. (2013)	South Korea	This paper discussed a secure and trusted framework for Government Data Sharing (SecureGov) implemented in the Public Information Sharing Center (PISC) in South Korea.
Colpaert et al. (2014)	Belgium	This paper proposed a technique to automatically identify the content of open government datasets with three metrics calculated through the use of a set of identifiers.
Corrêa et al. (2014)	Brazil	A comprehensive assessment survey of transparency websites of 20 Brazilian municipalities revealed a gap between the local portals and the ideal implementation requirements of OGD principles.
Elbadawi (2012)	Gulf Cooperation Council (GCC) countries	The analysis of GCC countries' OGD initiative showed the status of portals to be less than desired standards. The study identified the challenges and cited recommendations to improve OGD initiatives.
Krabina (2012)	Austria	The paper suggested a ten-criterion catalogue for internal data monitoring in identifying and prioritizing data to be released within Open Government Data initiatives.
Lee and Kwak (2011)	United States	The paper presented four stages of implementation before the achievement of a fully open government: Stage 0: Checking existing government data, Stage 1: Data transparency, Stage 2: Open participation, Stage 3: Open collaboration, and Stage 4: Ubiquitous engagement.

<Table 5> Implementation Studies (Cont.)

Author/s	Region/Country of study	Results summary
Lemieux et al. (2015)	Brazil, India, Jordan, Mexico, South Africa, Thailand, The United Kingdom, and the United States	Researchers examined available data about requests, complaints, and appeals published from central reporting agencies from 2011 to 2013. They found that practices in collecting and publishing these data are unstandardized and most often incomplete or unavailable.
Lourenço et al. (2013)	Portugal and Italy	The paper proposed a model to assess data dissemination by public entities based on Open Government principles. Results of their assessment model and Transparency index showed inadequate data to show accountability and to harness the potential of the internet.
Nam (2015)	South Korea	The study analyzed the strengths, weaknesses, opportunities, and threats (SWOT) of Government 3.0 initiative in South Korea and found serious issues regarding open government.
Sandoval-Almazan and Gil-Garcia (2014)	Mexico	The researchers proposed a new approach for data government portals using the concepts of wikinomics, open data, new institutionalism, and the fifth state (Network State) based on an analysis of 32 Mexican government websites from 2006 to 2012.
Solar et al. (2014)	Chile, Colombia, and El Salvador	A proposed model to assess maturity and capabilities of public agencies was piloted in seven public agencies in Chile, Colombia, and El Salvador to detect weaknesses in the programs.
Susha et al. (2015)	Not specified	Compared and identified the strengths and weaknesses of the benchmarks for evaluating progress of open data adoption including ODRA (World Bank), the ODB (Open Data Institute and World Wide Web Foundation), the ODI (OKNF), the PSI Scoreboard (ePSI Platform), and the Open Data Economy (Capgemini Consulting).
Verma and Gupta (2012)	International	The researchers' analysis of 30 country-level data portals revealed that governments release data in 80 different formats which may lead into issues of integration in the future as more data is published all over the world.
Yang et al. (2015)	Taiwan	An investigation of the factors that affect OGD initiatives in Taiwan showed that legislation and policy have the most significant impact followed by organizational and environmental perspectives.

racy, human capital, and budget document disclosures are consistently related to transparency, accountability, and the involvement of the Supreme Audit Authority with the public. Chan (2013) investigated open innovation strategies that will develop the Singapore open government data portal into an open innovation platform that will entice businesses to create e-services using open datasets. Aside from country level impacts, open data has also changed the way international organizations consider sharing data, planning, coordination and other uses of the data they collect through their operations (Luna-Reyes et al., 2014).

Davies et al. (2013) suggested two paths that research on OGD impacts might take— first; it might seek to measure impacts on the macro-level, investigating the statistical significances between the published measures of open data implementation and the variables that cover some anticipated impact of open data. Second, it may turn towards the micro-level

to seek to understand the different processes through which open data is used in particular conditions. Impacts could also be qualified in research as to whether it was effected by a particular dataset or by the open data initiative, in general. Another way to view impact is how open data have changed a specific sector in the society. Consequently, existing studies (<Table 6>) investigate whether the goals of transparency, participation, and collaboration, and whether goals are being achieved in a citizen-level or entrepreneurial/SMEs/business organizational level.

3.4. Actors

The citizens are the ultimate perceived beneficiaries of open data. Nonetheless, the whole idea is about citizens making use of the available data, not just to be informed, but to interact with the government and to create value with the published datasets. Davies (2013) mentioned that more than datasets, successful OGD initiatives also need intermediaries that will transform raw government data into different platforms and into a roster of products with social and economic values. This study's framework expands the World Wide Web Foundation's approach in measuring open data (Davies, 2013; Iglesias and Robinson, 2015) and separates actors as a distinct area of study in academic discussion.

