DATA DRIVEN GOVERNMENT: PRECONDITION AND MEDIATING VARIABLES TO UNLEASH THE POWER OF DATA

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A Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Philosophy (Development Administration)
School of Public Administration
National Institute of Development Administration
2020

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ABSTRACT

Title of Dissertation DATA DRIVEN GOVERNMENT: PRECONDITION AND MEDIATING VARIABLES TO UNLEASH THE POWER OF DATA

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Degree Doctor of Philosophy (Development Administration)

Year 2020

Open government data (OGD) are currently recognized as a strategic asset for public administration. However, there is still a knowledge gap on how data yield their value in practice. Little is known about how to use and unleash the power of OGD. The mismatch between the supply and demand sides may increase costs and limit the potential impacts of the data to produce changes in social, economic, and government outcomes. This dissertation raised simple, but very important questions by asking the following: "What are the determinants that influence the development of OGD?"; "Does OGD enhance government performance? If so, how?"; "Does OGD require government capabilities to unleash and expand its impacts? If so, what are the essential government capacities to activate the impacts?"; and "How do government capabilities and OGD impacts relate to each other?" Following the research questions, this dissertation has classified its objectives into five: (i) to perceive the essential preconditions influencing the development of OGD; (ii) to investigate how governments implement OGD principles; (iii) to explore how governments unleash the power of OGD and what government capabilities are required for that purpose; (iv) to investigate how OGD affects country development in terms of economic, social, and governance impacts; and (v) to provide policy recommendations for improving OGD and unleashing its power.

Since the concept of OGD and its impacts is a developing concept, this research used mixed-methods in order to holistically understand and describe OGD development and its utilization. The study includes (i) case study analysis; (ii) quantitative analysis; and (iii) interviews as a supplementary tool. In order to select the case studies, the top-ten successful countries in OGD development ranked by the

World Wide Web Foundation in 2016 were selected: the United Kingdom, Canada, France, the United States, South Korea, Australia, New Zealand, Japan, the Netherlands, and Norway. Additionally, Thailand was studied as well. For analyzing the OGD's impacts, 79 OGD projects were used as case studies to analyze the taxonomy of the impacts. Document analysis using content analysis was used for the case studies in order to analyze the relevant documents, such as laws and regulations, government policies or plans, government evaluation reports, and previous research. For Thailand, interviewing key informants was used as a supplementary tool. After obtaining the results of the case studies, an OGD model was developed and was tested using the quantitative method. This research used secondary data from 115 countries and from 2016 in order to maintain causality (causes and effects), only for some indicators for data security in 2015. The data were analyzed using partial least squares-structural equation modeling (PLS-SEM) using SmartPLS software.

This research found that the results were consistent between the qualitative and quantitative methods. They showed that there are four linked aspects of data-driven government: (i) pre-conditions influencing the OGD development; (ii) OGD implementation; (iii) government capabilities (GC); and (iv) OGD impacts (DI). This supported the main argument of this study: although OGD has its value as an asset, it might not make direct impacts—it requires proper GC to unlock the power of the data. First, there are three major preconditions that governments must recognize for OGD development: information and communication technology investment, data security, and trust in the national government. According to the statistical analysis, the preconditions explained 70.2% of the variance in OGD, which represented a moderate level of explanatory power. Second, there were eight common principles of OGD implemented by the top-ten countries: completeness, timeliness, machine readability, open standards/open formats, open licensing, free of charge, non-discrimination, and open by default.

Third, this research found seven key activation capabilities in unleashing the power of OGD: administrative cultural transformation, OGD policy, OGD management, data cooperation, government support, research and development, and citizen engagement. Last, OGD can have a valuable impact when the conditions are

sufficiently supported in three main ways: economic impacts (i.e. economic growth, innovation, business development, operation improvement, smarter decision-making, better marketing); social impacts (i.e. citizen-centric service, service innovation, real-time services, boosting public-private partnership); and governance impacts (i.e. data-driven policy, transparency, accountability, efficiency and effectiveness, digitized government, anti-corruption). The two methods showed consistently that GC was critical to unlocking the value of OGD. The statistical analysis indicated that OGD explained 79.7% of the variance in GC, and that OGD together with GC explained 84% of the variance in DI, which was also considered a substantial level of explanatory power. GC fully mediated the relationship between OGD implementation and the impact of OGD impacts. The model had a high overall model fit (0.816).

For Thailand, OGD implementation just began in 2015. From document analysis and interviews, Thailand is quite technologically ready but still needs time to make use of it. There are many challenges. For example, Thai citizens have little confidence in the government because they fear that the government will intervene and threaten their lives by using their data. Further, the Thai OGD system still needs to be developed in terms of the amount of data released and its quality; most of the disclosed OGD cannot be further used. Moreover, the work culture of the Thai government has remained an obstacle to the development of OGD as Thai government agencies have no culture of data collection, retention, or utilization. More importantly, there has been some misunderstanding that government data are owned by the state, not owned by the citizens. Thus, Thai people are far from driving the development and utilization of OGD. Additionally, although the statistically moderating analysis showed that political instability is not significant in the relationship between OGD and DI, the analysis of the Thai case was the opposite of that analysis. Covered with an authoritarian culture, centralized decision-making power, especially when ruled by a semi-military government, it has been difficult for Thai government agencies to release or share their data with the public since the data are a currency of power. The semi-military government has not used the available data to provide public services, has not cooperated with other local governments, and has ignored the citizens' voice. The relationship between the political context and

government capability is related to the administrative culture, values, the system structure, and bureaucrat behavior. The political issues should thus be further studied in terms of OGD formation, OGD development, and OGD utilization by taking into account a country's conditions.

This research suggests that improving OGD should be mostly concerned with IICT and DS as the important preconditions. Additionally, a government may follow the eight principles of OGD since applying these common principles will stimulate data provision and utilization. More importantly, by applying the research results and considering some of the limitations (i.e. limited financial resources, cultural restrictions, knowledge, and skills for OGD), this research suggests seven strategic phases for improving OGD provision and utilization: (i) launching an OGD vision to begin OGD policy, OGD management, and administrative culture transformation; (ii) finding the most correct and valuable data; (iii) beginning pilot projects of data utilization by including data providers and data users, such as public agencies, private sector or business units, startups, non-government units, academic institutions, researchers, and citizens; (iv) boosting data utilization by supporting knowledge, skills, or tools for data users; (v) promoting data impacts to communicate and raise awareness of OGD; (vi) expanding more valuable datasets in a variety of government agencies; and (vii) establishing an OGD system within government agencies in order to institutionalize new standards in government practices.

As a result of these analyses, the dissertation made two primary contributions. First, it contributed to the literature on (i) the linkage between OGD supply and demand sides by presenting systematic mechanisms to unlock the power of OGD; (ii) "open by default" as a new finding for practical OGD principles; and (iii) the taxonomy of OGD impacts. Second, it explained how OGD is the focal point of the transition of public administration in the present and the future through driving more quality practices of public administration. In addition, since OGD is a developing concept, there are opportunities for future research to explore this issue, such as how political contexts influence OGD development and utilization, what the cultural conditions or cultural factors area that influence OGD, how the private sector or business units utilizes the OGD value to run its businesses in terms of services,

products, and innovations, how to design and formulate a cooperative approach for the public and private sectors to develop and leverage OGD, and how to cultivate an OGD culture in the organization at the behavioral level. The latter may apply models of e-government applications (i.e. the technology acceptance model, the theory of reasoned action, the unified theory of acceptance technology and use of technology) in order to draw a conceptual framework to study why and how individuals will recognize the importance and benefits of OGD and implement it in practice. Further study of OGD in order to improve public administration will provide better, sounder, and smarter governance by making better evidence-based public policy, detecting fraud and errors, improving efficiency, reducing costs, and better understanding and forecasting social problems, needs, and trends.

ACKNOWLEDGEMENTS

My sincere goes appreciation to my advisor, Associate Professor Dr. Nuttakrit Powintara, for inspiring me with this research topic and for his mentorship. My wholehearted gratitude also goes to Professor Dr. Voradej Chandarasorn, Associate Professor Dr. Danuvas Sagarik, and Professor Dr. Anchana Na Ranong for their insightful feedback and critiques. Their academic expertise has helped me to develop my dissertation and research skills. My appreciation is also extended to Dr. Surachai Srisaracam and Dr. Sak Segkhoonthod as the key informants about Thailand's OGD situation. Thank you to my classmates and to the Ph.D. program staff for being part of my journey.

Importantly, I am extremely grateful to my parents for everything. My wholehearted gratitude goes to them, and to my sister, my brother, my relatives, and my friends for believing in me, encouraging me, and supporting me. My completion could not have been accomplished without their love, care, and prayers. Lastly, I just want to thank myself for never stopping believing in myself, thanks for never giving up, thanks for never stopping trying, thanks for never making excuses, thanks for all the hard work, and thanks for making it happen. This is the beginning. I will be more diligent, work harder, improve myself, and keep learning so that I can use my abilities to benefit society further.

Thalinee Sangkachan

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance of the Research

1.1.1 Significance of the Research

A country's development is now entering Industry 4.0, which is perceived as the fourth industrial revolution. This revolution has been driven by advanced technology, such as the Internet of things, the cloud, social media, Blockchain, mobile Internet, and robotics, which are driven by algorithms of machine learning (Marr, 2017; Schwab, 2016). Technology has been improving all the time, and this revolution has introduced the notion of the smart factory and smart system. The word "SMART" not only means intelligent, wise, or clever, but in this context as an acronym, it also means the following: S refers to start with strategy, M refers to measuring metrics and data, A refers to applying analytics, R refers to reporting results, and T refers to transforming business and decision-making (Marr, 2015). In order to achieve that smart meaning, advanced technologies produce the amount of data that allows computers or advanced technologies to communicate with each other and with humans. As the amount of data grows, the ability of computers to learn, understand, and respond has also increased (Marr, 2017). According to Mayer-Schonberger and Cukier (2013), data are the fundamental fuel to work, live a life, and for learning in the insight age.

Data are at the heart of this era of revolution (Marr, 2015). Data in themselves are not a new invention. Before computers and database development took place, governments continued to use data to track down actions using paper records. They had to select, however, what data should be collected, because of the burdensome quality of data collection. All of the data were reported with paper and entered by hand to create a database. Although there might have been several databases, those

databases could not be linked or integrated. Further, manual databases produced many errors and required time to manage them (Esty & Rushing, 2007; Marr, 2017).

As a result, it left large holes in monitoring and evaluating government activities. However, advanced technology nowadays makes a data driven government possible at a low cost. Paper is no longer required for reporting or for gathering data. Advanced technology allows us to collect, store, and organize data in large and in-depth ways in an easily accessible way. In the modern world, data are available and accessible with one click of a mouse, and data can be generated through many sources of digital technology, they can be created anywhere, and can be stored in a structured or unstructured format. Throughout advanced technology, data can be analyzed, and integrated according to various types. Data now cover everything from spreadsheets to photos, voice recordings, videos, texts, and data sensors (Marr, 2017). There is an estimation that data will have grown from about 5 zettabytes today to 50 zettabytes by 2020 (Marr, 2017). Additionally, the shock value of the recent prediction by the research group International Data Corporation reveals that the data sphere in the world will increase to 1 6 3 zettabytes (zettabytes is a trillion gigabytes) by 2 0 2 5 (Reinsel et al., 2017). Data never sleeps. We leave a digital footprint or trail in almost every action we take-browsing online, shopping with a credit card, sending an e-mail, texting, uploading or posting on social media such as Facebook, YouTube, Twitter, Instagram, taking photos, reading articles online, even walking down the street if we carry a cell phone or have a CCTV nearby (Marr, 2017). The influence of data spans nearly every aspect of modern life, from healthcare to our political elections. As we analyze data better, our ability to predict becomes better. We can also make specific recommendations based on those forecasts.

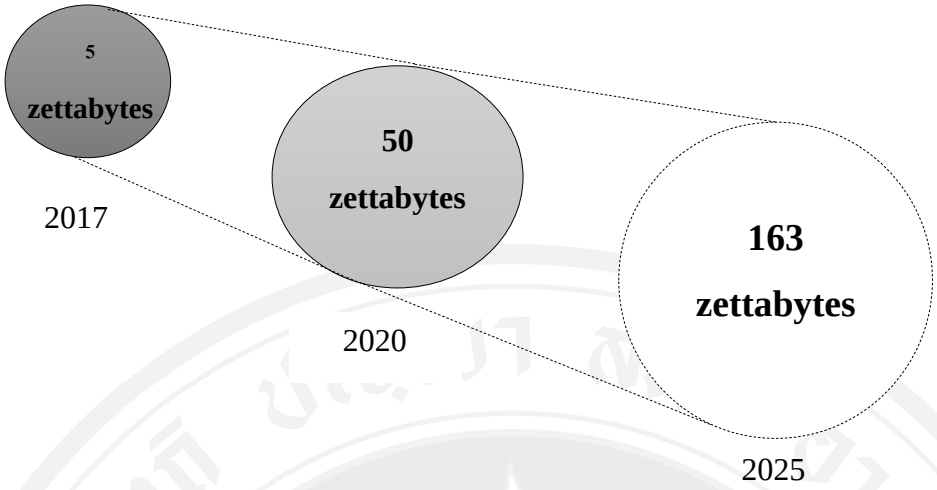


Figure 1.1 Projected Growth of Data in the Age of Digital Technology
Source: Marr (2017); Reinsel et al. (2017)
Note: 1 zettabytes = 10^{21} bytes = 1 trillion gigabytes.

In the business world, data are already revolutionizing the way in which companies operate. (Marr, 2017). Likewise, in the private sector, advances in technology have made governments digitized. Data, so-called open government data (OGD), are now revolutionizing the bureaucratic system. In terms of administrative technology, many governments may be familiar with E-government, which has brought about changes in delivering public services. However, this cannot be applied to all government systems-policy formation, planning, budgeting, implementing, and evaluating. Using or reusing data is not only about making the same things better, but also realizing how to eliminate redundancy, concentrating on problem-solving, and accepting a customer-centered perspective through leveraging data (Höchtl et al., 2016). A data analytic will improve government processes, reduce paperwork, and offer better-integrated data, and this will facilitate the linkages among government agencies and will eliminate filling out the same information repeatedly. Furthermore, services provided to the public will be more proactive as a result of predictive analysis based on both direct data and comparisons from similar services.

Importantly, using OGD provides better decision-making. Although the idea that government decisions should be based on data is not a new idea, what is new is the open door that has been created by data in this era. Data driven decision-making

empowers and enables us to concentrate on our most serious issues-problems or needs, effectively and equally allocating resources, designing reasonable and reliable policies that suitably focus on specific and appropriately targeted goals, and producing the desired outcomes (Esty & Rushing, 2007). For now, data driven governments have gained attention. Leading countries have collected and employed OGD in their operations. By publishing and releasing OGD to the public, public agencies will become more transparent and accountable. Moreover, by empowering the utilization of OGD, governments will advance business creation, innovation, and especially citizen-centric services (OECD, 2018).

Data have been applied in driving public services for a long time. In 1966, the Congress of the United States established the highway safety act and coordinated the making of a data system to identify possible causes of accidents, injuries, and deaths (Esty & Rushing, 2007). In 1994, the police department of New York addressed a computerized system-"CompStat"-"to track and map crime by neighborhood" based on crime data. The police department reported that police can more effectively deploy limited resources by joining numbers and carefully monitoring performance based on geographic data and targeting patrols in problem areas (Esty & Rushing, 2007). For more than 40 years, the United States internal revenue service (IRS) has used data analytics to improve operations. The IRS has also used the data to understand taxpayer behavior, educational needs, and service needs (IBM, 2015). In 2012, Obama powered electoral campaigns with data analytics. A team of over 100 data analysts was tasked with performing over 66,000 computer simulations every day. Electoral campaigns can deliver targeted messages through email, social media posts, and browser display ads. Over the years, all parties and most applicants have enthusiastically launched analytical strategies (Marr, 2017). In 2018, the White House began creating strategies to unlock federal data and to make the government more effective and efficient. In other words, the White House is utilizing data as a strategic asset. In its view, leveraging OGD can modernize the government to improve services, reduce fraud, and foster private-sector market activity (Kent et al., 2018).

Another example is the currently well-known notion of smart city. Generally, this notion may require various highly and advanced technologies but governments both at regional and municipal levels are challenged with flat or decreased funding as

well as limited staff size and skills to support the efforts of becoming a smart city. The solution is to utilize the available data to obtain a better view of identifying opportunities to make public service delivery more efficient, and also to engage key actors and stakeholders in OGD development (Cotton, 2015). For example in London, England the report of Gravestock (2017) on data driven government discusses many government programs that were successfully implemented through applying OGD, such as the processing of a smart city, and transport for London (TfL) services where a large amount of data can be fed to complex models, as well as potential connections to provide messages that are “just right” for the passenger. This will enable the city to become innovative and smart. OGD are thus essentially the fundamental basis for driving cities to become “smarter”. This capability supports smart city initiatives, making advanced services accessible from virtually any city. These examples show that performance can be dramatically improved by utilizing OGD, which will guide how to make public decisions, implementation, evaluation, and improvement. Data collection and reviews in real time would allow governments to detect and perceive problems before they mushroom. The overall idea of how OGD drives a city to become smarter is presented in Figure 1.2.

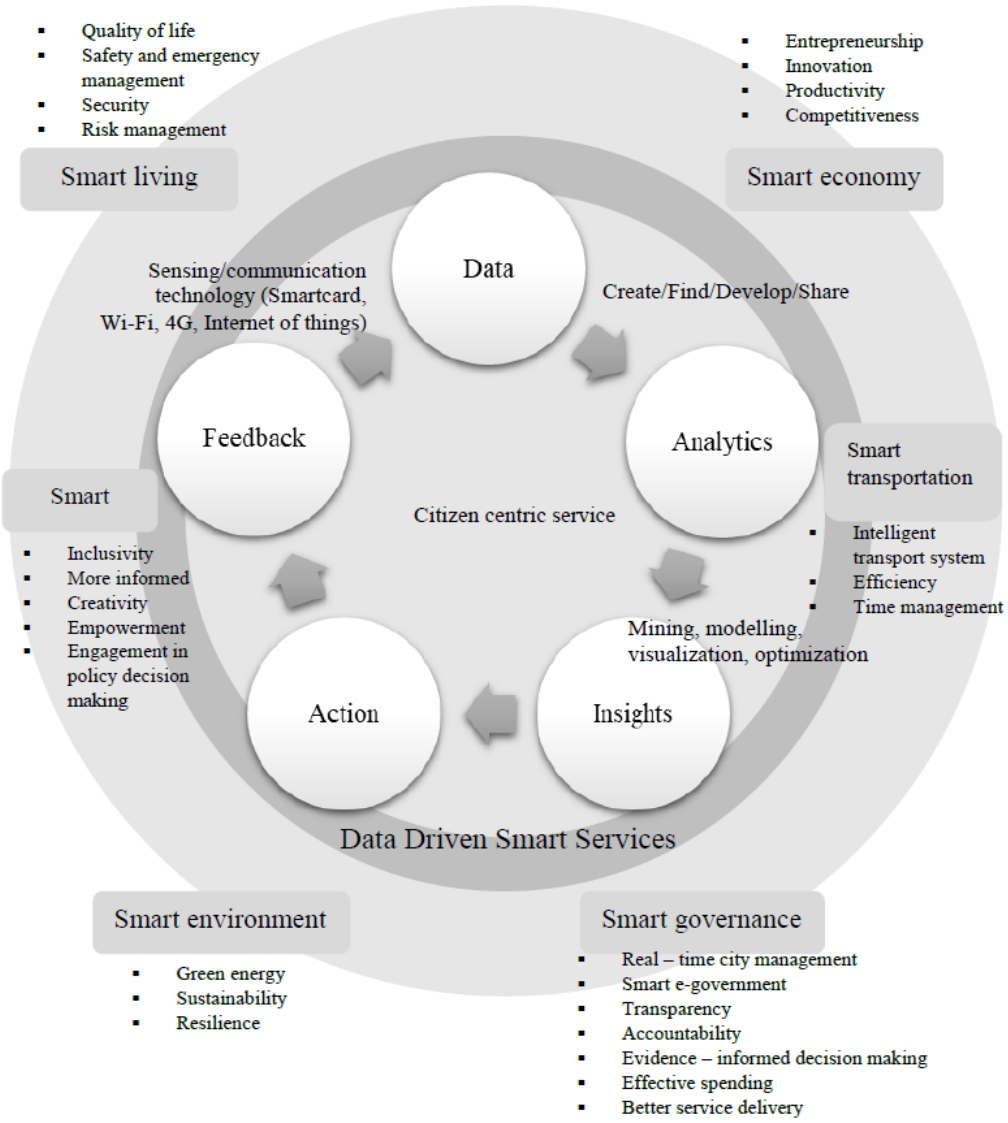


Figure 1.2 How Data Drive a City to Become Smarter

Source: Adapted from Anthopoulos (2017); Chen, Wang, & Guo (2016); Moustaka, Vakali, & Anthopoulos (2018)

Nowadays, how OGD and its analytics enable governments to improve public services and gain desired outcomes are recognized by all levels of public agencies (Chawda, 2017a). Governments that apply OGD as a strategic resource or asset can unleash the power of OGD to improve better, deeper, faster, and more insightful services (Chawda, 2017a; Cotton, 2015; Marr, 2017). More importantly, it will survive and thrive in governments under the rapidly changing wave of digital

technology (Marr, 2017). Data driven governments take all important decisions that are accessible whenever and wherever needed (IBM, 2015).

However, although OGD are certainly exciting, revolutionary, and can enhance the government's opportunities to provide effective public services, OGD are a technological challenge for governments, especially those governments that have always been fighting large-scale data systems and technology projects (Höchtl et al., 2016). Having more data does not always mean that the data are useful. To be truly useful, are is a must for performance that will help achieve their strategic goals and generate real value results (Marr, 2017). Without a smart action plan to use data to generate insights into public services, data can become an expensive and useless "white elephant." So, if governments want to avoid confrontation with overwhelming data or lack of data, they need to develop smart strategies (Marr, 2017). Moreover, it is a particularly serious challenge that governments have long faced a shortage of information technology skills and the complex skill sets required for data analysis (Höchtl et al., 2016). Especially, the perceptions among executives are still based on information technology (IT) matters, not the data themselves. In this regard, the OGD strategy tends to heavily focus on data storage, rather than on achieving the long-term strategic goals of organizations, which OGD can help with. Furthermore, governments have been challenged in modernizing and redesigning policy based on citizens' needs and viewpoints. This is a cultural challenge rather than a technological challenge. In order to standardize and integrate operations, public managers have to embrace long and difficult tasks. They will have to reframe the delivery of services to citizens. They must make all of their decisions and actions more visible. OGD systems need to be very reliable and stable for successful cyber-physical operations (Marr, 2017). These important problems and challenges show that government capability is required for using OGD in governments to offer and provide public services in a better way.