All other aspects of open data research involve actors – policy-makers, IT experts, administrative workers, citizens, entrepreneurs. Therefore, studies

<Table 6> Emerging Impacts Studies

Author/s	Region/Country of study	Results summary
Alvarez et al. (2012)	Europe	This paper proposes an improved unified Pan-European e-procurement platform that exploits the aggregation of public procurement notices using linked open government data to assist SMEs.
Bartenberger and Grubmüller (2014)	United States (Chicago)	A comprehensive model of collaborative governance was introduced to derive assumptions regarding the influence of open data on collaborative processes in a smart city context. Only minor evidence regarding the influence of open data was found.
Bedini et al. (2014)	Italy	This paper presents answers to efficiency and innovation questions about open government data by showing concrete examples of applications created from OGD raw data and transformed into public services (online and mobile app services).
Birchall (2015)	United States	This article reviews the implications of the open data movement in the United States and cites specific instances where the goals of open government data were in conflict with current events.
Canares (2014)	Philippines	This paper investigated the impacts of posting financial and procurement-related information on LGU websites and found that incentivizing openness is an important aspect in motivating local governments to publish data. Moreover, there should be awareness in the demand side to promote usage of published data.
De Mendonça et al. (2015)	Brazil	A case study in the municipality of Cuiabá showed an effective use of open date through the creation of a map to visualize information about the infestation of Aedes aegypti.

<Table 6> Emerging Impacts Studies (Cont.)

Author/s	Region/Country of study	Results summary
Graves and Hendler (2013)	United States	The paper proposed a tool prototype to make visualizations to solve the problem of people who cannot perform essential operations needed to make sense of OGD.
Gschwend et al. (2015)	Europe	The paper presented the first results of a project aimed to develop tourism-related applications and software components that are capable of supporting data stakeholders in transforming available data to Linked data.
Hansen et al. (2013)	Denmark	The Danish open government data initiative was analyzed to present the role of open public data in building a digital society.
Iemma (2014)	United States	An analysis of the 36 energy-oriented application services based on the US "Green Button" initiative open data, revealed that useful information come from a combination of open government data, consumption data, and corporate data.
Jetzek et al. (2013)	Not specified	Researchers presented a strategic framework outlining the different pathways to value generation from OGD.
Linders (2013)	International	The paper examined how aid agencies make use of open data to improve effectiveness of distributing international aid
Lönn and Uppström (2015)	Sweden	The paper drew upon the learnings of two research projects to propose core aspects for public value co-creation and identified the inhibitors of its realization in the fields of value co-creation, e-government and open government.
Lourenço (2013b)	International	The paper analyzed the levels of transparency in government portals and proposed a set of requirements that will help open government portals achieve the goal of transparency.
Seoud and Klischewski (2015); Stromer-Galley et al. (2012)	United States	The researchers employed a design science approach to develop a blueprint for sourcing open government applications from citizens.
Susha et al. (2015a)	Sweden & Netherlands	The paper explored the area of open data innovation and found that the driving factors for businesses to utilize data differ widely but innovativeness and skills stand out as crucial factors.
Susha et al. (2015b)	Sweden & Netherlands	Researchers found that public organizations find it challenging to support open data users' requirements and skills and are very limited in terms of their interaction to users making this one of the difficulties faced in facilitating open data use.
Vieira and Caldas (2012)	Brazil	This paper investigated the relationship of corruption in the government and transparency and presented empirical evidences of their negative association.

on Actors deliberately involve and investigate the human side of OGD, whether it be on the implementing side or the citizen side from the beginning to the end of the system. This paper cites this area of study as distinct from readiness, implementation, and impact, to be able to investigate the reactions, perceptions, and expectations of citizens toward open government data initiatives efficiently. Moreover, enriching the studies on OGD actors, especially on citizens and entrepreneurs, as the focus have usually

been on the governmental actors, will help policy-makers improve current OGD policies tailor-based to the needs and requirements of the civil society in order to participate and utilize open government data.

Moreover, studies on actors focus on the civil society as active participants of OGD initiatives, not just passive receivers of the service. It is evident that research on stakeholders of open data have mostly emerged as an afterthought for researchers because research on actors have mostly been published in the last four years - after OGD has been initiated (Albano and Reinhard, 2014; Cano, 2013; Pereira et al., 2015) whereas citizen-readiness is mentioned as one important aspect of OGD initiatives (Iglesias and Robinson, 2015).