1.1.2 The Current State and Gaps in Knowledge

According to Schwab (2016), the most important thing for us at the very beginning of a revolution that is changing our lifestyles, work, and relationships with each other is to understand the new technology and the revolutionary data forms that we have yet to fully understand. The existing academic discourses, debates, and literature of the data driven approach have been most studied in the private sector. In contrast, the study of the data driven approach in the public sector has focused on specific areas in case study, and regarding events or development programs.

Since OGD are in the early development stage, it has been developing and discussed in research and conceptual papers (Höchtl et al., 2016). For example, Höchtl et al. (2016) seek to bridge OGD and the public policy process that goes beyond service-based approaches to a new perspective on data-based policy decisions and data driven development. Based on reviewing the relevant literature, the current research topics can be divided into two sides: (i) the supply side, such as searching for the factors influencing the development of OGD, and the quality of OGD; and (ii) the demand side, such as seeking for a capacity to reuse OGD and the impacts of OGD. Although there is growing related research, the two sides have been studied on a specific issue within one side. For example on the supply side, a group of scholars, Liu et al. (2011), Maurino, Spahiu, Batini, and Viscusi (2014), Solar, Concha, and Meijueiro (2012) specifically studied the quality of OGD. Some groups of scholars, Blauer (2017), and Marr (2017), have only focused on how data security influences the development of OGD. For example on the demand side, research has also been done on specific issues. A group of scholars or experts, for example Blauer (2017), Hansson, Belkacem, and Ekenberg (2015), and Kornberger, Meyer, Brandtner, and Höllerer (2017), only focused on how administrative cultural transformation can help a government reuse OGD. Other issues have been studied in a specific way-focusing on OGD management, government ICT execution, data cooperation, citizen engagement in OGD, and government support. Examples of research are presented in Table 1.1.

Table 1.1 The Current State of Research Topics

The current state of research topics		Examples of works
Supply-side	Factors influencing the building of OGD	▪ Information and communication technology (ICT) (i.e. Lane (2018); Meyer, Mok, and Sullivan (2015)) ▪ Information security (i.e. Blauer (2017); Marr (2017)) ▪ Trust in government (i.e. Henderson & Applewhite (2017); Spavin and Fegan (2017))
	Quality of OGD	Liu et al. (2011); Maurino et al. (2014); Ubaldi (2013); World Wide Web Foundation. (2016); Solar et al. (2012))
Demand-side	Capacity to reuse OGD/unleashing the power of OGD	▪ Administrative cultural transformation (i.e. Blauer (2017); Hansson et al. (2015); Kornberger et al. (2017)) ▪ OGD management (i.e. Thorsby, Stowers, Wolslegel, and Tumbuan (2017); Wessels, Finn, Sveinsdottir, and Wadhwa (2017)) ▪ Government ICTs execution (i.e. Alderete (2018); Reggi, Luna-Reyes, Gascó, Martin, and Pyo (2018); Zhao and Fan (2018)) ▪ Data cooperation (i.e. Danneels, Viaene, and Van den Bergh (2017); Wessels et al. (2017)) ▪ Citizen engagement in OGD (i.e. Hivon and Titah (2017); Mellouli et al. (2014); Ruijer, Grimmelikhuijsen, and Meijer (2017); Zuiderwijk and Janssen (2014)) ▪ Government supporting (i.e. Reggi et al. (2018)) ▪ Research and development (i.e. (Doar and Gibbs (2017); Frith (2017); Lane (2018))

The current state of research topics		Examples of works
Demand-side	Utilities of OGD	▪ Social impacts (i.e. Parkes and Costello (2018)) ▪ Economic impacts (i.e. Heimstädt, Saunderson, and Heath (2014); Young and Verhulst (2016)) ▪ Government effectiveness (i.e. Lewis and Perricos (2013); Scott (2017); Ubaldi (2013)) ▪ Transparency and accountability (i.e. Peixoto (2013); Scott (2017); Ubaldi (2013); Verhulst (2016))

1.1.3 Problem Statement of This Research

All the mentioned literature shows the current research topics on both the supply and demand sides. However, both of them have only focused on a specific side or only on a specific issue. Yet, despite the growth of research on both the supply and demand sides, little is known about how those supply and demand sides are linked, or how they influence each other. More precisely, little is known about what kinds of preconditions influence building or improving OGD. Little is known about how preconditions influence the building or improving of OGD when the preconditions are included together. Importantly, although there is little conceptual knowledge or research about the capabilities to unleash the power of OGD, little is understood about how to use OGD. Even though the real-world examples are often presented to show the potential of data, knowledge of how OGD works in practice still has knowledge gaps.

Our knowledge and understanding of how OGD is transformed to make valuable impacts in practice are lacking. There is so little systematic research studying OGD's practical effects. Thus, this research seeks to build a more progressive study of OGD in terms of building and reusing OGD. In order to unlock the mechanisms that can clarify how OGD will unleash its value, this research applies a critical realist approach to the analysis.

1.2 Research Questions

Using OGD as a strategy to improve business both in the public and private sectors is still ongoing in discussion and research. Government capacities are fundamentally essential for governments to promote, build, and apply their OGD in order to enhance their performance (Cotton, 2015; Esty & Rushing, 2007; Gravestock, 2017; Höchtl et al., 2016; IBM, 2015; Marr, 2017; Mayer-Schonberger & Cukier, 2013). Therefore, based on the importance of OGD, its challenges, and the existing knowledge gaps, simple but very important questions can be raised: "What determinants influence the development of OGD?" and "How can governments use their OGD to enhance their performance?" In order to answer these questions with thorough explanations, this research will include three sub-questions:

(I) What are the determinants of the development of OGD?

(II) Does OGD enhance government performance? If so, how?

(III) Does OGD require government capacity to mediate and expand government performance? If so, what are the essential variables of government capability activating or mediating the impacts of OGD? More precisely, what are the government capabilities that mediate the relationship between OGD and government performance? How do these capabilities relate to OGD and government performance?

1.3 Research Objectives

1.3.1 To perceive the essential preconditions influencing the development of OGD

1.3.2 To investigate how governments implement OGD principles

1.3.3 To explore how governments unleash the power of OGD and what government capacity is required for that purpose

1.3.4 To investigate how OGD affects country development in terms of economic, social, and governance impacts

1.3.5 To provide policy recommendations for improving OGD and unleashing the power of OGD

1.4 Terminology

1.4.1 OGD refers to data and content that are freely used, modified, and shared by anyone for any purpose.

1.4.2 The pre-requisites for building and improving OGD refer to the essential factors that influence building and improving OGD. The essential factors that influence building and improving OGD include: (i) information and communication technology infrastructure, (ii) data security, and (iii) trust in government.

1.4.3 Government capacity refers to the required abilities of the government to use and apply OGD to improve government effectiveness. This includes: (i) administrative cultural transformation, (ii) the policy of OGD, (iii) the management of OGD, (iv) data cooperation, (v) government support, (vi) research and development, and (vii) citizen engagement.

1.4.4 OGD impacts refer to social impacts, economic impacts, and governance impacts.

1.4.5 Political instability refers to a sudden and significant change or disorder in the leadership, policies, or disturbance within a country that may be a loss of control.

1.5 The Contributions of This Research

Under the rapidly changing wave of digital technology, humanity is now facing dynamic challenges in a more complex and linked world. The new advanced technologies completely challenge the procedures of the decision-making regarding public policy in new ways. It is also the biggest challenge to academics. Digital technology will change how we will obtain OGD or gain knowledge. It is an opportunity for countries around the world to make dramatic changes and differences in the life of citizens. Although OGD have been the most popular trend in the business world throughout recent years, it is still an early phenomenon and a relatively new topic. Although OGD in government is an especially actively discussed topic, governments are very slow to recognize the power of OGD in improving policy formulation, administrative efficiency, and public service.

As long as such questions remain unanswered, there is a tendency to suffer from a disparity between the supply and actual demand sides of OGD. This mismatch may

have increased the costs of developing OGD. Furthermore, it may limit the potential impacts of OGD itself to produce changes in terms of social, economic, and government outcomes, such as transparency and accountability. Governments will need to move fast in order to gain benefits of OGD by positioning themselves both to promote and leverage the flood of OGD. This research will be most beneficial for governments in applying a data driven approach to improving governments' performance.

CHAPTER 2

LITERATURE REVIEW

Relevant concepts, theories, previous research, case studies or empirical examples, discussion, and conceptual papers are comprehensively reviewed in this section. This chapter incorporates (i) the fundamental concept of data driven government that explains the importance of OGD to improve government performance; (ii) the preconditions influencing the development of OGD; (iii) the impacts of OGD on government performance; and (iv) government capability for unleashing the power of OGD. The details are as follows.

2.1 Data Driven Government and Open Government Data (OGD)

In the age of digital transformation, governments have paid more attention to digital technology-based development. In particular, many governments have understood the growing importance of the value of data as the key strategic asset and the key foundation for better public policy, service delivery, and consistent performance management (OECD, 2019). The use of data for such purposes is not new, but it has now been gaining interest in an age of technological transformation where massive amounts of data can be produced, stored, and analyzed (Wiseman, 2018). Data driven governments refer to the use of data, which may be used together with advanced technologies, for all governmental critical decisions, public services, administration, process optimization, and challenges for society (Lutes, 2015; Thapa, 2019; van Donge et al., 2020). The Organization for Economic Co-operation and Development (OECD) uses the term “data driven public sector” (DDPS) (OECD, 2019), referring to the public sector that recognizes “data as an asset, integral to policymaking, service delivery, organizational management and innovation”
(Ubaldi, Van Ooijen, & Welby, 2019).

Driving a government with data provides better and sounder governance by making better and smarter decisions, providing better evidence-based public policy with predictive analytics, forecasting needs, simulation, and real-time management systems (Thapa, 2019), optimizing and detecting fraud and errors, improving public service based on insights, improving efficiency, reducing costs, and improving the public's life quality (Lutes, 2015). Governments that strategically implement data across the public sector will be able to better predict trends and social needs and to achieve more sustainable development. With this importance, data have the potential for playing a role in the ongoing digital transformation of governments. The following sections will provide fundamental knowledge concerning OGD in governments in terms of its definition and principles.

2.1.1 OGD for Improving Government Performance

In the digital era, humanity has entered into a dramatically changing period that has resulted from the widespread use of digital technology. One of the outputs from digital technologies that will challenge and influence the development of governments both in theoretical and practical approaches is "data." Developing advanced digital technologies and analytical tools can produce data in abundant quantities: "data are at the heart of a revolution" for modernizing and digitizing governments (Marr, 2017). The amount of data can be generated through communication between citizens and governments, or between citizens and citizens, which can leave digital traces. Governments play a particularly important role in providing and releasing government data to the public since such government data belongs to the public declared by law. Government data are available for both governments and other sectors to access and to leverage (Open Knowledge Foundation, 2012).

The data in governments are so-called "open government data," as indicated earlier. There are various meanings of the term as defined by scholars and central governments. For example, the White House states that the "OGD format would be platform-independent, machine-readable, and made available to the public without restrictions that would impede the re-use of that information." Reiche and Höfig (2013) indicated that "OGD only refers to data that is available free of charge for the

general public without any limitations." Kalampokis, Tambouris, and Tarabanis (2011) proposed that the definition is "making public sector information freely available in open formats and ways that enable public access and facilitate exploitation," while Kassen (2013) defined OGD as "an official web-portal launched at the federal or local level aimed at making certain types of governmental datasets publicly accessible via the internet in a machine-readable format." In international organizations that measure OGD, the World Wide Web Foundation (2017) provides the "Open Data Barometer Global Report" (http://www.opendatabarometer.org) and the Open Knowledge Foundation (n.d.) provides the global open data index, and they use a very simple definition of OGD: "OGD and content can be freely used, modified, and shared by anyone for any purpose." It can be concluded here that there are no single agree-upon principles of OGD but those mentioned definitions are quite similar. In this regard the definition of OGD for this research will follow the definition that is defined by the international organizations, that is, OGD refers to data and content that is freely used, modified, and shared by anyone for any purpose.

With advanced technologies, governments are entering into an increasingly rich data environment. The idea of using data in the public sector has obtained increased attention in the digital era (KPMG, 2017; Wiseman, 2018). Data driven government is an approach of using the power of data to empower the government to be more citizen-centrally focused through being concerned about their needs, complaints, viewpoints, and empirical experiences from public services. It also aims to be more reasonably focused on the biggest problems, to more efficiently and equitably allocate resources, and to have more insightfully actionable policies as well as offering public services that are appropriately and responsively targeted to produce desired results. For example, the White House started initiating a strategy to unravel federal data that will enhance the quality of government service delivery, release government policy, unleash values and job areas in the United States economy, and make the United States government more effective and efficient overall (Kent et al., 2018). In other words, the White House is leveraging data as an asset. In view of the White House, leveraging data can modernize the government to improve services, reduce fraud, and foster private-sector market activity.

The emerging landscape of “data” in the digital era proposes to transform how governments perform in all aspects-policy formulation, policy implementation, policy evaluation, and policy improvement. Traditionally, the policy formation process was essentially based on the political aspect. With the occurrence of advanced technologies, it helps to reduce time and increase empirical evidence for policy decisions. The growth of advanced technology can lead to possibilities in changing the way that policymaking is acknowledged and performed. Operating governments’ performance can be reasonable by using data to drive governments that can provide a framework for utilizing scientific evidence. Using data to drive governments is seen as “a framework for utilizing scientific evidence” in operating governments’ performance.

In this regard, data provide opportunities for more citizen-focused policy-making and actions, taking into account the needs of citizens and the real-life experiences of public service (Höchtl et al., 2016). Public service will be reframed based on citizens since all of the governments’ actions will be more visible. More precisely, policymakers have chances to make easier policy analyses, decisions, implementations, evaluations, and in particular obtain real-time feedback. Through being driven by data, public policy will go beyond the idea of e-government that specifically focuses on service delivery into the process of public policymaking as a vehicle that increases productivity due to improved data-processing capabilities.

For example, a policy could be formulated through the amount of data on citizens’ needs, viewpoints, and actual behaviors, as they would be digitally recorded whenever they communicate and interact with their governments. In policy implementation, the data released by digital technology will provide a real-time view of new data which will enhance the ability of government agencies to continue to monitor and improve their operations while executing policies. Through this understanding, governments enable their agencies to learn and develop how they work and redesign their service programs accordingly. In evaluating public policy, the policy cycle will be newly shaped through data analytics. Employing data analytics, an evaluation will be carried out in real-time, continuously, openly, with evidence and with reassessment evaluation. This evaluation will not be performed at the end of the policy process but is an ongoing process. This will change the whole policy cycle;

that is, policy evaluation will be a part of every policymaking step. This continuous evaluation will be formative since it happens during all policy processes. Additionally, it can be a summative evaluation because it relies upon a rational model. In policy improvement, the data driven decisions on how to allocate, provide, and support necessary resources and finances for implementing new or redesigned policies can be improved. Decision-making will be more rational if previous policy impacts and experiences can be analyzed in detail.

2.1.2 The Principles of OGD

There is a number of studies that explain the principles of OGD, such as those of Liu et al. (2011) and Solar et al. (2012), who proposed eight basic principles: (i) complete—all available public data that are not subject to privacy, security or privilege limitations are made available; (ii) primary—data are made available as they are available at the source, and not aggregated or modified; (iii) timely—data are made available to the public as soon as possible after the actual data are created, in order to preserve the value of the data; (iv) accessible—data are made available to as many consumers as possible, and with no limitations on their use; (v) machine processing—data are published in a structured manner to allow automated processing; (vi) non-discriminatory—data are available for all to use, without requiring any registration; (vii) non-proprietary—data are published in a format which is not controlled exclusively by a single entity; and (viii) license-free—other than allowing for reasonable privacy, security, and privilege restrictions, data are not subject to any limitations on their use due to copyright, patent, trademark, or trade secret regulations.

Previous studies found that most resources released by a government on websites are informational, not granular data; only a small percentage of granular data is open properly. This severely limits OGD utilities (Wang & Shepherd, 2020). The study of Maurino et al. (2014) found that OGD should be granular data or raw data released with applying the principles of OGD to be further leveraged. Completeness takes into account the availability and accessibility of data in terms of a standardized format (Maurino et al., 2014). Moreover, the international organizations that measure OGD use similar principles of such data for measurements. For example, the World Wide Web Foundation (2017) uses (i) completeness, (ii) timeliness, (iii) machine

readability, (iv) use of commonly owned standards/ease of physical and electronic access, (v) non-discrimination, (vi) free of charge, and (vii) openly licensing/ license-free. Additionally, Open Knowledge Foundation (n.d.) uses six principles to measure the data, including: (i) timeliness, (i) machine readability, (ii) downloadable at once, (iv) non-discrimination, (v) free of charge, and (vi) openly licensing. Based on this literature, it can be concluded that there is no single agree-upon principle of OGD. OGD are commonly perceived according to the seven principles as shown in Table 2.1.

2.2 The Preconditions Influencing the Development of OGD

Based on the literature and previous research, there are three major preconditions that governments must recognize before accomplishing a data driven government.

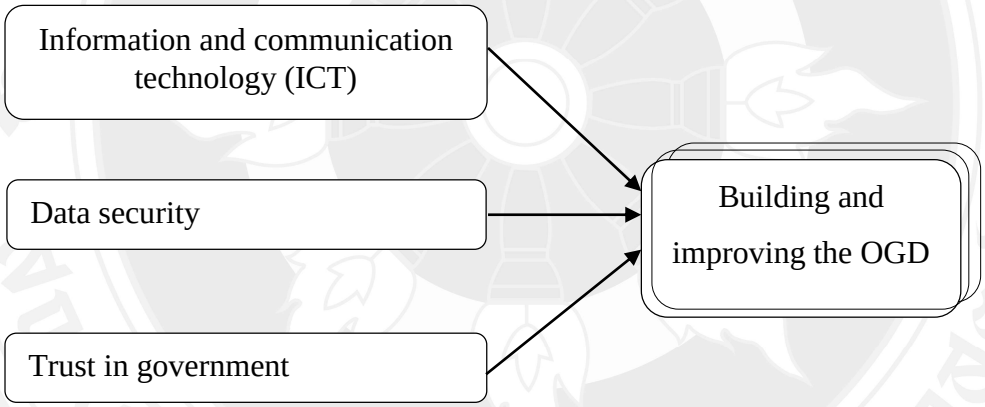


Figure 2.1 The Three Major Preconditions of OGD

Table 2.1 Overview of OGD Principles

Components	Description	References
1. Completeness	"All public data are made available. All available public data that is not subject to privacy, security, or privilege limitations is made available. Data are made available as it is available at the source, and not aggregated or modified."	Liu et al. (2011); Maurino et al. (2014); Solar et al. (2012); Ubaldi (2013); World Wide Web Foundation, (2017)
2. Timeliness	"Data are made available as quickly as necessary to preserve the value of the data. The extent to which the data or metadata is up to date."	Liu et al. (2011); Maurino et al. (2014); Open Knowledge Foundation (n.d.); Solar et al. (2012); Ubaldi (2013); World Wide Web Foundation (2017)
3. Machine readability	"Data are reasonably structured to allow automated processing. The data must be provided in a form readily processable by a computer and where the individual elements of the work can be easily accessed and modified."	Berners-Lee (2006); Liu et al. (2011); Open Knowledge Foundation (n.d.) Solar et al. (2012); World Wide Web Foundation (2017)
4. Use of common standards/ open format	"Develop and use uniform, unique identifiers and data standards in open format to ease the flow of data and reduce system complexity. Open-format	Berners-Lee (2006); Liu et al. (2011); Solar et al. (2012); World Wide Web Foundation (2017)

Components	Description	References
	places no restrictions, monetary or otherwise, upon its use and can be fully processed with at least one free/open-source software tool."	
5. Free of charge	"The data must be provided and should be downloadable via the Internet without charge. The data must not impose any fee arrangement, royalty, or other compensation or monetary remuneration as part of its conditions."	Open Knowledge Foundation (n.d.); World Wide Web Foundation (2017)
6. Openly licensing/ license-free	"The data must be in the public domain or provided under an open license. Data are not subject to any copyright, patent, trademark or trade secret regulation."	Berners-Lee (2006); Liu et al. (2011); Open Knowledge Foundation (n.d.) Solar et al. (2012); World Wide Web Foundation (2017)

2.2.1 Information and Communication Technology Infrastructure (ICTI)

The infrastructure of ICT is the fundamental need for building government data. Developing government data comes at a price. Although there is a motivation of governments to use data analytics, the things that make the differences are investment and skills within governments. Such infrastructure should be built with a careful cost-benefit balance that encompasses full community involvement. If the infrastructure is well designed, agencies can better manage and develop their data systems (Lane, 2018; Meyer et al., 2015; O'Flaherty & Maloney, 2017). For example, if any government needs to know the opinions of the public, using administrative databases to subrogate survey questions or to enhance the results of the survey will reduce any burden—response measurement errors, and nonresponses at the unit and item level. Operational costs for paying taxes will be decreased to save taxpayer dollars. Further, data can be used to track programs or project participants across such interventions, across agencies, and across time and areas (Lane, 2018). Using administrative data, governments can achieve significantly increased quality by simply making their programs and projects more efficient and effective (Lane, 2018; Meyer et al., 2015).

According to Lane (2018), information and communication technology infrastructure is the necessary equipment and infrastructure for an economy or an organization to function properly. Young and Verhulst (2016) indicated that the significant condition that enables the enhancement of data impacts is OGD infrastructure. They state that many of the most effective data projects are generated from proper infrastructure. It is the technical backend and organizational process needed to be able to regularly disseminate potentially impactful OGD to the public. There is developing advanced technology for OGD. Alexopoulos (2016) attempted to describe it as an open government infrastructure involving ICT infrastructure developed by a government agency to make OGD accessible by various actors as an architecture of data for archiving and providing data accessibility. New and advanced technology enables the utilization of data created by public agencies and automatized application services (Pereira et al., 2017). For example, the platforms of open data can be utilized as an instrument to investigate important data, to recognize and detect connections, and to analyze a mountain of real-time data; the platforms make it

workable for individuals to become associated with and involved in the procedures of their government and this unleashes the value of data together for society (Agrawal et al., 2014). Data published through the OGD platform help people more effectively and easily learn about government activities. It also creates a platform with which people can complain about their problems, and communicate and convey their opinions, representing an expansion of their greatest advantage in effectively and proactively overseeing the government process. With such development of new or advanced technologies, although there is rare advanced technology for OGD, it still requires an effort to develop such advanced technology because higher levels of information and communication technology development are associated with higher levels of economic and social activities (Alderete, 2018).

However, because governments sometimes cannot spend trillions of dollars on information and communication technology infrastructure, they will establish cooperation between the public and private sectors (O'Flaherty & Maloney, 2017). Such infrastructure can release useful data that make countries function with higher quality through accessing, reusing, and applying data. In order to build and develop ICT infrastructure, researchers, policymakers, and government agencies must work together to ensure that the country is well served with the proper data infrastructure (O'Flaherty & Maloney, 2017). Additionally, collaboration for such infrastructure requires the engagement of society in practice as well. Moreover, in order to develop appropriate infrastructure for data use, a good and true data infrastructure must be sustainable and its results must contribute to the development of the broader society it serves. Without value and social sustainability, the infrastructure will be meaningless (Lane, 2018). The ICT infrastructure is a long-term investment in nature. Therefore, financial sustainability must be gained with careful and flexible attention. Based on the literature review and previous research, the hypotheses proposed in this study are discussed below.

H1: Information and communication technology infrastructure positively influences building and improving open government data.

2.2.2 Data Security (DS)

The discussion on government data is still ongoing regarding privacy and data protection. According to O'Flaherty and Maloney (2017), as data reuse is fragile, privacy and data protection must be strictly protected. Using data may at the same time pose a danger or risk in terms of privacy issues. The value of data utilization and data security has to be balanced (O'Flaherty & Maloney, 2017). A poll produced by the OECD (Spavin & Fegan, 2017) indicated that citizens believe "data security to be the biggest challenge faced by the public sector in collecting and using data."

With this risk, the United Nations is aware of and is currently providing a set of important basic policies to help deal with this risk (O'Flaherty & Maloney, 2017). According to Huang, Liao, Liao, and Chen (2020), the perceptions of the risks of a government regarding OGD accountability positively affect inducing strategic workarounds when implementing OGD policies. Although protecting privacy is up to each government according to its policies, the issue of individual privacy around the world is always of concern by citizens with the expectation that government should be prudent in protecting it. Privacy information should be carefully protected and be carefully made publicly available (IBM, 2015). In this regard, governments should design their legal frameworks to both protect privacy and encourage data sharing to be useful for redesigning public services, research, and policy development. In practical terms, legal expertise is needed for countries to help understand and clarify the importance of protective laws as well as give importance to the values and potential impacts of data sharing. Legal and policy frameworks for the sharing of data between entities and the public must be protected in an appropriate way when using or changing restricted data (Blauer, 2017).

The issue of data security will increase whenever governments add or integrate new systems and access to such systems. For this reason, great reliability and stability of the system are needed for successful data-sharing operations (Marr, 2017). For the coming future, data security issues should be a top priority for governments to assure the public that the sharing of data is safe. With this occurrence of advanced technology, it is an opportunity for governments to overcome this fear of information security. To convince and encourage citizens regarding the results and values from data sharing, an explicit legal system for information security and the

potential values of data needs to be promoted and understood. This prerequisite will lead citizens to be more open minded, which is necessary to drive future government (Spavin & Fegan, 2017). Therefore, information security is one of the important prerequisites for improving OGD. Based on the literature review and previous research, the following hypothesis is proposed.

> H2: The higher the data security, the better has open government data been built and improved.

2.2.3 Trust in Government (TG)

In order to improve the quality of data to develop public services based on a citizen-centric approach, governments need access to more personal data (Spavin & Fegan, 2017), and such a need has increased nowadays. However, governments face difficulties in accessing such data. In contrast to the private sector or business unit, "citizens now voluntarily share data with the private sector rather than the government" (Gravestock, 2017). Gravestock (2017) pointed out the reasons for this situation; it is because the private sector is better at accurately determining the value of data. Once the data are received, the private sector maintains, organizes, and shares them efficiently within the organization in order to personalize the presentation of a product or service. If done well, customer loyalty and income will increase. In contrast, governments have struggled with accessing such data since governments have played the role of monopolistic providers. Since offering citizens services is generally performed, returning personalized information is carried out to less extent. Frequently, various government branches ask for the same details or information many times. This increases boredom and ignorance on the part of citizens. Data loss, misuse, and inaccuracy have always undermined public trust in the public sector (Chawda, 2017a). The public sector is thus constantly faced with challenges in persuading people to share their personal data (Gravestock, 2017).

An online poll was conducted by KPMG International Cooperative (KPMG International) in 2017 (Gravestock, 2017; Spavin & Fegan, 2017). KPMG conducted Twitter polls (107,924 anonymous votes from the United States, the United Kingdom, Canada, Australia, Germany, and India, with interest in government and civic affairs)

and found that public trust regarding data sharing remains low. Mistrust generally affects confidence in data handling. People love the idea of digital public service, but they are less inclined to share personal data with governments (Chawda, 2017a). In Australia, Unisys (Binsted, 2015), which is a global information technology firm, surveyed 1,210 adult Australians about trust in online security by asking the respondents about the possibility that government agencies would experience a breach of personal data. The study showed low confidence in the government, but citizens' expectations regarding government is still going to continue. Further, in America, the Pew Research Center studied the digital privacy environment there. The results showed that many Americans are afraid of losing control of their data and are worried about the ability of government agencies and corporations to protect the data that the agencies collect. In 2016, the center conducted a national survey with 1,040 American adults (Smithe, 2017) and the results revealed that American citizens think that their data are not secure and many citizens lack trust in public agencies in misusing their data. More precisely, most Americans (64%) have experienced a personal data breach. The public lacks trust in the federal government and social media sites to keep and protect their data.

However, the concept of trust between citizens and states is very complex (Chawda, 2017a). Mistrust of government and politics has generally increased (Gravestock, 2017). While most people feel the government should do more to move online services faster, they are still uncomfortable sharing personal data with the government (Spavin & Fegan, 2017). Therefore, building trust in governments can enhance the efficiency of data collection, analysis, interpretation, and the quality of the data (Chawda, 2017a; Gravestock, 2017; Henderson & Applewhite, 2017; Spavin & Fegan, 2017). Based on the literature review and previous research, the next hypothesis proposed in the study is.

> H3: Trust in government positively influences the building and improvement of open government data.

2.3 The Impacts of OGD

OGD provides opportunities to improve society in many beneficial ways. It is essential for determining the important benefits of the values being produced by OGD. The extensive values of OGD can be divided into three aspects: economic impacts, social impacts, and governance impacts, as follows.

2.3.1 Economic Impacts (EI)

OGD promotes economic growth by providing valuable opportunities, initiating knowledge-based innovations, making better decisions for investment, creating novel products and services, and improving organization process (Bertot et al., 2014; M. Janssen et al., 2012; Tinholt, 2013; Young & Verhulst, 2016). Data have revolutionized how companies operate their businesses (Marr, 2015). The release of government data, such as budgetary, geographic, and geo-spatial data, weather data, and traffic data, can provide citizens and business units with opportunities to create novel and advanced services and innovations (Bertot et al., 2014). Economic benefits can be achieved in many ways, such as growth results, competitiveness, innovation, process improvement, products and services, and they are useful data assets for investors (Janssen et al., 2012).

The key of competitive advantages is nowadays data, which helps a firm have greater ability to compete by leveraging data, applying analytics, and implementing new technologies (Marr, 2017). The emergence of OGD have resulted in the promotion and creation of new products and services and the improvement of existing ones. OGD drives growth by stimulating the creation of companies that freely reuse existing government data in new ways (Tinholt, 2013). OGD can boost the global economy more than $ 3 trillion by initiating marketing activities (Manyika et al., 2013). OGD can drive better decision-making to unlock 5% to 6% higher output and productivity (Brynjolfsson et al., 2011). Besides, for a data driven organization, OGD could create an average of over 30% benefits per year (Hopkins et al., 2018). In the case of the Finnish transport safety agency's data, the estimated gross annual increase in earnings by private companies from OGD utilization yielded a minimum of € 102 million. The estimated total annual value added to the economy through the use of OGD is € 41 million. The industries that benefit the most from OGD policies include “insurance and financial services, marketing, and publishing” (Leviäkangas &

Molarius, 2020). According to Magalhaes and Roseira (2020), the utilization of government data by business units to generate value depends on a company's activities.

Data are a key asset of growth not only for private sector (Marr, 2017) but also for public sector. Empirical research (Heimstädt et al., 2014) has revealed that the United Kingdom has gained many economic benefits by exploiting OGD as both a data user and a data supplier. For example, the report of KPMG (2017) on data driven government indicates many government programs that have been successfully implemented by cooperating with the private sector through applying data, such as the processing of the smart city, and transport for London (TfL) services that were operated using a great deal of data, which can support complex models, capacities, and demands, as well as possible connections to receive the right message for the passenger. Young & Verhulst (2016) provide empirical cases where the organizations have acquired their economic growth through employing such data. This points out that OGD are generating new opportunities for the economy for both citizens and organizations. Further, Tinholt (2013), the vice president of Capgemini, explained the key economic benefit areas include revenue growth, cost savings and improved efficiency, and employment generation while developing skills.

Table 2.2 The Key Economic Benefit Areas

	Driving revenue	**Cutting costs and driving efficiency**	**Boosting employment and developing future skills**
Benefits to public sector	- Increasing tax revenues - Increasing value-added information to business activities	- Reducing transactional costs - Increasing service efficiency	- Creating new opportunities and jobs

	Driving revenue	Cutting costs and driving efficiency	Boosting employment and developing future skills
Benefits to the private sector	- Offering new business activities and opportunities	- Providing better decision making based on data or evidence	- Gaining skilled employees

Source: Adapted from Tinholt (2013). The open data economy: Unlocking economic value by opening government and public data. Belgium: Capgemini consulting.

2.3.2 Social Impacts (SI)

OGD provides valuable impacts for society. Data are an essential part of the quality of policymaking and decision-making processes (Höchtl et al., 2016; Morales et al., 2014). OGD are used to support and enhance public service delivery and make it more efficient. Claire Vyvyan, executive director and general manager at Dell in the United Kingdom, indicated that "joining up public sector data sources can make government more efficient, save money, identify fraud and help public bodies better serve their citizens" (Rutter, 2014). OGD can provide insights and patterns for public policymakers as well as external organizations to make more logical and evidential strategic decisions to deliver efficient and effective services (Parkes & Costello, 2018). McKinsey (2014) pointed out that OGD should be perceived as "data of the people, and for the people." OGD have revolutionized not only how governments help their citizens to participate in their government better, but also how governments can improve their services to be more effective and efficient. OGD holds these promises. For example, when farmers have access to comprehensive and timely price data, they will be able to make better investment decisions in the future. When people can keep track of whether tax revenues are used to provide quality services for everyone's benefit, they have more trust in their government (Morales et al., 2014). People expect to be able to make better use of government data to make decisions and improve their quality of life, such as making specific databases easily accessible for example as through mobile applications, to better communicate their options. The government

also hopes to have easier access to diverse sets of data to support evidence-based decisions (Ubaldi, 2013). Additionally, providing OGD about government programs increases communication between the government and the people, and also ensures the transparency and quality of the programs (Keralis, n.d.). OGD can also help governments implement better policies for society, the economy, and the environment (Scott, 2017). Further, OGD can lead to insightfully monitor and evaluate policies. More importantly, the efficiency and effectiveness of improving public services can be further examined with OGD (Janssen et al., 2012; McKinsey, 2014; Scott, 2017) so that strategic, logical and clear decisions can be made for better delivery of public services (Parkes & Costello, 2018; Rutter, 2014). Thus, quality both in the efficiency and effectiveness of public service and service delivery chains can be promoted and driven by OGD. This leads to better social prosperity and quality.

2.3.3 Governance Impacts (GI)

According to the United Nations (n.d.), OGD are a new approach that encourages governments to improve the quality of decision-making processes and the delivery of public services. OGD promotes participation in decision-making, reduces resources, and unlocks opportunities for innovation and economic growth. At the macro level, OGD provides a scope for new ways for governments to operate through decision-making and resource allocation to improve efficiency (such as speeding up efforts to reduce fraud and errors). It encourages more efficient and effective delivery of more intelligent, creative, and private-public service while improving the quality of government-user interactions (Ubaldi, 2013).

More importantly, OGD are perceived as a tool that can lead to the transparency and accountability of governments (TA) (Lourenço, 2016; Rui Pedro Lourenço, Piotrowski, & Ingrams, 2017; United Nations, 2016). Governments must freely disclose and disseminate data to show transparency and accountability for a democratic society (Peixoto, 2013). Government monitoring can be enhanced on an insightful OGD (Ubaldi, 2013). Providing people with a means to view service plans and infrastructure, spending, and public policy evolution begins with providing access to data (ESRI, 2012). The more the citizens perceive easy access to their governments, the more the governments have to be transparent and accountable.

Previous research has indicated a strong relationship between OGD and transparency and accountability (Verhulst, 2016; Yu & Robinson, 2012). The creation of OGD aims to enhance transparency through the dissemination of data and the reuse of the data to achieve social or economic value (Linders & Wilson, 2011). The linkage between OGD and transparency is a strong relationship. Releasing data and transparency together is the essential components of the value chain that leads to accountability. The value chain that leads to accountability is subject to three main criteria: (i) obtaining accurate data, (ii) enabling practitioners to find, process, and use data, and (iii) enabling the public to choose services (Verhulst, 2016).

When governments are responsible to their citizens, they show them how decisions are made and whether public policy is successful, and provide space for businesses and citizens to participate to help them achieve their goals. OGD allows citizens to assess the conduct of public officials (Miller, 2005; Yu & Robinson, 2012). As stated by Yu and Robinson (2012), OGD can be power for public accountability because its data are easier than ever to process, analyze, and synthesize, providing an opportunity to achieve a new level of public scrutiny. In addition, OGD technology enhances and improves service delivery. The government may give credit for increased public responsibility just by offering OGD technology. Accountability can build confidence in the government (ESRI, 2012). Further, OGD also allows citizens to assess the ethics of public officials that have been assigned control and responsibility (Yu & Robinson, 2012). OGD can help people better understand what governments are doing and how well they are doing and how accountable they are regarding any improper actions or outcomes. This is especially true since many of these government data are becoming more and more accessible and can be combined with data from other sources. Increased data transparency is fundamental for citizen participation and collaboration in the creation of innovation and value-added services (Ubaldi, 2013). If people know more about the government, they can monitor their leaders, make more informed decisions, and demand better policies (Scott, 2017). Based on the above literature, empirical case studies, and previous research findings, the following research hypothesis is formulated as follows.

H4: Higher levels of open government data lead to higher levels of open government data impacts, including economic, social, and governance impacts.

However, the idea of OGD is in the early steps on a tough road to transparency and accountability. Some scholars have indicated that the disclosure of large datasets does not necessarily lead to greater transparency and does not necessarily lead to greater accountability (Lourenço, 2013). Even if the data published and released are "both usable and of high quality," simply releasing OGD does not mean that they will be more transparent and responsible (Harrison et al., 2012). Occasionally, OGD have little opportunity to enter the public arena to strengthen accountability without the ability to leverage the data (Peixoto, 2013). In order to unleash data value, it requires the supported capabilities of the government to pursue transparency and accountability. This argument led this research to explore the moderate variables that have impacts on government transparency and accountability that are produced by OGD.

2.4 Government Capability for Unleashing the Power of OGD

Although data are perceived as an asset, data themselves cannot make any value or impact. It still requires the government's capabilities to unleash the value of the data. Previous research and experts' suggestions have shown various capabilities required for governments to apply their data in order to enhance their efficiency and effectiveness (Cotton, 2015; Esty & Rushing, 2007; Höchtl et al., 2016; IBM, 2015; KPMG, 2017; Marr, 2015, 2017; Mayer-Schonberger & Cukier, 2013). OGD are still preliminary; if government organizations are not prepared for the adoption of OGD and the utilization of OGD, the cost of the investment will be essentially wasted, and there are no significant impacts. A smart strategy needs to be developed for governments to achieve their goals (Marr, 2017). Yang and Wu (2016) examined the factors influencing the intentions and efforts of government agencies in publishing data publications. The empirical results show that "organizational capability is the crucial factor having the strongest positive effect." According to Yang and Wu (2016), the organization's capability was defined according to two aspects:

organizational readiness and organizations acting. Organizational readiness is seen as the level that government entities are at in terms of the competence and expertise needed to be able to use OGD. Organizations that act as data providers need to have sufficient capacity to extract and integrate data from data platform systems. With these capacities, a government organization can influence the activities in collecting, storing, and analyzing OGD. According to Yang and Wu (2016), the empirical results suggest that if the agency has sufficient competence, such as the competence of employees, the resources needed, and the ability to manage it, it can be more confident in handling process changes and technical issues.

Governments must develop a smart strategy to enable them to focus on useful data that will help them achieve their goals (Marr, 2017). Government capability, therefore, explains how and why OGD make its maximum impact. From a comprehensive literature review, the following seven components of government capability are discovered.

First, administrative cultural transformation (ACT) is key to leveraging OGD (Blauer, 2017; Marr, 2015, 2017). More than 71.7 % of data driven organizations have failed because they have not yet created a data culture (NewVantage Partners, 2019). Together with investing in advanced technology, hiring talents, and having adequate resourcing, governments first have to shift their culture in a problem-solving way. Previous or traditional cultures may be ineffective and unproductive, and they should be revolutionized by novel advanced and productive ideas. As stated by Blauer (2017), “Government must be vigorous and responsive to the changing and dynamic needs of their citizens.” A rooted government culture is regularly the largest and most difficult barrier to success (Blauer, 2017). With the complexity and changing environment as well as external and internal pressure, the future city needs to proactively respond to needs and predicted problems. Such a future city is one where data value is high and everyone is using these data to make better service decisions and to meet the changing needs of residents. Future cities will no longer depend on an incremental or status quo policy to provide and deliver services for their citizens in the age of digital technology. In order to make present and future cities more effective and competitive, governments should be able to deal with culture transformation, where they need to shift their perspective on using or reusing their OGD. Changing

the culture of government operations into data driven decision-making is an ongoing challenge (Blauer, 2017).

Nowadays, open government is recognized as a vital tool in combating the negative effects of public administration (Kornberger et al., 2017). In other words, open government is the reverse of the traditional government. This means that an open government can measure the extent to which the administrative culture has been transformed. The open government encourages governments to develop the transparency, participation, and collaboration of the state, the private sector, and the public (Geiger & Von Lucke, 2012). The concept of open government is not only focused on technology. Instead, it focuses on the interoperability, openness, and engagement dimensions where technology may increase efficiency, as well as fundamentally change how governments operate. Open government is not only about being open in the sense of OGD (vision) but also about being open in terms of the relationship between government and the people (their voice) (Hansson et al., 2015; A. J. Meijer et al., 2012).

OGD itself is one of the key principles of an open government. According to Zuiderwijk and Janssen (2014), organizations are incentivized to be more open by creating OGD policies. An organization's willingness to be truly open is positively influenced by a culture of dissemination with a focus on all aspects of OGD policy. Further, Zhao and Fan (2018) indicated that the nature and value of OGD published by governments have been understood as the organizational data culture that will lead to potential effects on resource management and agency awareness to unleash and operate data. Understanding how an open government is established means understanding the purposes of OGD and how the data will be shared with the public. OGD released by governments helps to boost citizens' participation and engagement, which can help the government unlock the value from the data. When a solid argument for using data in business is built, the business should promote and "evangelize" it across the whole company. Selling data to employees is a crucial early step on the data journey. When the workers understand the value of data to the organization, they are much more likely to incorporate it into their decisions in the future (Marr, 2017). Business leaders ought to look forward to creating an appropriate data culture in their company, with the recognition of data as a "key business asset."

A good data strategy should evolve as new technologies are discovered and as the business's needs change. Marr (2017) insisted that culture is the key.

Second, the policy of OGD (POGD) is a mechanism to increase the confidence and sustainability of long-term OGD development (Jaeger & Bertot, 2010; Jung & Park, 2015; Manyika et al., 2013; Sayogo & Yuli, 2018; Styrin et al., 2017). Governments have played a crucial role as suppliers and as data regulators. They use data policy and mechanisms to identify the appropriate characteristics of the OGD within their society (Manyika et al., 2013). Beginning with OGD policy is very important because the policy can ensure the sustainability of the data in the long term (Jaeger & Bertot, 2010). Additionally, it can contribute to citizens being able to access government data as the citizens' rights. As stated by Young and Verhulst (2016), the key factor in succeeding in creating and improving OGD is "the existence of clear OGD policy." To begin and continually develop OGD, there is the need for an explicit data policy that will support investing in advanced technology instead of existence in a vacuum. Policymakers should play a role in creating such data policy with flexible and forecasted legal contexts. This will support the launch of OGD and technical innovation and stimulate the creation of mechanisms for evaluating and monitoring public sector activities

The development of OGD policy is significant in terms of how OGD improves. For example, Jung and Park (2015), who studied South Korea's open public data policy, revealed its background, content, and the long-term implementation plans of the policy during the years 2013 to 2017. They indicated that Korea has continued efforts to develop OGD policy—both new and existing ones. Moreover, Bertot, Jaeger, Munson, and Glaisyer (2010) and Janssen (2012) determined that OGD policies can potentially improve participation, the interaction between the public sector and the public, self-empowerment, and the collaboration of OGD users (such as citizens) and service providers. Additionally, it stimulates economic growth (Borzacchiello & Craglia, 2012) with various advantages. There are diversities of key motivations for the public sector to initiate and develop its OGD policy. The diversity results in different objectives of the policy. For example, the European Commission indicated that using the OGD released by governments has boosted both direct and indirect economic outputs (European Commission, 2011). In

the United States, on the other hand, the Obama administration employed OGD policy to increase and amplify transparency, public participation and engagement, and collaboration among citizens and public agencies. This helped the Obama administration to improve their services with greater quality and effectiveness for American citizens (Kent et al., 2018; McDermott, 2010). However, although there are differences, they describe the potential power of OGD policies that stimulate the acquisition and use of OGD in different ways, and this can provide an opportunity to learn from each other (McDermott, 2010). Zuiderwijk and Janssen (2014) suggested that the current policy is quite optimistic. OGD policy can be improved by partnering with other organizations, concentrating on OGD's impacts, encouraging the use of OGD, and building an OGD culture. This guides how OGD should be released or unreleased, the reuse of the data, the expected positive effects, and the predicted and unpredicted risks.