Nonetheless, research on OGD actors remain uncultivated (only 21 studies based on our list of references) and mostly cover perceptive concepts of agents and citizens towards OGD (<Table 7>). It is expected that in the coming years more inspection on the actors of open government data will emerge as current studies find policies and current implementation frameworks to fail in their goals to engage citizens and the private sector to open government data (Bertot et al., 2014; Lönn and Uppström, 2015). Therefore, more research about how the government can persuade involvement from citizens are needed (Lee, 2015)— including the means and vehicles as to how to most efficiently and conveniently enforce these measures, e.g. social media (Khan, 2015). This paper proposes that a focus on OGD actors could help address the participation and collaboration issue among OGD initiatives in order to find out the behaviors and motivations of citizens to take part in the initiative.

Ⅳ. Contributions and Research Implications

Open government data is a foundational facet in the open government paradigm. This review of related literature summarizes the existing studies by expanding the World Wide Web Foundation's (2013) measures of open data; readiness, implementation, and emerging impacts with the addition of actors. Through the framework, this paper shows that existing studies and investigations not only involve technological factors, which are obviously needed in creating an open data initiative, but more importantly, the social factors that go with it. Most, if not all, existing researches involve government involvement in the readiness and implementation, whereas the emerging impacts and actors studies involve assessing the benefits of open data to the civil society. Moreover, the boundaries regarding each approach can overlap each other as open data initiatives studies are concerned about development of open government data as a whole. This illustrates the socio-technical perspective that underscores the importance of a systems viewpoint instead of isolated factors.

Currently, studies regarding open government data initiatives are steadily growing in number especially in the past 2 years. However, there is a visible gap between the rigor of studies between developed and developing countries. With the Open Government Partnership (2011) being 59-nation strong, with countries ranging their implementation plans from development to 3rd cycle, the extent of investigation between countries and initiatives remain very limited or non-existent. Even in developed countries, research remains very confined to countries like the United States and a few European countries. It is worth noting though that OGD research is also growing steadily in South American countries like Brazil

<Table 7> Actors Studies

Author/s	Region/Country of study	Results summary
Albano and Reinhard (2014)	Brazil	The paper presented the perceptions of Brazilian OGD users and government agents for improving OGD supply and usage for a country in the initial stage of its OGD initiative.
Cano (2013)	Spain	The paper found that members of the educational communities had high expectations for open government policies and principles embodied by transparency, participation, and collaboration. The paper then proposed a conceptual framework to evaluate open government initiatives from the educational viewpoint.
Dos Santos Brito et al. (2015)	Brazil	An analysis of the benefits of the use of OGD-based applications perceived by the general population of Brazil showed that citizens consider the applications more useful than official government websites, capable of reducing corruption, and influence voting decisions.
Ganapati and Reddick (2012)	United States	A survey of Chief Information Officers (CIO) in the US showed that open e-government initiatives are unevenly developed. Despite CIOs feeling that they have achieved higher levels of open e-government, fewer CIOs felt the same way concerning the pillars of open government.
Ganapati and Reddick (2014)	United States	A survey of Chief Administrative Officers showed a high satisfaction with the overall implementation of open government.
Hellberg (2014)	Sweden	A qualitative, interpretive research on policy, process, and people showed that people are not incentivized enough to motivate them to take part in the OGD agenda.
Kaasenbrood et al. (2015)	Europe	Researchers found that in order for private organizations to utilize open government data, the data must have; (1) a clear source and content, (2) a usable open data license, and (3) have continuity of updates.
Nam (2012b)	United States	This paper presents the findings of the analysis of the Pew national survey regarding citizen's attitudes towards OG and Government 2.0. It revealed that despite the positive attitude toward OG, the attitudes do not change much with the introduction of new goals and e-government tools.
Nam (2012a)	United States	The paper suggests a framework for citizen-sourcing where the government, in relation to OGD initiatives, can analyze the content of citizen content.
Pereira et al. (2015)	United States	The researchers analyzed the impact of OGD on the different stakeholders to understand the impact of open data, how it improved their activities and its unintended consequences.

and Mexico. Conversely, research in developed countries are starting to advance into second generation open data implementation as compared to developing countries research which are mostly focused on evaluating first phase implementations. However, developing countries are at risk of sustainability issues for OGD initiatives as some of them run on grants provided to governments externally. As the OGD initiatives continue to develop across the globe, traditional leaders (the US and the UK), are being challenged by a new generation of open data adopters (France, Canada, Mexico, Uruguay, Korea, and the Philippines) as these countries are embracing a leadership attitude in their respective regions (Iglesias

and Robinson, 2015).