Third, the management of OGD (MOGD) turns data into practice (Marr, 2016; Styrin et al., 2017). The OGD management system is in an infant stage of creation and development (Danneels, Viaene, & Van den Bergh, 2017; Thorsby, Stowers, Wolslegel, & Tumbuan, 2017) and needs a proactive and effective process to support, help, and improve data users as well as its features (Thorsby et al., 2017). A group of US companies with nearly 450 senior executives recently (Marr, 2016) revealed that the difference that has made their organizations successful in disclosing the true value of data is how executives work together between their mission and analytical functions. This can give government learning lessons and shows how important executing OGD is. Since OGD are in the early use, its management has been variously named. Mostly, the management is perceived as an OGD ecosystem. The term "data ecosystem" was created by O'Reilly (Harrison et al., 2012). It represents "a mean for decision-making and planning as well as helping in realizing the advantages of OGD and creating its value." The data ecosystem is a necessity to create value out of OGD (Ubaldi, 2013). Managing the reused data under the data ecosystem means that the value of the data will be shared with various people (Pollock, 2011) as it is considered a "special form of knowledge system that can cause essential impacts on society" (Danneels et al., 2017).

The systems of managing OGD are based on an exogenous variable (Danneels, Viaene, & Van den Bergh, 2017) and the potential impact produced by advanced and innovative technology (Henderson et al., 2003). There are seven key elements for operating the system integrated required; namely the following: "(i) releasing and publishing OGD on the internet, (ii) searching, finding, evaluating and viewing data and their related licenses, iii) cleansing, analyzing, enriching, combining, linking and visualizing data, (iv) interpreting and discussing data and providing feedback to the data provider and other stakeholders, (v) user pathways showing directions for how OGD can be used, (vi) a quality management system and vii) different types of metadata to be able to connect the elements" (Zuiderwijk, Janssen, & Davis, 2014). The potential value of OGD is recognized only if it is structured and networked to ensure that the data are maintained, stored, and shared in an open approach. This requires well-resourced OGD and consistency of the system network (Sansone et al., 2012; Wessels et al., 2017). The resources for the systems are different for each country. They are described by different interdependent conditions of socio-technical levels, measurements, key actors (such as data providers and users, and infomediaries), key principles and components of OGD, OGD policy, innovation, budgeting, association, licenses, culture, lawful structures (Ubaldi, 2013; Wessels et al., 2017; Zuiderwijk et al., 2014), the existence of power and asymmetrical distribution of information, training levels, risk of security and privacy assessment (Hall et al., 2012), city population, and participation (Thorsby et al., 2017). These characteristics are important because they specifically facilitate how OGD is produced, rotated, and shared among ecosystems. Additionally, an organization requires an implementation plan to turn data into action (Marr, 2017). In order to create an implementation plan, Dawes, Vidiasova, and Parkhimovich (2016) indicated that higher-level government agencies should support other entities to facilitate the implementation of OGD. In particular, appropriate technical and operational training and strategies should be provided to meet the needs of government agencies. In addition, government agencies may also learn from the experiences of other private organizations by collaborating and sharing each other's experiences.

More importantly, OGD are not new, but it still challenges people and organizations that may not understand the core value and specific content of OGD (de Rosnay & Janssen, 2014). Moreover, some barriers may account for lower-than-expected profits, such as negative attitudes of government officials and a lack of recognition of the value of data (Halonen, 2012). For public agencies, providing and releasing "raw data in machine-readable format may be unclear" (Conradie & Choenni, 2014). As stated by Zuiderwijk and Janssen (2014), agencies and their civil servants do not understand the difference between OGD and traditional information disclosures, as well as the value and meaning of OGD. Ignorance of OGD will seriously influence the implementation of OGD. Numerous organizations might be worried that OGD may cause loss of power, income, and work while increasing privacy issues. Their concerns can be caused by "misuse and wrong use of the opened data" (Kassen, 2013; Yang et al., 2015). If public entities do not understand OGD's key ideas and content and lack a clear picture of the vital value of OGD, they may hesitate disclosing OGD to the public. A misunderstanding of OGD can lead to public entities not disclosing the data or the profitable value of the data (Zhao & Fan, 2018).

Fourth is the data cooperation (DC), which is required to support the data driven approach. OGD have been highly expected to transform government and to bring valuable impacts to the society. With this expectation, how OGD is implemented through an ecosystem view considers and links the sophisticated interactions between key actors (Danneels, Viaene, & Van den Bergh, 2017). In this view, the definition of OGD is broader than the portal of the dataset, but it includes (the results of) the use of the data and stakeholders (Danneels et al., 2017). The actors' engagement can be provided by a central organization (government) or a group of organizations. The view of Janssen and Estevez (2013) refers to "government as the orchestrator of a complex network of collaborative entities and sees technological platforms as a key enabler." Practically, according to the data ecosystem, the OGD system provides three types of interaction between data actors. In other words, the system contains data cycles with the ecosystem of users (feedback loops), the ecosystem of data producers ("sharing of data back to publishers"), and the ecosystem of infomediaries ("sharing between so-called infomediaries") (Ubaldi, 2013; Wessels, Finn, Sveinsdottir, & Wadhwa, 2017); namely: "(i) Ecosystem of data

producers, (ii) Ecosystem of infomediaries, and (iii) Ecosystem of users". Based on the management system of OGD, Sieber and Johnson (2015) explained that the above three types of data ecosystem have interacted for each level.

As mentioned above, OGD includes various stakeholders, not only external stakeholders such as non-profit organizations, private organizations, international organizations, etc., but also internal stakeholders, especially in local governments. Especially, data that are collected and stored at local levels, as well as those supported by local government, are crucial for OGD success (Conradie & Choenni, 2014). At local levels, there is a need for actors to understand and realize how potential OGD is (Kassen, 2013). OGD capacity at the local level facilitates and promotes proactive citizen engagement. Further, based on the empirical research conducted by Chatfield and Reddick (2017), having local data online makes a significant difference in how residents engage with their local OGD over time. Moreover, Thorsby, Stowers, Wolslegel, and Tumbuan (2017) analyzed 36 portals of OGD both in terms of their features and contents in many American cities. The researchers found that "there are three general areas in which government data can prove useful including (i) to improve government functioning, (ii) to enhance citizen knowledge about government and its functions, and (iii) to enhance local economic development and business by allowing businesses to create and sell interactive applications (apps) from the data." The OGD initiatives at local levels thus provide benefits and value—chains at the national level.

OGD in a city or regional government is influenced by their national government in running the data initiatives (Chatfield & Reddick, 2017; Dawes, Vidiasova, & Parkhimovich, 2016; Fan & Zhao, 2017; van Veenstra & van den Broek, 2013). OGD are seen as part of the cross-border data sharing between governments (Fan & Zhao, 2017). In this regard, the development of OGD can be certainly affected by government policy and legal aspects because any development and implementation of a public project must be based on the guidance of laws. This means that the OGD providers and users are influenced by environmental determinants, such as regulations, policies, political pressure, and organizational conditions. Especially, relevant policy and regulations are important factors affecting the development of OGD (van Veenstra & van den Broek, 2013). According to the

study of Dawes et al. (2016), they researched planning and designing OGD programs in New York, the United States, and St. Petersburg, Russia. The United States federal government does not require any state, local government, or municipality to meet OGD standards or guidelines; each government organization is encouraged to apply OGD practices that are appropriate to their environments. Likewise, the federal government allows states and municipalities the freedom to run their own local OGD programs covering a wide range of stakeholders. According to that same study, the New York government has driven OGD programs in conjunction with interactions between the public, private, and citizen groups to address and develop urban issues such as economic, social, and political concerns. The St. Petersburg government in Russia is also driving OGD through the collaboration of IT technicians, portal developers, data activists, application developers, data users, and non-governmental, social, and business sectors.

Similarly, the study of Fan and Zhao (2017) indicated that both central and local governments have to be aware of and understand the value and importance of OGD. Specifically, overall policy, planning, and a framework for implementation should be created by the central government at the national level as the first stage of OGD development. Then, local governments have to create and develop their schedules and objectives to implement OGD. The researchers suggested that the central government is very important to OGD. Government agencies have to allocate the necessary resources for OGD in order to ensure quality. Governments should encourage public perception, promote public participation in public activities, and expand public participation channels. At the same time, the government should connect private organizations, social organizations, and individuals to mobilize their opinions on OGD in different ways.

However, Kassen (2013) argues that in practice, it is not clear how the potential of the OGD concept will be achieved locally, as no current project analysis has been performed. Moreover, similar to the national level, the development of an OGD portal at the local government level is still in its infancy even in developed countries such as the United States (Thorsby, Stowers, Wolslegel, & Tumbuan, 2017) and also Australian local governments (Chatfield & Reddick, 2017). Based on Thorsby, Stowers, Wolslegel, and Tumbuan (2017), who analyzed 36 OGD portals

both in terms of their features and contents in American cities, there is a lack of the provision of data visualization and data analytics tools across the cities. Further, some empirical studies (Melin, 2016) found that the local level tends to avoid having to open information. The problem of local data depends on local norms and values. As studied by Janssen and Estevez (2013), local government is rather different than central government agencies, e.g. ministries, in terms of implementing OGD. This leads to concerns for this research regarding the investigation of the potential power of the data at local levels to mediate the power of OGD at a national level for its expected benefits.

Fifth is government support (GS), especially in investing in a data driven culture. Currently, OGD are not widely used (Martin, 2014) due to the lack of necessary skills and the lack of knowing the potential of the data (Susha et al., 2015). Nowadays, governments are becoming increasingly aware of the use of appropriate training to optimize the use of OGD rather than recruiting talents (Chui et al., 2014). Governments, corporations, and individuals must understand how to take advantage of OGD as a player in maximizing the interests of OGD. Gaining valuable insights from OGD will require new rules and procedures and new attitudes and investments (Manyika et al., 2013). Senior leadership must “buy into” the idea that data are a vital part of how you run the business and create revenue, and how people across the organization make decisions. Attitude is key to getting the strategy off the ground and into implementation (Marr, 2017). Communication, or lack of it, is a big stumbling block. Often, strategies are not communicated effectively, so nobody understands them. If it is shown why data values are important to the business, they (managers and implementers) are much more likely to see that they get done. Thus, getting staff at every level on board with the new strategy is critical to its success. Data functions need to be able to be communicated successfully with other parts of a company.

Conradie and Choenni (2014) explained this point—that is, the level of understanding of what roles the public agency plays in OGD, especially in determining the adoption of OGD initiatives. Agencies may release data only once and no further actions may be taken. These agencies might not have seen the explicit benefits they can obtain by opening their data and concerns are raised about this rather than what citizens can benefit from them. Moreover, Reggi, Luna-Reyes, Gascó,

Martin, and Pyo (2018) explained that promoting the use of OGD means raising awareness about OGD, improving user skills, and participation in the use of OGD through training interventions. They compared and contrasted the methods of training regarding data in Spain, Italy, and the United States. They found that "being aware of OGD and its benefits are insufficient to promote use." Wang and Lo (2016) examined the factors influencing OGD adoptions by government agencies in Taiwan through survey data from 342 government agencies, and their work showed a significant positive correlation between the perception of benefits and the adoption of OGD. Similarly, Wessels, Finn, Sveinsdottir, and Wadhwa (2017) indicated that OGD involves many actors. Data actors need to understand data, their types, how they are created, and how they are used. The value of OGD arises from its characteristics and how it can be applied in a particular context. OGD supporters and civil society organizations have exercised influence in promoting the notion of OGD, and they have linked this to the vision of open knowledge.

However, there is still limited use of OGD (Martin, 2014). This the limitation of OGD use has been caused by limited skills and knowledge that have influenced the use of OGD (Susha et al., 2015). More precisely, most data users still lack the required skills in perceiving the potentiality of the data and what they can do with it, and in assessing data quality and having the analytical skills for using the data. Nowadays, governments are aware of how training can facilitate and optimize OGD use rather than recruiting talents (Chui et al., 2014). However, limited research has been done on strategies to develop training for data users, although data user training is essential. Moreover, there is still a knowledge gap in terms of the interventions to develop and improve the data users' skills, and their knowledge (Reggi et al., 2018). As stated by Reggi et al. (2018), although the potential value of OGD has been proposed, limited empirical evidence has been put forward to show its transformative value, particularly given the lack of data user training and supporting technical skills. Reggi et al. (2018) reported three important findings by comparing OGD training in Spain, Italy, and the United States. First, it was seen that introductory and analytical skills are combined to promote and promote the use of OGD since increasing awareness and benefits are not sufficient to motivate and promote the use of data. Second, training for OGD together with providing knowledge about context and

government interactions seem to be more effective. Last, the use of training interventions regarding the specific needs of users is critical to success. In this regard, Miller (2016) presented a set of data-related skills: data self-manipulation, selection of analytical methods, communication of findings, and participation in lifelong learning. Young and Verhulst (2016) concluded that the OGD initiative is limited by a lack of capacity and readiness among the most likely to benefit. In order to enhance capacity for OGD use, several approaches of government supports are required (Young & Verhulst, 2016). Coaching and training centers should be set up to teach and offer knowledge about the application and potential power of OGD for policymakers and stakeholders. For instance, the portal of open budget transparency in Brazil obtained extreme benefits from television campaigns and routine workshops to provide training for citizens, news, and public workers on how to access the data portal—an open budget—and how to use the portal in beneficial ways.

Sixth is research and development (RD), which is the focal point of OGD. The development of OGD focuses on collaboration among researchers, policymakers and governments. These people play a key role as data providers, data implementers, and data users (Lane, 2018; O'Flaherty & Maloney, 2017). Generally, the public sector has faced problems with the lack of data, it does not have enough or updated data to use, and does not know which data should be collected to use so that it can unleash the power of the data to develop the country. Not all data can be collected. In this regard, Frith (2017) insisted that researchers working with governments together are capable of effectively choosing what data should be collected, what online activities of people should be followed, and which data are useful to be a base for policymaking. Indeed, there is clear interest in data driven research (Catlett et al., 2014). It is insufficient to assure that data are released and published with availability and accessibility for research purposes and operational uses. In order to develop OGD, much of this attention is paid to researchers, policymakers, and government program bodies as a focal point, as they act both as data makers and data users (Lane, 2018).

Researchers along with policymakers should use data to improve their quality of work (Doar & Gibbs, 2017). In a practical sense, researchers might think that a federal or state agency collects certain data, but it is important to speak with the data

producers in order to ensure that the specific data of interest are available and are useful enough to do research or analysis to find something valuable (Maxwell & Trends, 2017). How OGD is produced should be critically considered by researchers (Connelly et al., 2016). Furthermore, researchers should pose questions on the quality of data resources and their contents. Some errors occur in OGD, such as processing, measurement, nonresponse, and adjustment errors. However, there is generally less tendency to contain those errors because OGD produced by digital technology does not rely on samples or sampling errors (Groen, 2012). Working together between researchers, public agencies, and policymakers is needed. Especially, a mountain of data requires that researchers play a role in interpreting correlations within it. Careful interpretation will not occur effectively if there are no "subject-matter experts" (Frith, 2017; Kitchin, 2014).

Last is citizens' engagement (CE) in OGD (Hivon & Titah, 2017; Sayogo & Yuli, 2018; Styrin et al., 2017). Data are the currency of social collaboration (Emerson et al., 2012). The idea of data is not just collecting massive amounts of data, but it is finding new ways to exploit its power (Marr, 2017). Based on the essential value of data, this research proposes that providing government data for citizens is a critically innovative way to use the power of data since providing government data lays the fundamental ground and opportunity for citizen engagement in public policymaking to develop their society (Fischer, 2000) by integrating their opinions and knowledge to influence public policies and programs (Mellouli et al., 2014; United Nations, 2008, 2012).

Traditionally, the nature of participation processed by governments was inefficient because there was unequal power distribution, underestimated capabilities of citizens, and knowledge or information asymmetries between citizens and governments (Bartenberger & Grubmüller, 2014; Evans & Campos, 2013). In other words, citizens will be skeptical in such a process because they lack resources, power, and knowledge or information (Ansell & Gash, 2007). Some stakeholders that do not have sufficient knowledge or data to participate with others and their governments will ignore participation or may be manipulated by stronger key stakeholders (Ansell & Gash, 2007). In order to deal with such critical problems in the process of citizen engagement, OGD are hypothesized to decrease knowledge asymmetries between

citizens and governments (Bartenberger & Grubmüller, 2014). Many governments in developed countries have embraced the idea of open government, which needs to open data to empower their citizens with useful, relevant, and complete sets of data that allow their citizens to engage in meaningful and smart ways with their government (Bartenberger & Grubmüller, 2014; Mellouli et al., 2014). The needs of data users (i.e. third-party innovators) are the sources for cultivating an OGD platform ecosystem (Bonina & Eaton, 2020) as well. External data users play important roles in developing and using data. According to Zhenbin, Kankanhalli, Ha, and Tayi (2020), what drives public agencies to share and release their data is the need for conformity and resource dependence of a public agencies on external innovators. The resource dependence on external innovators greatly affects their sharing behavior. Conformity needs and the sensitivity of the agencies' mission also influence information sharing behavior.

Accessing data is the critical first step for citizens to understand what the government is doing. Nowadays, as stated by the United Nations (2016), e-participation has been developed from the concept of public information and public consultation to make citizen participation cheaper, easier, faster, and more transparent. OGD can provide valuable information that can enable citizens to affect the process of decision-making in new and effective ways (Kassen, 2013). Such data can be directly useful not only for specific stakeholders, external experts, and new entrants to contribute to policy debates and the process of public policymaking that will result in evidence-based government actions (Odongo & Rono, 2016). According to Davies (2012), OGD can give citizens a better voice in three different ways: the political aspect (i.e. informing citizens as voters, supporting public debate); the collaboration aspect (i.e. co-produced planning, public services, and information); and the service aspect (i.e. improving the quality of services and competitive innovation).

Moreover, OGD will shift from citizens as passive customers that are waiting and offered services by governments, to active or proactive citizens to sharpen policies and programs (Cornwall & Gaventa, 2000; United Nations, 2012). With data, active or proactive citizens will be those that are more critical, analytical, active, and have more interest in participating in the decision-making process in government policies or programs. Additionally, as critical data users and the key contributor to

OGD use (Hivon & Titah, 2017), citizens will have more interest in collaborating with their governments to identify problems, question public issues, seek solutions to the problems and needs, as well as give feedback to governments (Hays & Kogl, 2007). In this sense, OGD will catalyze citizen engagement to use social networks and social media areas to initiate and propose new solutions to social problems and also to control political aspects (Ramirez-Alujas & Dassen, 2014). Collaboratively working among citizens, private units, governments, and academia can enable the discovery of new answers to social problems (United Nations, 2012).

Based on this discussion of government capability (GC) with the seven dimensions, the fifth hypothesis of this study is.

> H5: Government capability (mediator) significantly mediates the relationship between open government data (independent variable) and the impacts of open government data (dependent variable).

Two hypotheses are developed for the analysis of mediating variable: OGD are likely to enhance government capability since it can deliver evidence-based policies and streamline decisions so as to modernize and deliver effective and efficient citizen-centric services (Esty & Rushing, 2007; Parkes & Costello, 2018; Rutter, 2014). This study thus hypothesizes that:

> H6: Open government data has a positive relationship with government capability.

As mentioned, government capability is needed to unlock the true potential of OGD (Höchtl et al., 2016; IBM, 2015; KPMG, 2017; Marr, 2015; Mayer-Schonberger & Cukier, 2013). Therefore, the following hypothesis is offered.

> H7: Government capability has a positive effect on the impacts of open government data.

Additionally, a development is often hampered by an unstable political environment. Political instability (PI) is defined as a sudden and significant change or disorder in the leadership, policies, or disturbance within a country that may be a loss of control. It creates uncertainty and reduces economic and social growth (Aisen & Veiga, 2013; Carmignani, 2003; Jong-A-Pin, 2009). There have been studies on the relationship between political stability and economic development, indicating that such a relationship is not novel. Previous studies have pointed out that political stability is associated with economic stability and growth. For example, Alesina, Özler, Roubini, and Swagel (1996) indicated that investment and economic development will be reduced during unstable politics. It also increases the chances of government collapse and political unrest. In short, the economy is adversely affected by political instability. This is similar to the notion of Jong-A-Pin (2009), who found that political instability has a significant negative effect on economic development.

Further, Aisen and Veiga (2013) reported that political instability harms growth by reducing the rate of growth in productivity and the accumulation of physical and human capital. Carmignani (2003) asserts that the impact of political instability increases the level of uncertainty about the economic situation and economic policy. Furthermore, Radu (2015) studied political stability as “a condition for sustainable growth in Romania” and found that political stability plays a vital role in the country's economic growth and helps to create a consistent and continuous path for sustainable development.

Likewise, there are several pieces of research indicating that there is a relationship between political stability and government effectiveness. For example, Hussain, Sabir, and Meo (2018) found that corruption controls, government effectiveness, and political stability have a strong positive correlation. In terms of regime, government effectiveness is linked to higher levels of support for a more stable regime (Magalhães, 2014). Moreover, transparency is associated with the increased stability of democratic regimes (Hollyer et al., 2014). According to Hollyer et al. (2014), both corruption and government failures often coincide with political instability in a democratic system, indicating a critical need to achieve political stability.

Additionally, political instability and corruption may be linked. According to Leite and Weidmann (1999), instability means that the state does not have sufficient political influence to issue effective anti-corruption measures. On the other hand, Treisman (2000) suggested that political stability adds positive value and therefore leads to less corruption. Thus, political instability may influence government processes (Hollyer et al., 2014) that may obstruct the power of data. This research, therefore, hypothesizes a moderated mediation effect as follows.

> H8: Political instability moderates the relationship between government capability and the impacts of open government data.

CHAPTER 3

RESEARCH METHODS

3.1 Theoretical Framework

This research began with the synthesis of knowledge, both theoretical and practical, so as to create and develop a theoretical framework for the research. Based on an extensive review, unleashing the power of OGD requires four main aspects: the first is pre-conditions. This refers to the essential factors that influence building and improving OGD. Based on the literature review, the essential factors that influence building and improving OGD include: (i) information and communication technology infrastructure; see Lane (2018), Mayer-Schonberger and Cukier (2013), and O'Flaherty and Maloney (2017); (ii) data security; see Blauer (2017), IBM (2015), O'Flaherty and Maloney (2017), and Spavin and Fegan (2017); and (iii) trust in government; see Gravestock (2017), Henderson and Applewhite (2017), and Spavin and Fegan (2017).

The second is how a country implements the principles of OGD. Based on the literature review, the significant principles of OGD consist of (i) completeness of the data, (ii) timeliness of the data, (iii) machine readability, (iv) ease of physical and electronic access/ use of commonly owned standards, (v) being free of charge, and (vi) open licensing. This provides a relationship between OGD and data impacts (DI) itself since the essential factor that may hinder the full potential of OGD is the quality of OGD (Yoon, 2017), which is related to OGD principles (Vetro et al., 2016). That is, higher levels of OGD will positively influence higher levels of DI on government performance; see Chui, Farrel, and Jackson (2014), Janssen, Charalabidis, and Zuiderwijk (2012), Keralis (n.d.), Lewis and Perricos (2013), Morales, Hsu, Poole, Rae, and Rutherford (2014), Parkes and Costello (2018), Scott (2017), Ubaldi (2013), and the United Nations (2016).

The third is the government capability (GC), which is required to unlock the power of OGD. GC refers to the required abilities of the government to use and apply government data to improve government effectiveness. Based the extensive literature review, GC includes (i) administrative cultural transformation, (ii) the policy of OGD, (iii) the management of OGD, (iv) data cooperation, (v) government support, (vi) research and development, and (vii) citizen engagement. In this matter, GC (mediator) significantly mediates the relationship between OGD (independent variable) and government performance (dependent variable) (i.e. Blauer, 2017; Cohen, 2010; Cotton, 2015; Esty & Rushing, 2007; Höchtl et al., 2016; IBM, 2015; Janssen & Zuiderwijk, 2014; Jung & Park, 2015; KPMG, 2017; Marr, 2015; Mayer-Schonberger & Cukier, 2013).

The last one is data impacts (DI). How OGD has affected government performance is investigated. DI in this research refers to social impacts, economic impacts, and governance impacts (Bertot et al., 2014; de Rosnay & Janssen, 2014; Foulonneau et al., 2014; Mercado-Lara & Gil-Garcia, 2014; Parycek et al., 2014). Moreover, considering establishing and developing OGD improvement, political instability is included as a moderator variable in order to explore its effect on the relationship between GC and DI (Aisen & Veiga, 2013; Alesina et al., 1996; Carmignani, 2003; Haider et al., 2011; Hollyer et al., 2014; Hussain et al., 2018; Jong-A-Pin, 2009; Leite & Weidmann, 1999; Magalhães, 2014; Waguespack et al., 2005). This theoretical framework helped with the understanding and design of the research process, along with building a research tool to explore holistic viewpoints, classification, and clarification in doing this research.

3.2 Research Process

Since OGD and its impact are in the early conceptual development (Manyika et al., 2013; Safarov, 2019; A. Zuiderwijk & Janssen, 2014), a mixed-method design consisting of case study analysis and quantitative analysis was used to understand and describe the existing phenomenon. The research process is shown in Figure 3.1.

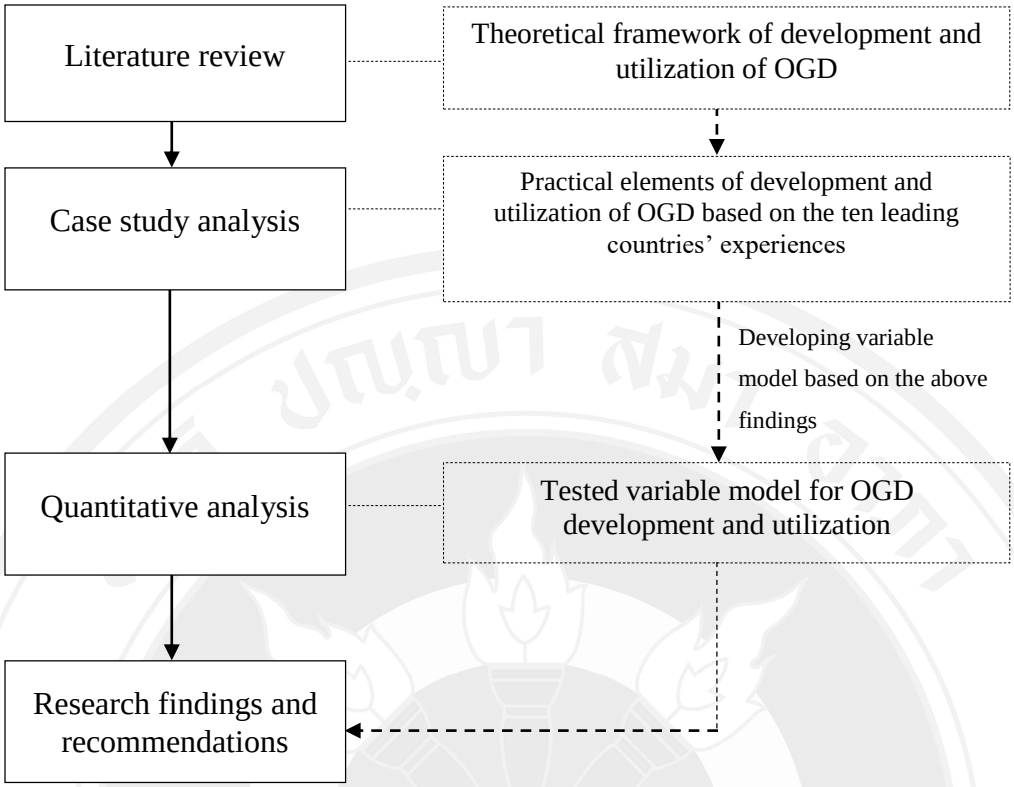


Figure 3.1 The Research Process

First, case studies were used as they are appropriate for the early stages, for developing concepts (Eisenhardt, 1989), and investigating new phenomena (Yin, 2013). Case studies are well suited and useful for new research areas or particularly research for existing and developing theories or concepts, especially, if such theories or concepts are at early exploratory stages (Eisenhardt, 1989). Additionally, to develop a theory or concept, it has to be processed through not only a deductive process but mostly an inductive approach of empirical cases (Eisenhardt, 1989; Patton & Appelbaum, 2003; Rowley, 2002): Case studies are useful in providing answers to How? And Why? questions for exploratory, descriptive, or explanatory research" (Rowley, 2002) and offering the "opportunity for a holistic view of a process" in developing theory (Patton & Appelbaum, 2003). In this matter, the top ten most successful countries regarding OGD ranked by the World Wide Web Foundation (2017) and Thailand will be one of the case studies. Moreover, since this research included Thailand as one of the case studies, interviewing key informants is a

supplementary tool together with document analysis for collecting the data about Thailand's OGD.

Second, a partial least square structural equations model (PLS-SEM) is employed for this research to test the research model for many reasons including:

I) The research questions and objectives focus on the prediction of the impacts of OGD on government performance and its relationships among the variables, similar to PLS-SEM, which is prediction-based. In other words, the main objective of PLS-SEM that focuses on the prediction of hypothesized relationships is to maximize the variance in the dependent variable(s) (J. F. Hair et al., 2017; Henseler et al., 2009; Sarstedt et al., 2014; Wold, 1985; Wong, 2013). Due to this matter, PLS fundamentally contributes to predictive causal analyses in "highly complex situations with poorly developed theoretical understanding" (or existing theories or concepts).

II) As Hair, Ringle, & Sarstedt (2011) recommended, if the research is studying the exploratory or extensive-existing theories or concepts, such research should employ PLS-SEM as its method. In the other words, PLS-SEM is appropriate in situations where a theory or a concept is being developed (Hair, Black, Babin, & Anderson, 2010; Hair et al., 2017, 2011; Sarstedt et al., 2014; Wong, 2013). As the goal of the PLS-SEM approach is principally exploratory research used to develop or expand a new or existing theory, this approach focuses on explaining the variance in the dependent variable(s) when examining the model.

III) All of the variables, both exogenous and endogenous variables, in this research are formatively constructed measurements (i.e., DI on government performance, GC for unleashing the power of data, OGD, pre-conditions for building and improving government data). PLS-SEM is appropriate for the model that contains formatively measured constructs (Lee et al., 2016; Sarstedt et al., 2014). Additionally, as Hair et al. (2011) recommended, PLS-SEM is suitable for making a prediction of key-targeted constructs or determining key operator constructs.

IV) There are 115 countries as the samples for this research, which may be a small sample size. PLS-SEM is "less sensitive to a small sample size and can handle with the small sample size" (Sarstedt et al., 2014; Wong, 2013). Further, according to Hoyle (1995), a generally accepted starting point to implement the path modeling is the sample size of 100 to 200. Similarly, Chin, Marcolin, & Newsted, (2013) specified

that the sample size should be “ten times the largest number of paths directed at a construct in the structural model” as the rule of thumb. Following the rule of thumb, the structural model in this research has four directed paths. This means that the research sample size should be over eighty samplings. Thus, 115 countries are sufficient for PLS-SEM.

V) This research employs secondary data as empirical data sources, which may have the problem of normal distribution. PLS-SEM is the primary and important choice for analyzing such secondary data (Sarstedt et al., 2014). Moreover, PLS-SEM has no assumptions concerning the normality assumptions of the data (normal distribution) (Henseler et al., 2009; Sarstedt et al., 2014; Vinzi et al., 2010; Wong, 2013). With the function of PLS, “it can handle with all types of data (i.e., non-metric to metric) with very minimal assumptions about the characteristics of the data” (Hair et al., 2010; Hair et al., 2017, 2011). Thus, it is helpful and useful for testing the research model.

3.3 Steps of the Case Study Analysis and Interviewing (As a Supplementary Tool)

3.3.1 Case Selection

The selection of case studies was done according to the ranking of countries in the Open Data Barometer (2017). The Open Data Barometer is one of the missions of the World Wide Web Foundation (World Wide Web Foundation, 2017) which was established in 2009 to be an independent and international organization to fight for digital equality. The Open Data Barometer aims to do the following: (1) measure the progress and impact of OGD in countries around the world; (2) analyze OGD global trends; and (3) compare OGD in countries and regions to rank governments in terms of open data availability, implementation, and impact. Ranking the OGD of governments around the world provides an important benchmark for policymakers, organizations, and civil society to improve the initiatives and utilization of OGD. This research used the 2017 evaluation to select ten leading countries to be the case studies. Additionally, Thailand was included in the case studies to benefit the country in which the research was conducted. In sum, the countries for this research include:

i) the United Kingdom,	ii) Canada,	iii) France,
iv) the United States,	v) Korea,	vi) Australia,
vii) New Zealand,	viii) Japan,	
ix) the Netherlands,	x) Norway,	xi) Thailand

3.3.2 Selecting Cases of Data Impacts in the Ten Leading Countries

The opening of government data is intended to encourage the use of the data beyond the government as its primary use. The potential benefits of using OGD are significant if the conditions are favorable. The utilization of OGD can take place across all sectors and with many users. It is therefore beneficial to many sectors and provides opportunities for government enhancement and development of additional services to meet the needs of the users. Currently, although there are many beneficial aspects of OGD, we need to keep in mind that there is still room for improvement. In selecting OGD projects as case studies from ten countries, this research used a multi-step process involving determining the impact framework of OGD. In many cases, OGD projects output results in more than one impact dimension.

The analysis revealed that there are three main ways in which OGD affects people's lives, but they are not limited to these: economic, social, and governance impacts. Economic impacts refer to economic growth, values, and activities that are provided by using OGD mainly in the private sector or collaboration between public and private sectors. Social impacts refer to better public services driven by OGD and are provided by the public sector, the private sector, or civil society. Governance impacts refer to government performance in terms of public process, efficiency and effectiveness, and good governance.

The multi-step process that this research undertook is as follows. First, documents (i.e. previous research or assessment reports) were thoroughly reviewed. Second, some cases in the documents were explored in greater detail. Third, repositories of OGD cases in their data web-portals were explored. Based on these steps, this research identified a list of approximately 79 cases retrieved from ten countries to analyze the taxonomy of the data impacts. These included examples from the private sector, civil society, and government agencies that have utilized OGD for their operations.

3.3.3 Data Collection for Case Study

Document research was employed to collect and analyze relevant and credible secondary documents. In order to obtain in-depth data, the data sources were varied, and readily available, such as laws and regulations, government policies or plans, government evaluation reports, previous research, and so on. Examples of relevant documents are shown in the table.

Table 3.1 Examples of Relevant Documents for Case Study Analysis

Types of secondary documents	**Example of relevant documents**
Laws and regulations	- Open government data act of the United States of America (2017) - Act to amend the parliament of Canada act and the access to information act (transparency) (2014) - Foundations for evidence-based policymaking act, public law of the United States of America (2018) - Act on promotion of the provision and use of public data of South Korea (2013) (Act on Promotion of the Provision and Use of Public Data (2013)) - Act on promotion of the provision and use of public data of South Korea, act no. 14839 (2017) (Act on Promotion of the Provision and Use of Public Data, 2017)
Government policies or plans	- A budget for a better America: promises kept taxpayers first (2020) - Australian government public data policy statement (2015) (Australian government, 2015) - Planning: Open data in your organization provided by Australia government (2019) - Open data released by the department of the prime minister and cabinet of Australian government (n.d.)

Types of secondary documents	Example of relevant documents
	- Japan open data charter action plan (2013) - Policy on open data of the Netherlands (2019) - Open data white paper of the United Kingdom (2012) - Open data policy in Toronto released by city Clerk's Office, Canada (2011) - Third biennial plan to the open government partnership (2016-2018) of Canada (2016) - Japan open data charter action plan (2013) - Declaration to be the World's most advanced IT nation of Japan (2013) - Policy on open data of the Netherlands released by Kennis- en Exploitatiecentrum Officiële Overheidspublicaties (KOOP) (2019) - Guidelines for making public data available provided by ministry of local government and modernization of Norway (2017) - One digital public sector: digital strategy for the public sector 2019–2025 provided by ministry of local government and modernization of Norway (2019) - Korea, leading the world e-Government provided by Ministry of the Interior and Safety (2017) - Formats for open data, machine readable and human readable provided by New Zealand government (2018) - Open government partnership: the 3rd national action plan released by Korean government (2016) - Legislative review: new flexible, future–focused data and statistics legislation provided by Stats New Zealand (2019) - Executive order - making open and machine readable

Types of secondary documents	Example of relevant documents
	the new default for government information provided by the White House (2013)
Government evaluation reports	- Open data 500 Australia (2015a) - Data availability and use of Australia government (2017) - The Australian public service big data strategy: Improved understanding through enhanced data-analytics capability reported by the department of finance and deregulation of Australian government (2013) - Open government consultation report of Canada (2012) - Open government consultation report released by Government of Canada (2012) - Open data white paper: unleashing The potential of United Kingdom government reported by minister for the cabinet office and paymaster general, Her Majesty government (2012)
Previous research	- Open data in the G8 analyzed by Castro, & Korte (2015) - International open data best practices reported by La Iniciativa Aporta (2017) - Institutional dimensions of OGD implementation: evidence from the Netherlands reported by Safarov (2019) - Open data best practices in Europe's top performers analyzed by Radu (2020) - Data.gouv.fr: The French open platform for open data reported by European Union (2019)

Types of secondary documents	Example of relevant documents
	- Open data and the fight against corruption in France reported by Savy (2017)

3.3.4 Interviewing (As a Supplementary Tool) for Thailand

The interview was the qualitative method for this research. It aims (i) to understand the current situation and approach for using data to drive the government in Thailand and (ii) to propose policy recommendations for Thailand. To collect the data, key informants were experts or professionals that have had experience and knowledge related to this research topic and could provide insights into the issue. The key informants were contacted by or e-mail about this research and the researcher's information. Presently, because of the COVID-19 situation, the researcher and the key informants could not set a schedule for face-to-face interviews. For this reason, the researcher consulted with the key informants to determine an appropriate interview method during this situation. A telephone interview was consequently used, which took approximately 30-45 minutes for each key informant. The interview questions were based on the theoretical framework. However, they were adapted based on the current situations during the interview in order to get further insight into an issue. An example list of basic questions is as follows.

- Could you please describe the current situation about OGD in Thailand?

- Do the data exist? Is it easy to find information from the dataset? Is the dataset up to date? Is it available online in any form? And free of charge? How?

- What are the pre-conditions required for building OGD?

- How does Thai OGD have an impact on government efficiency and effectiveness? How does using OGD by the government improve the quality of government services? How does Thai open data have an impact on the economy?

- What are the government capacities required to unleash the power of the data?

- What do you think about the open data policy in the country?

- How successful is promoting the use of OGD?

- What do you think about the management of OGD in the country?

The questions were free-flowing and allowed the key informants to provide their knowledge and expertise in the answers. If they hesitated or did not feel comfortable answering a question, the question was skipped. The data were stored secretly and securely. Their responses were kept confidential and were not linked to their names. Only the research and advisor were able to access the data. The data from the interview were analyzed using a content analysis approach. More importantly, the data were used only for this research. To refer to the opinion of the key informants in the research report, their names were not mentioned.

This research was certified and granted an exemption on human research protection by the Ethics Committee in Human Research, National Institute of Development Administration (Certificate of Exemption: COE No. 2019/0010, approval date: September 24th, 2019).

3.3.5 Data Analysis

In order to analyze the case studies, the use of qualitative content analysis in case studies was employed as a useful tool for analyzing the data. Content analysis is employed to deal with the complexity of different pieces of evidence (Yin, 2013). The content analysis for case studies contributes to “openness and ability to deal with complexity, theory-guided analysis, integration of context, and integration of different material or evidence” (Kohlbacher, 2006). The systematic steps of content analysis were as follows.

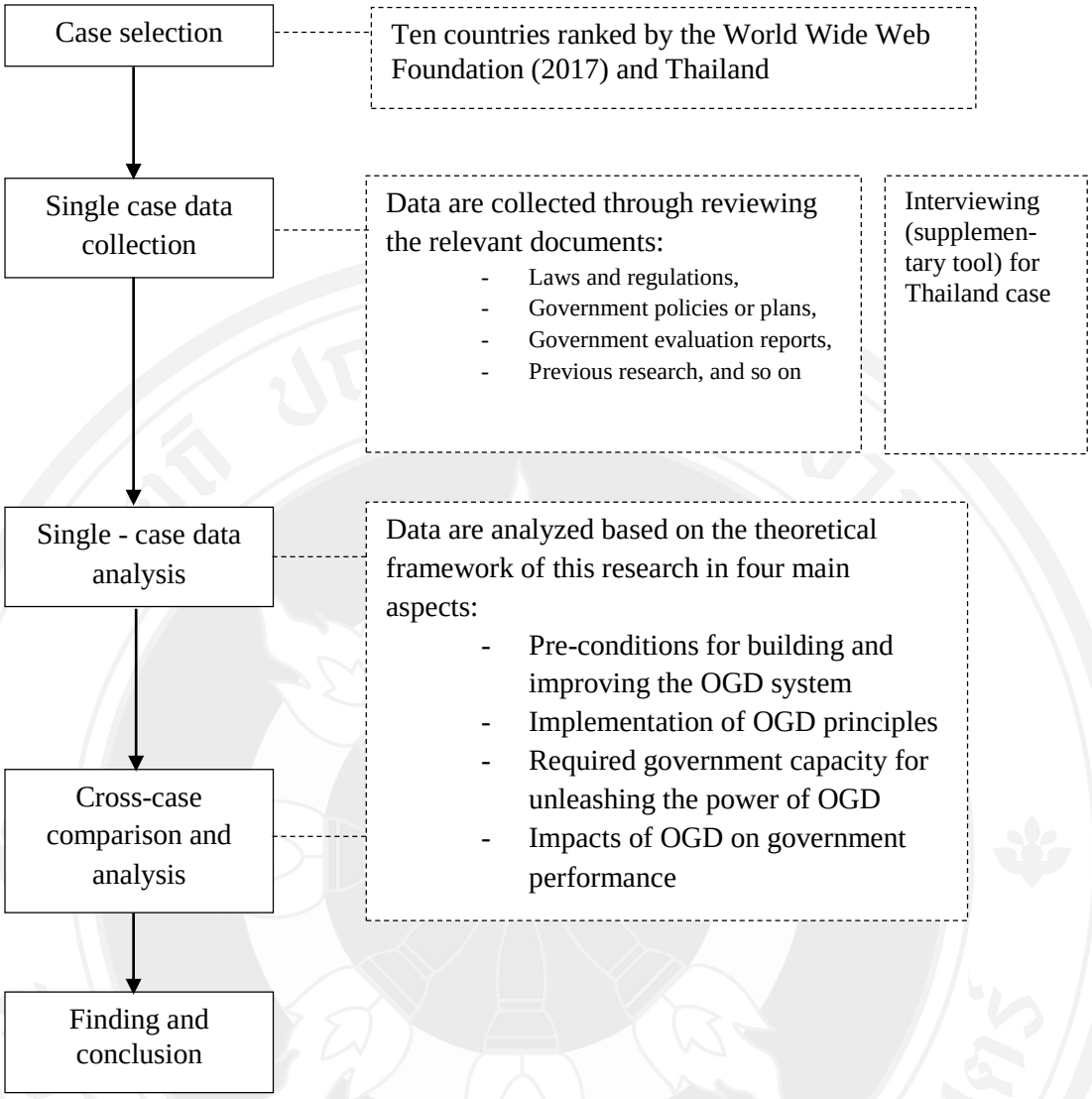


Figure 3.2 The Systematic Stages of Content Analysis in Case Studies

3.4 Steps in the Quantitative Analysis

3.4.1 Research Hypothesis Development

OGD itself does not have any value or make any impact. Collecting data or analyzing them is not the “end game” of a data strategy. The essential thing is how to use them, or how to reveal their power. Thus, this research sought to build systematic research of OGD in terms of the ways to build or reuse them. In order reveal the mechanisms that can explain how OGD will become more valuable, this research applied a critical realist method of analysis with the assumption that GC should be perceived as the critical mechanism or mediate variable to uncover the power of such data. In the other words, the relationship between OGD and DI is mediated by GC.