Topics of OGD research covered by readiness, implementation, impacts, and actors also vary in scope and depth. As shown here, the topics remain fluid as more difficult aspects of open government data continue to emerge. Additionally, literature from the United States vary in subject matter and depth (Ganapati and Reddick, 2012; Lemieux et al., 2015; Nam, 2012a) while European studies (Alexopoulos et al., 2013; Alvarez et al., 2012; Huntgeburth and Veit, 2013) mostly focus on policies and comparisons of implementation strategies. Moreover, other developed countries still lag in the proper adoption of OGD (Elbadawi, 2012). These gaps in OGD research are being addressed by other organizations by funding research in comparing OGD efforts across countries using proposed standard indices (Davies, 2013; Iglesias and Robinson, 2015; Stott and Kaplan, 2013) but research takes a long time. Therefore, these reports only show rankings for past performance and do not necessarily represent how OGD initiatives are being improved in the present time.

When it comes to standards, most studies from the academic field and international sponsoring organizations remain to be subjective and exploratory with success measured in different benchmarking standards because an all-encompassing standard that covers all goals of OGD is not yet in existence. Nonetheless, different benchmarking standards have shown to have their own strengths and weaknesses and therefore is worth looking into (Susha et al., 2014). Moreover, another issue on coming up with a standard measure OGD initiatives are the different motivations for initiating OGD (Huijboom and Broek, 2011). These differences show the different priorities of countries for releasing data and therefore a valid ground for questioning for researchers. In addition, these differences show how coming up with a one size fits all measurement of OGD initiatives would be problematic. As OGD is continually evolving, a measurement standard for it must be able to mirror current achievements without putting limits on its growth.

The framework for literature presented in this study aims to mirror the development of OGD initiatives from its conception to its ultimate goals and present how it is a matter of human and technological interaction. Furthermore, this study tried to simplify the growing number of research on open government in order to reveal the significant complexities of topics studied under each area. This paper aspires to contribute in the fulfilment of the goals of OG initiatives by building a solid framework out of existing knowledge. Likewise, as explained by scholars of open government data, the ultimate goal of OD is not just transparency but more importantly, on making meaning out of the published data so that citizens can be motivated to participate and collaborate with the government in creating new services (Kassen, 2013). The research also extends its focus from readiness, implementation, and impacts (Davies, 2013; Iglesias and Robinson, 2015), by recommending another field of study to investigate, the actors. As investigation of OGD initiatives find out about the weaknesses and strengths of open government frameworks to engage citizens and entrepreneurs to participate and collaborate, studies on actors can guide policy-makers tailor future OGD policies based on the needs and requirements of the civil society to utilize open government data.

Future direction of open government data research remain very promising and broad not only because of IT development and the differences of adoption between countries but also due to the evolution of human perception toward open governance. OGD research is far from maturity, as it remains a global

concern with varied rates and stages of developments internationally. As countries like the United States and the United Kingdom continue to improve their programs, as other countries follow suit by adopting best practices and evolving their own initiatives, and as international support for developing countries increase, the study of Open Government Data will continue to grow, albeit not at the same pace for all nations. Nonetheless, it would be a healthy sort of race. As countries' initiatives become more stable, the next step would be building international linked open government data among countries.

On this paper, we showed how readiness, implementation, impacts, and actor's research encompass the growing aspects of OGD knowledge as concerns that are more difficult continue to emerge globally. With datasets alone, as part of implementation, points for research include, data preparation, data security, data formats, data usability, etc. Moreover, despite most countries having started their own initiatives, the principles of open data are still not safe from questioning. Open data policies are still evolving and would have to face criticisms about privacy and security. To add to that, another pressing issue is how open government initiatives are being used in countries with different political views such as China.

On the other hand, the area of research on actors is still in its early stages and more topics about the stakeholders of OGD can be studied to stress the importance of adopting a systems perspective in enacting change. Because citizens are considered as the receiving end of OGD, it is vital to include their readiness and perception in policy-making. It is important to note that OGD initiatives involve a technical side and certain technologies require a period of adoption, therefore citizens must also be prepared for the technology. This training may come from different aspects of the society but the most obvious source would be incorporating the values of OGD into education. This step would contribute to raising the next generation of OGD users who would be the next flag-bearers of open data. From the socio-technical perspective, the maturity of OGD involves both infrastructure maturity and citizen maturity.

Ultimately, despite the limited conclusive evidences to prove without doubt that open government data will result to transparency, participation, and collaboration within this generation, the belief that OGD initiatives will lead to these goals remain firm. As OGD initiatives continue to be laid out and improved across different countries, there is a strong pressure right now to study and investigate the different aspects of open government data globally. It is, however, clear that in order for OGD initiatives to complete take off, promote democracy, and harness the projected benefits, open government data should not be treated as a black box but instead involve both governments and citizens in striving to achieve transparency, participation, and collaboration.

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