In term of research methods, mediation will occur when “(1) the independent variable significantly affects the mediator, (2) the independent variable significantly affects the dependent variable in the absence of the mediator, (3) the mediator has a significant unique effect on the dependent variable, and (4) the effect of the independent variable on the dependent variable shrinks upon the addition of the mediator to the model” (Preacher & Leonardelli, 2001). The mediation model presents an “explanation for how, or why, two variables are related, where an intervening or mediating variable, M, is hypothesized to be intermediate in the relation between an independent variable, X, and an outcome, Y” (MacKinnon et al., 2012).

In sum, this study examines (1) the essential prerequisite components activating OGD to improve governments’ performance, and (2) the effects of the mediating variable on the direct path between OGD and its impacts. The research model is presented in the path diagram, which was drawn for the single-mediator model. Based on the theoretical framework, the developed research hypotheses can be categorized into four groups:

First, the research hypotheses for the pre-conditions for building and improving government data are as follows:

Table 3.2 The Research Hypotheses for the Preconditions for Building and Improving OGD

Research hypothesis	Statement	Examples of references
H1	Information and communication technology infrastructure positively influences building and improving OGD.	Lane (2018); Meyer et al. (2015); O'Flaherty & Maloney (2017)
H2	The higher data security, the better OGD have been built and improved.	Blauer (2017); IBM (2015); O'Flaherty & Maloney (2017); Spavin & Fegan (2017)
H3	Trust in government positively influences building and improving OGD.	Gravestock (2017); Henderson & Applewhite (2017); Spavin & Fegan (2017)

Second, the research hypotheses for the relationship between OGD and DI are as follows:

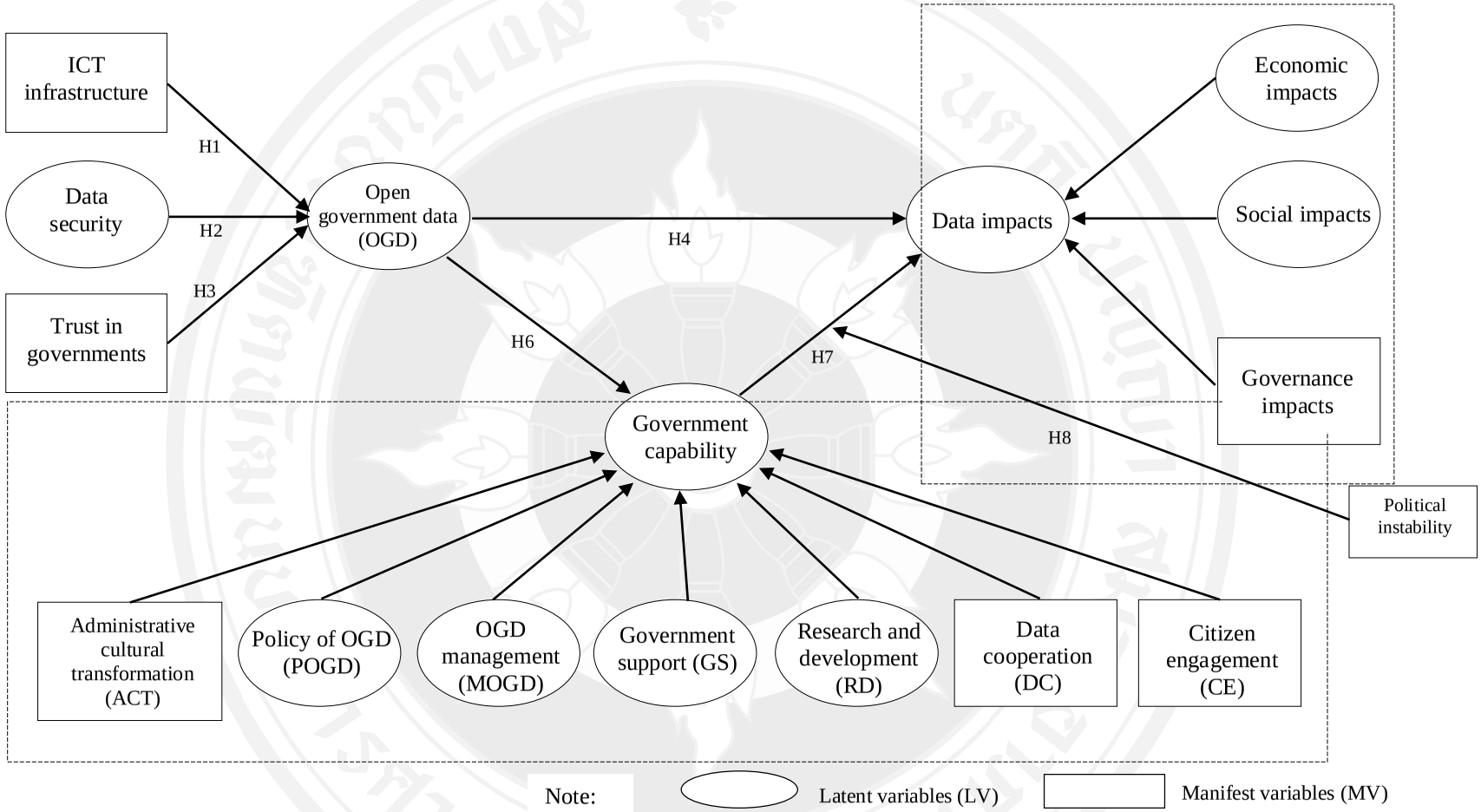


Figure 3.3 Theoretical Framework

Table 3.3 The Research Hypotheses for the Relationship between OGD and Data Impacts

Research hypothesis	Statement	Examples of References
H4	The higher levels of OGD will positively influence the higher levels of data impacts including economic impacts, social impacts, and governance impacts.	Keralis (n.d.); Lewis & Perricos (2013); McKinsey (2014); Morales et al. (2014); Parkes & Costello (2018); Scott (2017); Ubaldi (2013); Zuiderwijk, Janssen, Choenni, Meijer, & Alibaks (2012)

Third, the research hypotheses for GC were identified. These are required to unleash the power of OGD as follows:

Table 3.4 The Research Hypotheses for the Mediation Analysis

Research hypothesis	Statement	References
H5	Government capacity (mediator) significantly mediates the relationship between OGD (independent variable) and data impacts (dependent variable).	Blauer (2017), Cohen (2010), Cotton (2015), Esty and Rushing (2007), Höchtl et al. (2016), IBM (2015), Janssen and Zuiderwijk (2014), Jung and Park (2015), KPMG (2017), Marr (2015), and Mayer-Schonberger and Cukier (2013)
H6	OGD have a positive relationship with government capability.	Esty and Rushing (2007), Parkes et al. (2018), and Rutter (2014)
H7	Government capability has a positive effect on data	Höchtl et al. (2016), IBM, (2015), KPMG (2017), Marr

Research hypothesis	Statement	References
	impacts.	(2015), and Mayer-Schonberger and Cukier (2013)

Last, the research hypothesis for the moderator variable (political instability) affecting the relation between government capability and data impacts is as follows:

Table 3.5 The Research Hypotheses for the Moderator Variable

Research hypothesis	Statement	References
H8	Political instability (moderator variable) will significantly moderate the relation between government capability and data impacts.	Aisen and Veiga (2013), Carmignani (2003), Haider et al. (2011), Hollyer et al. (2014), Hussain et al. (2018), Jong-A-Pin (2009), Leite and Weidmann (1999), Magalhães (2014), and Waguespack et al., (2005)

3.4.2 Unit of Analysis

This research uses the macro-perspective, and employs “countries” as the unit of analysis (115 countries). These countries measured the improvement and quality of their OGD by the World Wide Web Foundation. Table 3.6 below is a list of countries that will be used in the analysis.

Table 3.6 A List of Countries Used in the Analysis

No.	Country	No.	Country	No.	Country
1	Albania	39	Ghana	77	New Zealand
2	United Arab Emirates	40	Greece	78	Pakistan
3	Argentina	41	Guatemala	79	Panama
4	Australia	42	Croatia	80	Peru
5	Austria	43	Haiti	81	Philippines
6	Belgium	44	Hungary	82	Poland
7	Benin	45	Indonesia	83	Portugal
8	Burkina Faso	46	India	84	Paraguay
9	Bangladesh	47	Ireland	85	Palestine
10	Bulgaria	48	Iceland	86	Qatar
11	Bahrain	49	Israel	87	Russia
12	Bosnia and Herzegovina	50	Italy	88	Rwanda
13	Belarus	51	Jamaica	89	Saudi Arabia
14	Bolivia	52	Jordan	90	Senegal
15	Brazil	53	Japan	91	Singapore
16	Botswana	54	Kazakhstan	92	Sierra Leone
17	Canada	55	Kenya	93	El Salvador
18	Switzerland	56	Kyrgyzstan	94	Serbia
19	Chile	57	Korea	95	Slovakia
20	China	58	Lebanon	96	Sweden
21	Côte d'Ivoire	59	Saint Lucia	97	Swaziland
22	Cameroon	60	Latvia	98	Togo
23	DR Congo	61	Morocco	99	Thailand
24	Colombia	62	Moldova	100	Tajikistan
25	Costa Rica	63	Mexico	101	Trinidad and Tobago
26	Czech Republic	64	Macedonia	102	Tunisia

No.	Country	No.	Country	No.	Country
27	Germany	65	Mali	103	Turkey
28	Denmark	66	Myanmar	104	Tanzania
29	Dominican Republic	67	Montenegro	105	Uganda
30	Ecuador	68	Mozambique	106	Ukraine
31	Egypt	69	Mauritius	107	Uruguay
32	Spain	70	Malawi	108	United States of America
33	Estonia	71	Malaysia	109	Venezuela
34	Ethiopia	72	Namibia	110	Vietnam
35	Finland	73	Nigeria	111	Kosovo
36	France	74	The Netherlands	112	Yemen
37	United Kingdom	75	Norway	113	South Africa
38	Georgia	76	Nepal	114	Zambia
				115	Zimbabwe

3.4.3 Data Collection and Measurement of Variables

This research will employ secondary data from well-known and reliable organizations. The table below shows the source of data for each variable.

3.4.3.1 Data Source for OGD

Table 3.7 Data Source for OGD

Latent variable	Dimensions/Items	Example of references	Data source
Open government data (OGD)	(i) Completeness of data (OGDC): (“Does the data exist?”) (ii) Timeliness of data (OGDT): (“Is the dataset being kept regularly updated?”) (iii) Machine readability (OGDM):	Kalampokis et al. (2011); Kassen (2013); Reiche & Höfig (2013)	World Wide Web Foundation (2017)*

Latent variable	Dimensions/Items	Example of references	Data source
	(“Is the dataset provided in a machine-readable format?”) (iv) Ease of electronic access (OGDE): (“Is it available online from the government in any form?”) (v) Open licensing (OGDL): (“Is the data openly licensed?”).		

For this variable, there were main six principles of OGD mentioned in the literature review and there were common eight principles of OGD uncovered by the case study analysis. However, the available score data for the OGD assessment provided by World Wide Web Foundation (2017) were mainly chosen and focused on the six principles of OGD, including completeness, timeliness, machine readability, ease of electronic access, open licensing, and being free of charge. Yet, when analyzing the multicollinearity for assessing for the formative construct validity of the measurement model for this variable, the items of machine readability (OGDM) and being free of charge (OGDF) (“Is the dataset available free of charge?) were highly correlated with the value of the variance inflation factor (VIF) greater than 10. This indicates that any change in a variable is related to a shift or change in another variable. In other words, the data of the two variables are related in the same direction. If the value of one variable increases, then the value of another variable will be greater in the same direction. However, this may reduce the accuracy of the estimated coefficient and weaken the statistical power of the model (Gujarati, 2003; Hair, Hult, Ringle, & Sarstedt, 2014; Henseler, Ringle, & Sinkovics, 2009b; Urbach & Ahlemann, 2010). In this matter, in order to avoid misinterpretation of the research results, the researcher selected the item of OGDM after testing if any item was eliminated; the VIF value of the model was then improved. After the elimination, the VIF value for the measurement model was seen to be acceptable. The results presented that the VIF values of all items of this variable were below 10. This

indicated that there was no multicollinearity for this variable in the first-order construct.

3.4.3.2 Data Source for DI

Table 3.8 Data Source for DI

Latent variable	Dimensions/Items	Example of references	Data source
Data impacts (DI)	(i) Economic impact (EI): (a) The extent to which OGD affects the economy (EI1) (b) The extent to which OGD increases the entrepreneurs' success in using open data to build new businesses (EI2)	Bertot et al. (2014); Janssen et al. (2012); Tinholt (2013); Young & Verhulst (2016)	World Wide Web Foundation (2017)*
	(ii) Social impact (SI): (a) The extent of the effect of OGD on government efficiency and effectiveness (SI1) (b) The extent to which OGD increases access for marginalized groups to participate in policymaking and accessing government services (SI2)	Morales et al. (2014); Scott (2017); Ubaldi (2013)	World Wide Web Foundation (2017)*
	(c) The extent to which ICT affects citizen access to public services (SI3)		Baller, Dutta, & Lanvin (2016) (World Economic Forum)***

Latent variable	Dimensions/Items	Example of references	Data source
	(iii) Governance impact (TA): The extent to which OGD increases government transparency and accountability (TAA)	(Peixoto, 2013) ; Verhulst (2016); Yu & Robinson (2012)	World Wide Web Foundation (2017)*

3.4.3.3 Data Source for GC

Table 3.9 Data Source for GC

Latent variable	Dimensions/Items	Example of references	Data source
Government capability (GC)	(i) Administrative cultural transformation (ACT): The extent of government openness	Blauer (2017); Geiger & Von Lucke (2012); Marr (2015, 2017); Zuiderwijk & Janssen (2014)	Ponce et al. (2016) (World Justice Project)**
	(ii) Policy of OGD (POGD): (a) The extent to which the open data policy or strategy has been clearly defined in a country (POGD1)	(Jung & Park (2015); Manyika et al. (2013)	World Wide Web Foundation (2017)*
	(b) The extent to which advanced technology is available in a country (POGD2)	Pereira et al. (2017); Young & Verhulst (2016)	World Wide Web Foundation (2017)*

Latent variable	Dimensions/Items	Example of references	Data source
	(iii) Management of OGD (MOGD): (a) The extent to which the government has a clear implementation plan for using the information from the data to improve the competitiveness of the country (MOGD1)	Dawes, Bershadskaya, & Parkhimovich (2016); Marr (2017)	Baller et al. (2016) (World Economic Forum)***
	(b) The extent to which the encouragement of IT use in a country has been successful (MOGD2)	Kassen (2013); Zhao & Fan (2018); Zuiderwijk & Janssen (2014)	Baller et al. (2016) (World Economic Forum)***
	(c) The consistency level of the OGD management (MOGD3)	Danneels, Viaene, & Van den Bergh (2017); Sansone et al. (2012); Wessels, Finn, Sveinsdottir, & Wadhwa (2017)	World Wide Web Foundation (2017)*
	(iv) Data cooperation (DC): The extent to which the government has run open data initiatives regionally or locally	Fan & Zhao, (2017); Marr, (2017); Thorsby, Stowers, Wolslegel, & Tumbuan	World Wide Web Foundation (2017)*

Latent variable	Dimensions/Items	Example of references	Data source
		(2017)	
	(v) government support (GS): (a) The level of available training organized by the government for individuals and business units to improve their skills in using OGD (GS1) (b) "The level of government support to promote a culture of innovation by utilizing open data" (GS2)	Fan & Zhao, (2017); Marr, (2017); Thorsby, Stowers, Wolslegel, & Tumbuan (2017)	World Wide Web Foundation (2017)*
	(vi) Research and development (RD): (a) The number of researchers per million people (RD1) (b) The total expenditure on R & D (% of GDP) (RD2)	Connelly, Playford, Gayle, & Dibben (2016); Frith (2017); Lane (2018); Maxwell & Trends (2017)	Dutta, Lanvin, & Wunsch-Vincent (2016) (Cornell University)****
	(vii) Citizen engagement (CE): The level of participation of civil society and the government in open data	Bartenberger & Grubmüller (2014); Bertot et al. (2014); Kassen (2013); Mellouli et al. (2014); Zuiderwijk, Janssen, &	World Wide Web Foundation (2017)*

Latent variable	Dimensions/Items	Example of references	Data source
		Davis (2014)	

3.4.3.4 Data Source for Preconditions of OGD

Table 3.10 Data Source for Preconditions of OGD

Latent variable	Dimensions/Items	Example of references	Data source
Information and Communication Technology Investment (ICTI)	The level of the available and networked ICT infrastructure	Lane (2018); O'Flaherty & Maloney (2017)	International Telecommunication Union (2017)***** (The data used in this research was in 2016)
Data Security (DS)	(i) The strength of the legal or regulatory framework in protecting the personal data in a country (DS1)	Blauer (2017); IBM (2015); Marr (2017); O'Flaherty & Maloney (2017); Spavin & Fegan (2017)	World Wide Web Foundation (2017)*
	(ii) The legal development related to ICT use in the country (DS2)		Baller, Dutta, & Lanvin (2016) ***
	(iii) The government's commitment to cybersecurity (including legal, technical, organizational, potential, and		International Telecommunication Union (2015) *****

Latent variable	Dimensions/Items	Example of references	Data source
	cooperation measures) (DS3)		
Trust in government (TG)	The level of trust the citizens have regarding their government	Chawda (2017b); Gravestock (2017); Henderson & Applewhite (2017); Spavin & Fegan (2017)	Helliwell, Layard, & Sachs (2017) (World Happiness)****** (The data used in this research was in 2016)

3.4.3.5 Data Source for PI

Table 3.11 Data Source for PI

Latent variable	Dimensions/Items	Example of references	Data source
Political instability (PI)	The perception level regarding the probability of political instability	Aisen & Veiga (2013); Carmignani (2003); Hollyer et al. (2014); Jong-A-Pin (2009)	Kaufmann, Kraay, & Mastruzzi (2018) (Worldwide Governance Indicators)******* (The data used in this research was in 2016)

Note
* No permission was required to use this data.
** The data were retrieved and permission was obtained from the Ponce et al. (2016) (World Justice Project).
*** The data were retrieved from Baller, Dutta, and Lanvin (2016) and permission was obtained from the World Economic Forum.
**** The data were retrieved and permission was obtained from Dutta, Lanvin, and Wunsch-Vincent (2016) (Cornell University).
***** The data (the data used in this research was from 2016) were retrieved and permission was obtained from the International Telecommunication Union (2017).
****** The data for the year 2016 were retrieved and permission was obtained from Helliwell, Layard, and Sachs (2017) (World Happiness).
******* The data were retrieved and permission was obtained from Kaufmann et al. (2018) (Worldwide Governance Indicators).

3.4.4 Data Processing and Statistical Data Analysis

A partial least square structural equations model (PLS-SEM) was employed in this research. The process of transforming the secondary data into appropriate data for analysis is explained in Figure 3.4.

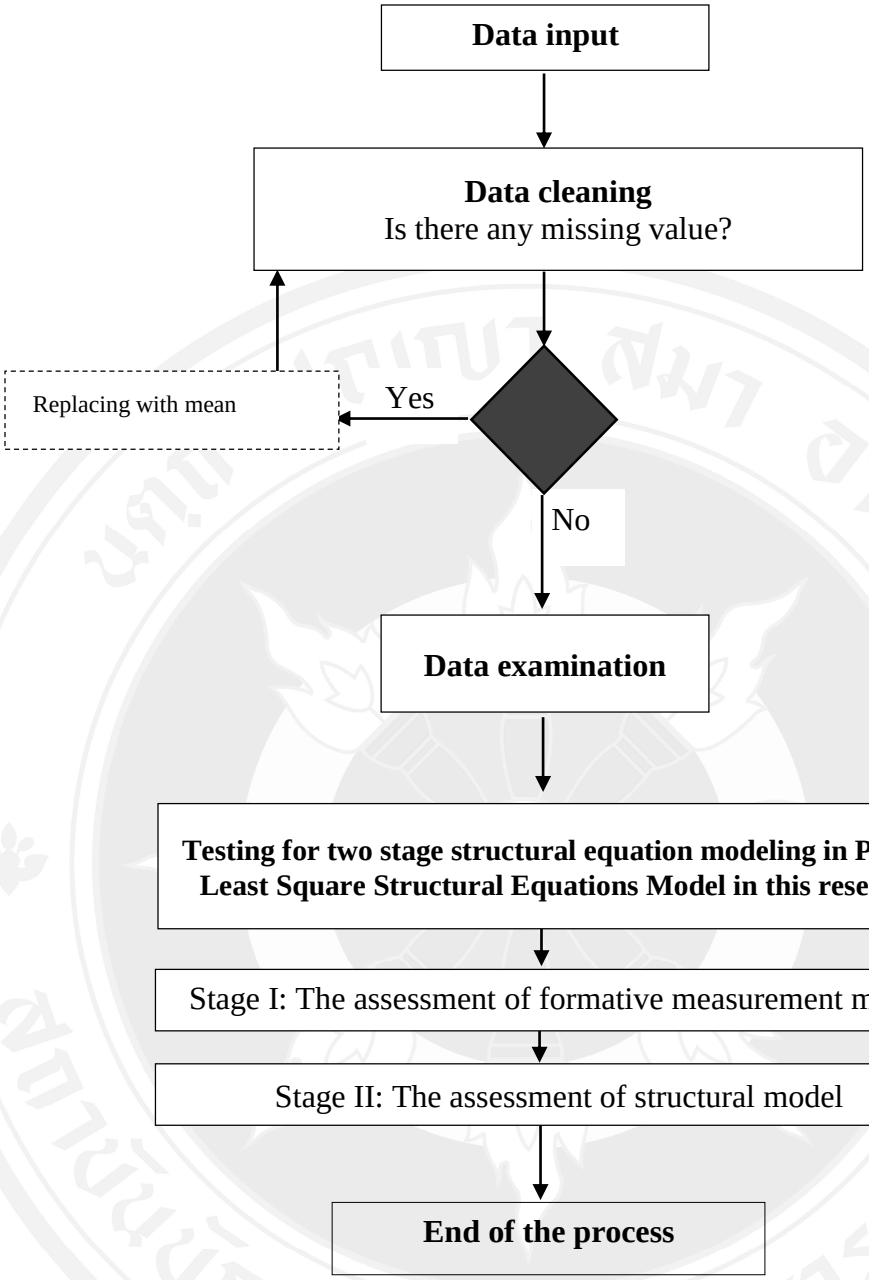


Figure 3.4 Data Processing

A partial least square structural equations model is an OLS regression-based estimation approach that prescribes its statistical properties. It combines two elements including, first, the measurement model that employs factor analysis and secondly, the structural model that employs path analysis. The two elements represent a two-stage analysis through the use of each technique. That is, the measurement model shows the relationships between the constructed variables and their indicators (for each constructed variable). The structural model presents the relationships (paths) between the constructed variables.

This research employs SmartPLS to test both the measurement and structural models because this tool is less sensitive in terms of small samples. It provides greater statistical power than a tool of the covariance-based analysis group (i.e., LISREL and AMOS). The two-stage structural equation modeling was adopted from from Hair et al. (2017, 2011), Lee et al. (2016), Sarstedt et al. (2014), and Wong (2013). The two-stage structural equation modeling includes (i) the assessment of the measurement model as presented in Figure 3.5 and (ii) the assessment of the structural model as presented in Figure 3.6. PLS algorithms and PLS bootstrapping were used with a maximum number of 10,000 iterations to assess both models. The process of the analysis is presented in Figure 3.4.

The first stage is the assessment of the formative measurement model; construct validity tests are assessed by applying factor analysis in considering convergent validity, discriminant validity, and multicollinearity. Then, the second-order constructs are analyzed by using the latent variable scores from the first-order constructs. Further, the second-order constructs are validated using the three construct validity tests. Additionally, reliability verification is not required in analyzing PLS-SEM since PLS-SEM assumes that the correlation between the measurement items is very low (Hair, Black, Babin, & Anderson (2019); Lee et al. (2016); Wong (2013)).

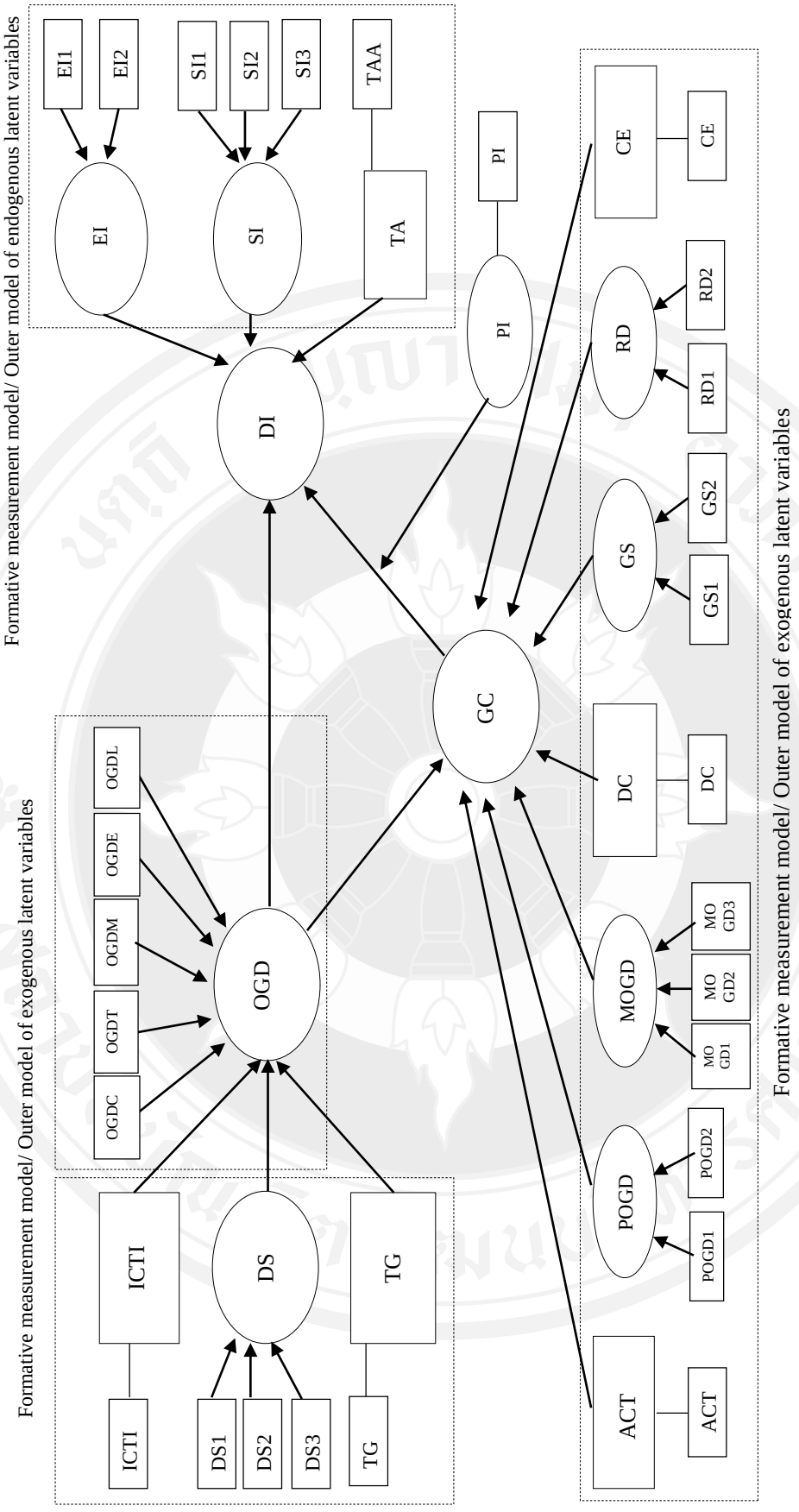


Figure 3.5 Formative Measurement Model/ Outer Model of PLS-SEM

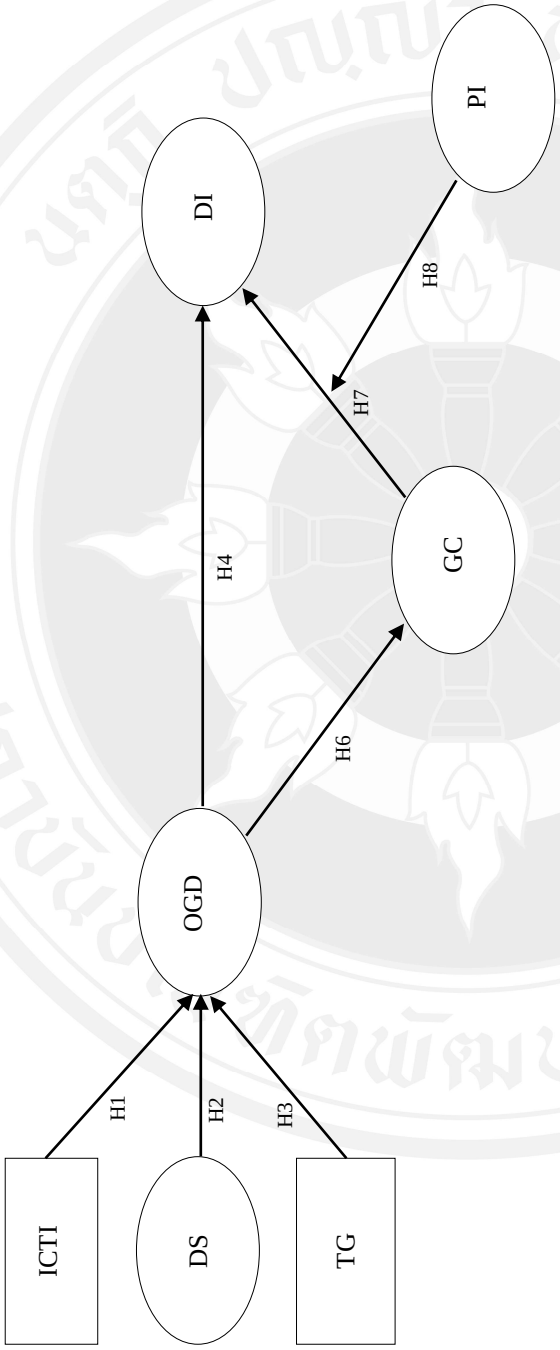
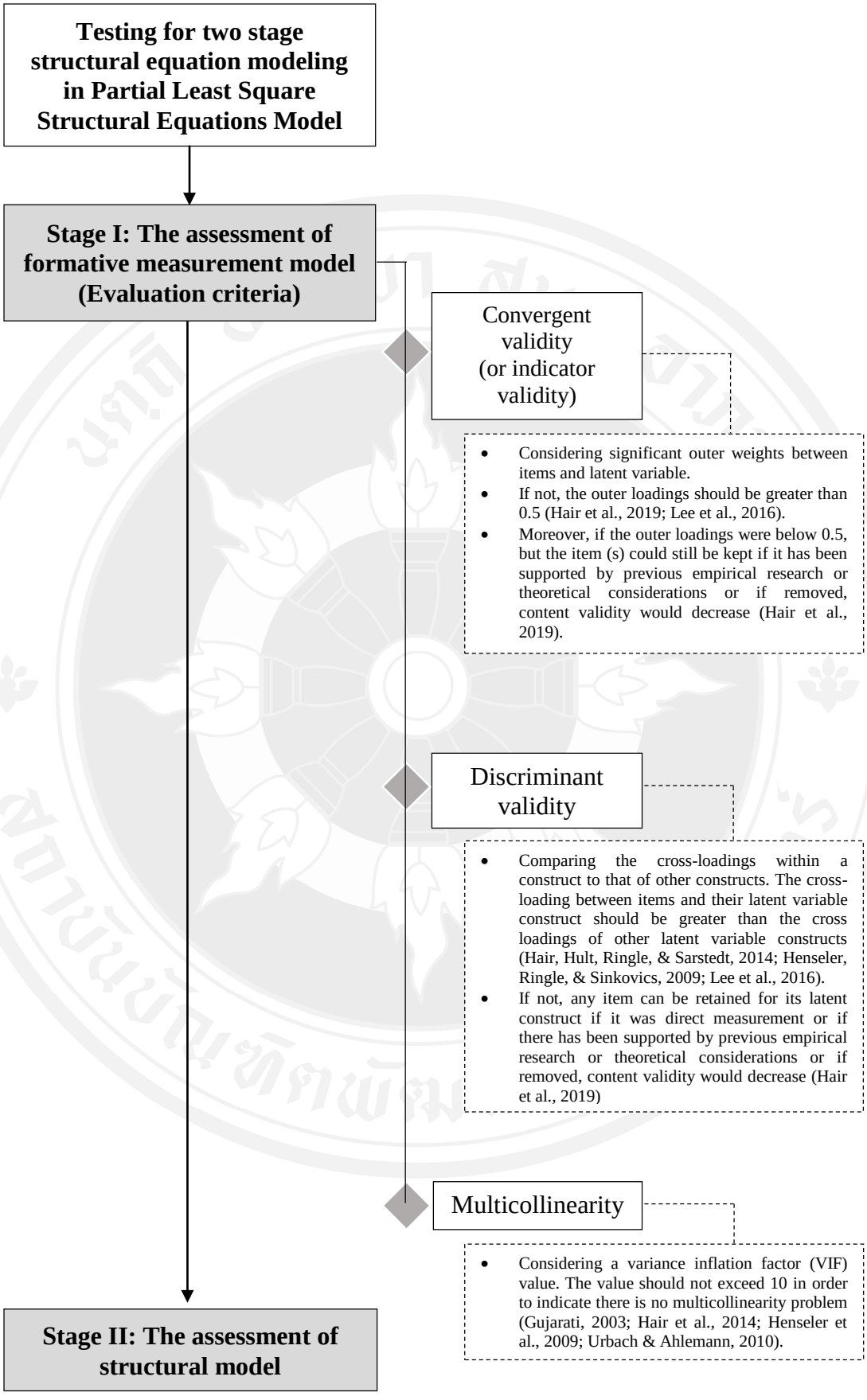


Figure 3.6 Structural Model/ Inner Model for PLS-SEM


Testing for two stage structural equation modeling in Partial Least Square Structural Equations Model
Stage I: The assessment of formative measurement model (Evaluation criteria)
Convergent validity (or indicator validity)
Considering significant outer weights between items and latent variable.
If not, the outer loadings should be greater than 0.5 (Hair et al., 2019; Lee et al., 2016).
Moreover, if the outer loadings were below 0.5, but the item (s) could still be kept if it has been supported by previous empirical research or theoretical considerations or if removed, content validity would decrease (Hair et al., 2019).
Discriminant validity
Comparing the cross-loadings within a construct to that of other constructs. The cross-loading between items and their latent variable construct should be greater than the cross loadings of other latent variable constructs (Hair, Hult, Ringle, & Sarstedt, 2014; Henseler, Ringle, & Sinkovics, 2009; Lee et al., 2016).
If not, any item can be retained for its latent construct if it was direct measurement or if there has been supported by previous empirical research or theoretical considerations or if removed, content validity would decrease (Hair et al., 2019)
Multicollinearity
Considering a variance inflation factor (VIF) value. The value should not exceed 10 in order to indicate there is no multicollinearity problem (Gujarati, 2003; Hair et al., 2014; Henseler et al., 2009; Urbach & Ahlemann, 2010).
Stage II: The assessment of structural model

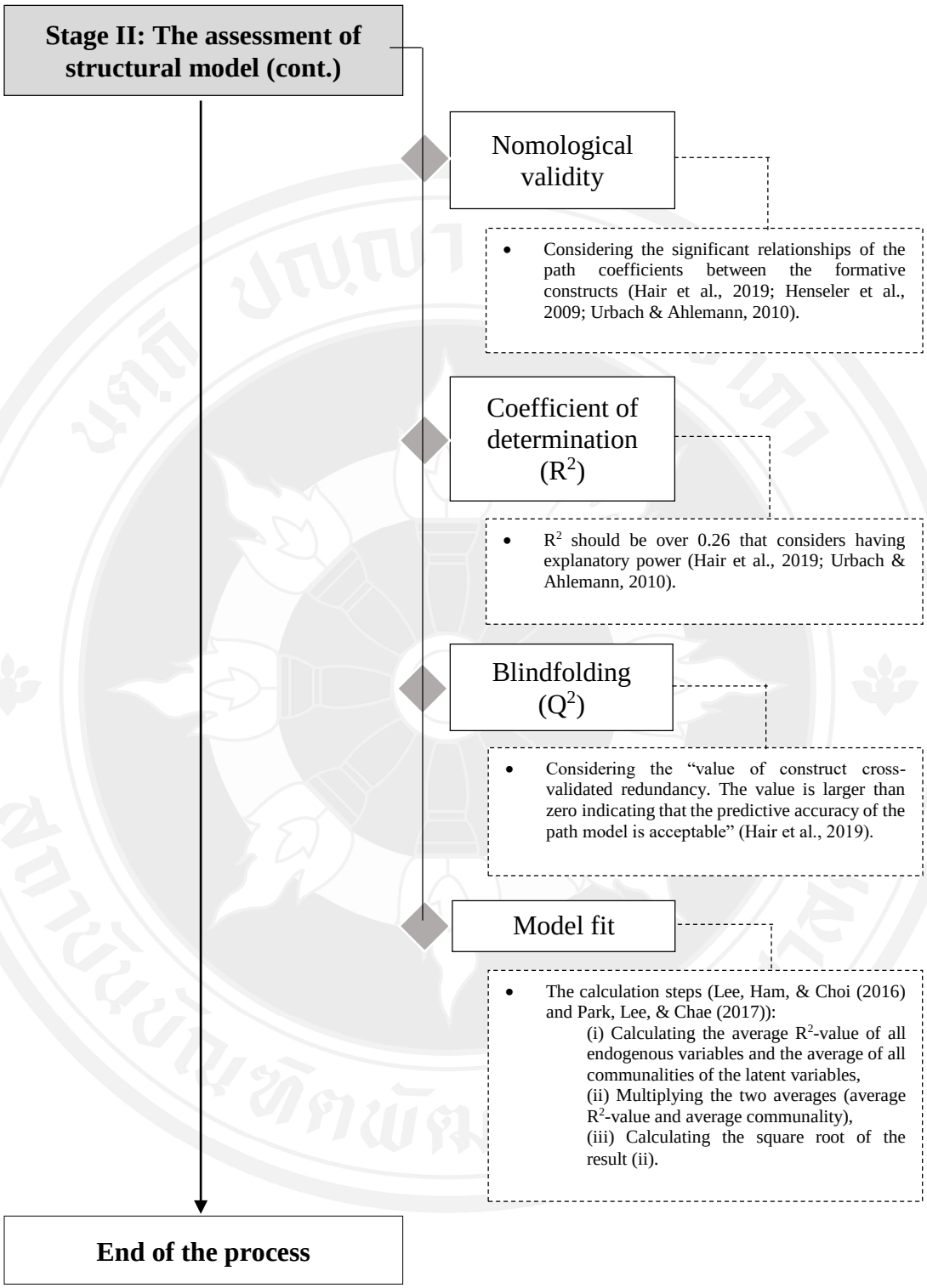


Figure 3.7 The Steps for Analyzing the Mediated Regression

Source: Adapted from Gujarati (2003), Hair et al. (2019, 2014, 2017, 2011), Henseler et al. (2009b), Lee et al. (2016), Park, Lee, and Chae (2017), Sarstedt et al. (2014), Urbach and Ahlemann (2010), and Wong (2013)

According to Figure 3.7, the second step was to assess the structural model in which the significant structural path was assessed in bootstrapping. Data based on the validated measurement model were used to examine the association between the exogenous variables and the endogenous variables. There were four criteria used to measure the relationship: nomological validity, coefficient of determination (R^2), blindfolding (Q^2), and model fit. Importantly, mediation was considered accordingly.

Mediation occurs when a variable intervenes between an exogenous variable and an endogenous variable. The intervention variable is called a mediator variable. More precisely, any changing unit in the exogenous variable will cause "a change in the mediator variable, which, in turn, results in a change in the endogenous variable in the PLS path model. Thereby, a mediator variable governs the nature (i.e., the underlying mechanism or process) of the relationship between two constructs."

Based on a simple mediator model, as shown in Figure 3.8, "p_3 is the direct effect between the independent variable and dependent variable. p_1 and p_2 are the indirect effects of the independent variable and dependent variable through the mediator, and the total effect is combined from the direct effect and indirect effect."

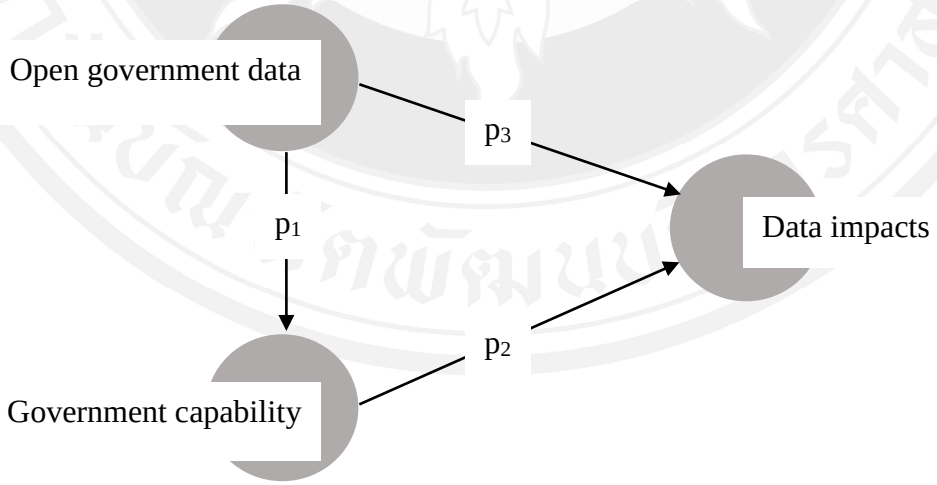


Figure 3.8 A Simple Mediator Model Used in This Research

To consider whether OGD and DI in relation to government performance will be mediated by GC, this research followed “the systematic mediator analysis process in PLS-SEM” proposed by Hair et al. (2017) and Zhao, Lynch, & Chen (2010) to indicate the type of mediation in the model as presented in Figure 3.9.

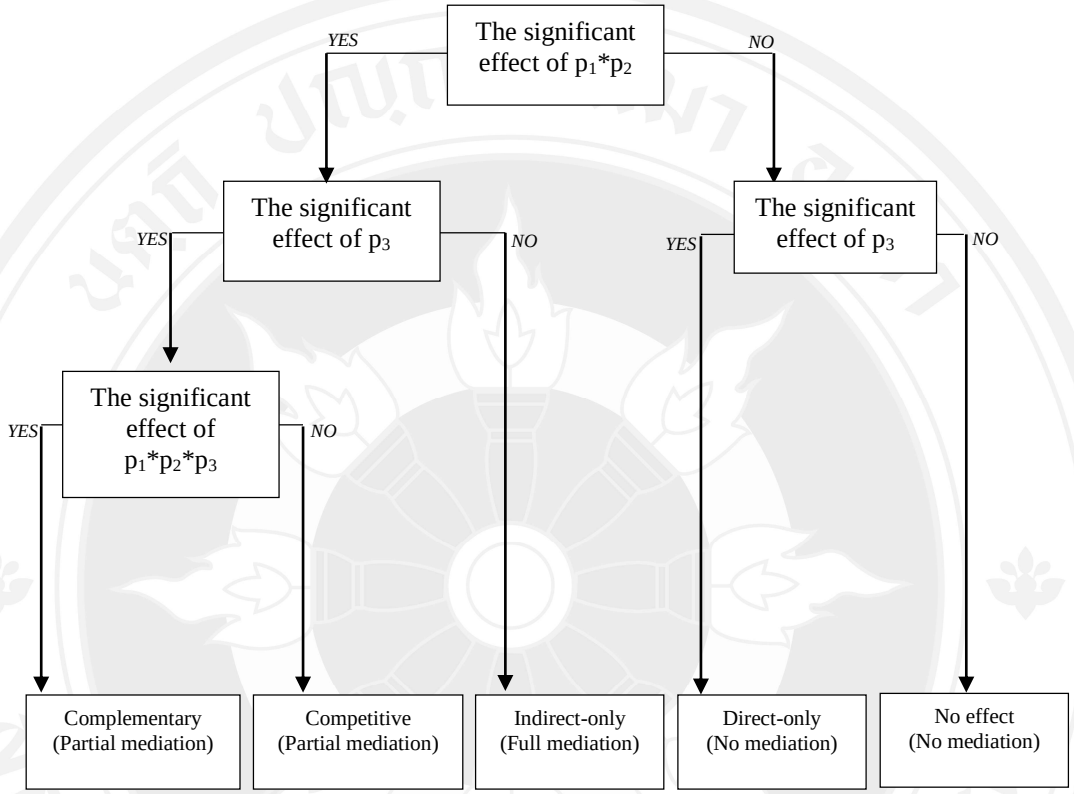


Figure 3.9 The Systematic Mediator Analysis Process to Use for PLS-SEM (adapted from http://www. smartpls.com)

As a result, the kind of mediation was decided with regards to the indirect effect of the mediation.

CHAPTER 4

RESEARCH RESULTS

4.1 The Results of the Case Study Analysis

4.1.1 Overview of OGD of the Ten Leading Countries

The top ten countries, as presented in Table 4.1, have a long history of developing OGD. The OGD are the result of the freedom of information act or right to information act. As presented, the United States was the first country to establish officially the right to information act in 1966. However, considering the context of open data in France, the declaration of rights of man and of the citizen inscribed the right to access public data in 1789 that citizens have the right of requesting any information from any public organization. Since then, the relative policies on OGD have been progressively developed. In recent years, they have proactively launched an OGD portal provided by government agencies. The portals consolidate government data and availably and release them to the public for use. The portals provide extensive search capabilities to the public, who can freely make use of them.

Table 4.1 Overview Movement of OGD in the Ten Leading Countries

Ranked	Country	Year of the FIA*/RIA**	OGD portal	Year of portal launch
1	United Kingdom	2000*	https://data.gov.uk	2010
2	Canada	1983**	https://open.canada.ca	2014
3	France	1978**	https://www.data.gouv.fr	2011
4	United States of America	1966**	https://www.data.gov	2009
5	South Korea	1996**	https://www.data.go.kr	2011
6	Australia	1982**	https://data.gov.au	2013

Ranked	Country	Year of the FIA*/RIA**	OGD portal	Year of portal launch
7	New Zealand	1982**	https://www.data.govt.nz	2009
8	Japan	1999**	http://www.data.go.jp	2014
9	The Netherlands	1978**	https://data.overheid.nl	2011
10	Norway	1970**	https://data.norge.no	2010

Note * FIA is the "Freedom of Information Act"

** RIA is the "Right to Information Act"

According to Table 4.1, although most of the countries only launched an OGD portal eleven years ago, they have made great progress in OGD development and accessibility. They perceive open government data as a strategic public asset, as with Australia (Department of Finance and Deregulation of Australia, 2013), the United States (Open government data act, 2017), the United Kingdom (Minister for the Cabinet Office and Paymaster General of England, 2012), Canada (Government of Ontario, 2015), New Zealand (Stats New Zealand, 2019e), and Japan (Castro & Korte, 2015).

4.1.2 Preconditions for Developing OGD in the Ten Leading Countries

4.1.2.1 Information and Communication Technology Infrastructure (ICTI)

ICTI has the power to drive innovation as a versatile tool. ICTI leads to higher productivity gains by laying the foundation for growth potential. Importantly, ICT can help facilitate employment, increase the quantitative workforce, improve operational quality, and contribute to economic recovery and address social problems. The use of ICTI is essential to modernize, simplify, and improve government processes and boost external outcomes. ICTI digitizes public operations in ways that support economic productivity, digital innovation, and competitiveness. The ICTI policy aims to influence ICTI development to achieve potential and efficiency in the public sector that fosters innovation and creates added value and inclusion in sustainable social development. The more that modern technology is invested and

developed, the more governments can use it to develop better public digital services. The development of public digital services is seen to be more relevant and suited to the needs of citizens and agencies. Such implementation of the government will be vital for future development and the creation of a more sustainable welfare society.

Table 4.2 ICTI of Each Country Regarding OGD Development

Country	Technology investment and development			Examples of advanced technology
	ICT1	ICT2	ICT3	
United Kingdom	*	*	*	- Cloud Technology - Application Programming Interfaces (APIs) - Robotic Process Automation (RPA)
Canada	*	*		
France	*		*	
United States of America	*			- Artificial Intelligence (AI) - Robotic Process Automation (RPA)
South Korea	*		*	- Internet of Things (IoT) - Cloud technology - Big data - Mobile platform
Australia	*	*	*	- Mobile and cloud technology - Grid computing - Cloud computing - Supercomputers/clusters - In-database processing - In-memory processing - Application Programming

Country	Technology investment and development			Examples of advanced technology
	ICT1	ICT2	ICT3	
				Interfaces (APIs)
New Zealand	*			-
Japan	*	*	*	- Artificial Intelligence (AI) - Internet of Things (IoT) - Cloud computing
The Netherlands	*		*	
Norway	*	*	*	

Note:

ICT1: Acknowledging and investing in advanced/disruptive technology

ICT2: Initiating guidelines/standards to improve technology for OGD development

ICT3: Improving the environment of OGD development

1) Acknowledging and Investing in Advanced/Disruptive Technology

The expansion of information and communication technology is ongoing and is critical in these countries. The technology that hosts the data must be developed and maintained in order to accommodate data storage and access. All countries see that previous ICT systems are insufficient for OGD management, as previous systems were unable to directly share the data in an open format. Previous systems were not designed to allow external actors to access, retrieve, or take advantage of the data. Traditional systems may hinder the capacity development of OGD. Data technology needs to be developed to support data entry, retention, dissemination, access, and data security. Based on the case study analysis, the advanced technologies that many countries have invested in can be seen in Table 4.2. Each country has developed its data technologies as follows.

The United Kingdom is constantly improving its technology infrastructure. For example, the redesigned data.gov.uk site helps people find and use

OGD as well as encourages government organizations to release more OGD (European Commission, 2019). The goal of the government's ICTI policy is to coordinate the data technology infrastructure to facilitate the discovery of knowledge and the creation of new integrated services. The government focuses on developing interoperable and engaging cross-domain city data as the policy hub to provide the most advanced methods for sharing and using data (Suzuki & Finkelstein, 2019). The advanced technology to support the policy is cloud technology, for example. A cloud-based open-source system (CKAN) and APIs are used in London to harvest and present OGD. Since London's data store is an open-source, cloud-based, and cloud-agnostic system to meet the needs of multiple users with secure access, the public can access the data via web interface. The systems are found throughout London (not just in the public sector, but in many companies). Cloud-based digital infrastructure creates flexible interfaces and is tied to a London government initiative to integrate existing IT activities (Suzuki & Finkelstein, 2019).

More importantly, the United Kingdom is the world leader in exploring the potential of robotic process automation (RPA). The RPA Center of Excellence (CoE) was established by the UK's cabinet for spreading potential and adoption of OGD across the federal government. For example, RPA has been applied in the national health service (NHS) (National Health Service, n.d.), the government public-health service, established by the national health service act of 1946. RPA is currently estimated to save the cost of public-health services over £495 million each year (McGregor, 2019). RPA helps to reduce the amount of time that employees spend on repetitive and routine activities or eliminates low-value work and helps employees focus on higher-value activities. RPA can lead to cost reduction goals, drive efficiency, and helps organizations deliver critical public services. Importantly, it drives and improves the quality of data available for executive decisions. Due to the benefits of reducing costs and improving its services to be automated, the British government is trying to continue to use the technology as the foundation of government processes.

Similar to the United Kingdom, the Canadian government has improved its web service to make it easier for Canadians to discover and access government data and services online via the new Canada.ca. Canada.ca is the source

for all government data and services and can be accessed by using any device, such as desktops, tablets, or smartphones. The government delivers its data based on Canadians' needs (OECD, 2014a). The implementation of IT management methodology is undertaken by Canadian government agencies, and the treasury board of Canada secretariat office of the chief information officer of Canada," in order to ensure the continued use of digital technology (OECD, 2014a). Likewise, the French government has developed a system with digital technology that covers all areas (Explanatory Memorandum (Digital Republic Bill), n.d.). The government has taken action regarding the digital technology of data in collaboration with business and government agencies that introduce concrete strategies and transform the digital economy (Republique Francaise, n.d.). According to the regional digital development guidelines (schémas directeurs territoriaux d'aménagement numérique, SDTAN), the government provides services and strategies for expanding electronic communication infrastructure and networks, mobile phone networks, high-speed broadband networks, and satellite networks. These guidelines aim to promote consistency in government initiatives and appropriate coordination with private investment through technology infrastructure (Explanatory Memorandum (Digital Republic Bill), n.d.).

The United States has continued to invest in information technology in the development of the "Data.gov" portal. The United States general services administration uses cutting-edge methods and technology to improve the lives of citizens and public servants through transforming the way in which public agencies use technology. Public services can be more accessible and efficient with modern applications and platforms (U.S. General Services Administration, 2009). The agency chief information officer is responsible for regularly evaluating and improving technology and selected data (Office of the Press Secretary (The White House), 2016a). Importantly, the government has given importance to investing more in advanced technology, including artificial intelligence (AI) and Robotic Process Automation (RPA) to shift their work and resources to high-value work (Office of Management and Budget of the United States, 2018). Robotics, process automation, and other emerging technologies are being used by government organizations to reduce errors, improve compliance, and prioritize federal workers to do higher-value work (The White House, Executive Office of the President, &

Office of Management and Budget, 2019). For example, the chief financial officer office has shifted employees to higher-value jobs after automated work, spending about 12,000 hours a year on work for about half the cost. The national aeronautics and space administration's shared services center has four bots running nine different processes, including "distributing funds, procurement, documenting images, scanning files, and creating folders to establish grants packages." The U.S. department of health and human services is using artificial intelligence to help identify automotive integration opportunities that could save significant costs and take advantage of the overall purchasing power of the department to maintain lower prices, but achieve operational efficiency (U.S. Department of Health and Human Services, n.d.).

In South Korea, the minister of the interior and security must establish, manage, and promote the use of OGD portals to ensure the effective provision of OGD due to article 21 of the act on promotion of the provision and use of public data of 2014. South Korea has a key to laying the groundwork for an open information portal through e-government as a driving force behind the rapid development of Korea (Ministry of the Interior and Safety (South Korea), 2016). Korea has made a bold decision to invest 1% of the country's budget in e-government. The most stable and fast path to e-government has built a widespread national basic computer network and high-speed ICT infrastructure. In particular, "new technology converged with IoT, cloud, big data, and mobile, the so-called 'ICBM', is transforming the future of e-Government." The blueprint for Korea's new e-government provides advanced intelligence management using new technology and creates a smart collaboration environment: Korea's new 2020 e-government focuses on human investment to recognize the advanced ICT. The Korean government is now actively providing public services using the latest information technology such as mobile platforms to serve the public.

The Australian government's ICT strategy 2018-2021 is paving the way for consolidating new technology and investment opportunities in ICT infrastructure to drive better services and to provide governments with more informed decisions, for example, in South Australia (Government of South Australia, 2018). Strategy vision ICT is to take advantage of the opportunities created by new

technology and new work methods to make meaningful and convenient engagement with Australians (Government of South Australia, 2018). Mobile and cloud technologies are used to offer a seamlessly integrated experience that provides easier access to data and better analytics. In order to implement that, the appropriate infrastructure options for an agency must be considered for their objectives: (i) grid computing-applications, (ii) cloud computing and supercomputers/clusters, and (iii) in-database processing.

The New Zealand government recognizes the OGD as a long-term cultural shift for public sector practice. Sufficient infrastructure, laws and policies, resources, and personnel have been provided to support the implementation of OGD and its long-term outcomes (New Zealand government, 2018). In the technology aspect, the establishment of an open data infrastructure has been undertaken by investing in the OGD portal, which increases OGD integrity throughout the government.

Likewise, the Japanese government has focused on IT strategies and practices for more than two decades (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). IT revolutionized Japan and made a big change in the industrial revolution (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). EJapan's strategy has focused on developing information technology (IT) infrastructures such as ultra-high-speed networks, developing e-commerce regulations, and investing human resources so that all people can proactively use the IT. Since then, Japan's national development priorities have shifted towards the utilization and application of IT policies aiming to be the most advanced IT country in the world (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Because the amount of data is greatly circulated through using its potentiality, the government has developed advanced technology: artificial intelligence, Internet of Things, and cloud computing (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). According to the basic act on the advancement of public and private sector data utilization of 2016, artificial intelligence-related technology means “technology for the realization of intelligent functions, such as learning, inference,

and judgment, by artificial means, and utilization of the relevant functions realized by artificial means." The Internet of things utilization-related technology means "technology for the utilization of a large amount of information which is sent from or to various and many objects connected to the internet, which brings improvement in the management efficiency and productivity of companies, creation of new businesses and increase of employment opportunities through the creation of added value by utilizing the information, thereby contributing to the improvement of the citizens' lives and sound development of the national economy". Cloud computing service-related technology means "technology for services providing computers (including an input-output device; the same applies hereinafter) for another person's use for information processing via the Internet or any other advanced information and telecommunications network" (Basic Act on the Advancement of Public and Private Sector Data Utilization, 2016).

In the Netherlands, after 2 0 years of ICT development, ICT infrastructure has largely been implemented and used to enable service providers to improve their services. In the Netherlands, four common technology infrastructures include service delivery portal (i.e. overhead.nl, ondernmersplein.nl., and catalog of services), authentication (i.e. DigiD (for citizens), eHerkenning (standard for business)), interconnectivity (i.e. networks and standards, such as diginetwerk, digipoort, certification/PKI overhead scheme, open standard list, reference architecture), and open government data (i.e. Data.overheid.nl, CBS (Statistics), National georegister) (Ministry of the Interior and Kingdom Relations of Netherlands, 2017). These technological infrastructures have supported

In Norway, the government seeks to provide additional funding to organize ICT programs and digitalization to ensure that ICT programs are adequately connected and the necessary links between government stakeholders (OECD, 2017). The Norwegian government points out from a socio-economic perspective that the government should take advantage of the advancements in technology taking place in a competitive market rather than self-developed technology (Norwegian Ministry of Local Government and Modernization, 2019b). Establishing a centralized ICT procurement strategy is an effective strategy to build stronger negotiating power of the public sector in the private procurement of ICT

goods and services (OECD, 2017). The government also released 5 principles for digital projects in the public sector including “(i) start with needs, (ii) think big - start small, (iii) choose the right partner, (iv) ensure the right expertise and good managerial understanding, and (v) live frequently - create benefits all the way” (Ministry of Local Government and Modernization of Norway, 2016a). IT infrastructures have been maintaining to facilitate the development of digital services at the same time that new digital solutions are evolving.

2) Initiating Guidelines/Standards to Improve Technology for OGD Development

Under the United Kingdom’s digital government infrastructure policy, the government digital service team has revised the open government standards principles to make it easier for government agencies to adopt the standards since April 2018 (European Commission, 2019; Government of the United Kingdom, n.d.-b; Suzuki & Finkelstein, 2019). For example, London's digital infrastructure plans are clear regarding the role of OGD as the central asset of infrastructure delivery, asset management, utility support, complex business planning, and application development. The features in London's data infrastructure are as follows: (i) sharing (sharing and presenting OGD to city data partners through a variety of tools such as citizens, city managers, other third parties); (ii) sensing (the ability to process and analyze effectively to enable customization and use of data by a city or citizen); (iii) storaging (as the storage tends to be distributed, cataloging it so that it can be searched and accessed from a single point); (iv) advanced analytics (techniques for working with unstructured and large data such as software and hardware).

In Canada, templates, guides, and applications are presented with guidelines and methods to government agencies to report IT investment plans over three years (OECD, 2014a). This allows for cross- and inter-departmental comparisons and informs the Canadian government of departmental IT progress, planned costs, and digital transformation efforts. The Canadian government has implemented principles to improve technology for supporting the development of OGD: (i) The application portfolio management (a tool and manual for life cycle management, standards, and IT age assessment methods) and (ii) the IT management accountability framework (the core elements required good IT management in the

public sector and ensures that departments continue to focus on excellence in management and efficient service delivery).

In Australia, the government implements, coordinates and supports the organization's ICT strategy to ensure that the ICT infrastructure and software support OGD's operations. The principles of ICT development are "(i) better access by exploring an assessable, flexible, controllable, and timely software, (ii) seamless service delivery by establishing the center digital services with agile, hybrid, and multi-cloud IT environments, (iii) a connected government by enhancing modernized integration and compatibility across agencies, and (iv) contemporary architecture by embracing cloud-native techniques, technologies, and architectures including micro-services architecture and application programming interfaces" (Government of South Australia, 2018).

In Japan, the utilization of OGD has been realized since the basic act on the formation of an advanced information and telecommunications network society was established in 2000 (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society, 2000). This law is intended to promote measures to rapidly intensify the creation of an advanced society, a network of information, and telecommunications, taking into account the urgency of adapting to the rapid and radical economic and social structural changes of the world caused by the use of information and telecommunications technology. It guides the standards for OGD development and utilization.

In Norway, maximizing ICT progress is not a goal, but evolving as a tool for making life easier (Ministry of Local Government and Modernization of Norway, 2016b). The government has established 5 principles in the ICT policy respectively (Ministry of Local Government and Modernization (KMD) of Norway, 2016), 2016): "(i) a user-centric focus, (ii) efficient use of ICT, which constitutes a significant input fact for innovation and productivity and the authorities shall accommodate increased digital innovation by adapting regulations, creating favorable framework conditions, removing obstacles to digitization, and facilitating a world-class infrastructure providing high-quality electronic communication networks and services, (iii) strengthened digital competence and inclusion, (iv) effective

digitization of the public sector, and (v) sound data protection and information security".

3) Improving the Technology Environment of OGD

The governments also focus on improving the technological environment of OGD, which refers to technology for data users to access and to be able to use the data. Due to the size and population density of a country, numerous communities are rural or isolated, and therefore are without reliable access to the Internet. In order to ensure that all citizens have equal access to the data they have, a government needs to be mindful of the so-called digital divide.

In the United Kingdom, the data-sharing environment is created securely. The government provides accessible ICT for its citizens. Further, the French government has perceived that access to the digital technology of the population is essential. The government agencies have set a multi-year strategy to make the OGD portal and mobile apps and software accessible. The strategy must include a way to review and verify additions, and content modifications (Explanatory Memorandum (Digital Republic Bill), n.d.). Further, the South Korean government sees the new ICT as creating a connected society through connecting people, things, and space without restrictions. The Korean government takes public services very seriously through the use of the latest information technology, such as mobile platforms, to provide a wide range of services. Thus, the citizens of Korea are greatly encouraged to use technology. In the dimension of technology marketing, South Korea strongly supports private companies in technological development competition (Ministry of the Interior and Safety (South Korea), 2016). Additionally, the Australian government supports citizen services with coverage of mobile and social technologies (Government of South Australia, 2018).

Japan's government also supports its citizens to reap the benefits of information and telecommunication technologies (Hiramoto, 2013). IT strategy has been transformed by driving "the IT structural revolution to achieve a society where everyone can feel the benefits of IT anytime and anywhere." Since then, it has fostered the integration of advanced data, telecommunication networks, content enrichment, and data acquisition skills (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society, 2000). The

benefits of digital technology are offered for everyone to create a citizen-driven digital society and to bring about a transformation to a real knowledge society. The Japanese government secures the world's highest IT infrastructure environment by implementing a policy of continuous and fair competition between businesses in order to ensure access to high-speed and low-cost broadband (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Japan's broadband environment is developed and secured according to regional characteristics. Remote areas such as rural and remote islands have also been developed and expanded to provide high-speed broadband services in order to ensure that IT is available even during natural disasters.

4.1.2.2 Data Security

The world of data is rapidly changing through ever-increasing new sources, increasing demand for data, and increasing user capabilities. OGD presents new challenges regarding data privacy and security. Keeping the data safe and protecting privacy and confidentiality are essential. Data security is a fundamental prerequisite for OGD development. Hence, successful digitalization is about protecting data based on security and privacy requirements. Government agencies must ensure that personal data are not released or available to the public, with only authorized persons as necessary knowing about it. In this regard, the development of OGD systems requires addressing several specific privacy issues, such as the practice of improving the use of data, developing better practices in data association, and necessary considerations before releasing OGD.

Table 4.3 Data Security

	Data security	
Country	**DS1**	**DS2**
United Kingdom	*	*
Canada	*	
France	*	
United States	*	*

Country	Data security	
	DS1	**DS2**
South Korea	*	
Australia	*	*
New Zealand	*	
Japan	*	
The Netherlands	*	
Norway	*	*

Note: DS1: Protecting Citizens' Rights and Privacy with Laws or Policies

DS2: Implementing the Privacy Impact Assessment

1) Protecting Citizens' Rights and Privacy with Laws or Policies

OGD management policies must be based on laws related to the dissemination of datasets and the control of the use of the data so as to consider privacy and any ethical implications. Laws concerning the dissemination of OGD and the use of OGD need to be established to ensure that personal data or other government data are collected fairly and legally, to inform individuals how the data are being collected and how it is being maintained, to inform individuals how the data will be used, and to keep personal data safe from unauthorized access and misuse. Digital security is a top priority for governments. Digital security requires a holistic view across all sectors and in other security contexts. It is therefore vital that all performers, both public and private, work together to address the challenges of digital security.

In the United Kingdom, data security is essentially related to the digital government (European Commission, 2019). The UK has currently implemented the data protection act 2018, which focuses heavily on "data subject rights, special category personal data, data protection fees, data protection offenses, consent from children and enforcement" (Data Protection Act of 2018, n.d.). According to the national cybersecurity strategy 2016-2021 (HM Government, 2016), the government plans to make the UK more secure and resilient in cybersecurity with three main objectives: (i) defend, (ii) deter, and (iii) develop. The first is to protect the UK from cyber threats by effectively confronting incidents to ensure that UK

networks and systems are protected from such threats. Further, people, businesses, and government agencies can protect themselves in the cyber world. The second is to become a tough target for all forms of cyber aggression through detecting, understanding, investigating, deterring cybercrime, monitoring, and prosecuting offenders. The last one is building an innovative and growing cybersecurity industry. Adequate skills and new expertise will meet demands and overcome future threats and challenges. The UK's vision for 2021 is security and resilience against cyber threats while thriving and being confident in cybersecurity. The national cyber security center was created to serve as the organization for creating cybersecurity environments, sharing knowledge, addressing vulnerabilities, and being a leader in national cybersecurity issues. Additionally, the government works with international organizations to enhance cybersecurity and to protect UK interests overseas, such as NATO, EU, and UN. The British government has invested £ 1.9 billion to significantly transform UK cybersecurity. The UK has been pushing for secure cyber behaviors that need to stay ahead of emerging threats. The UK's future for security and prosperity rests on a thriving digital society that is both resilient and capable to manage and fight cyber threats (HM Government, 2016).

Canada has 28 laws at the federal, provincial, and local levels for data protection and privacy. At the national level, collection, utilization, and disclosure of information are governed by bill C-6 of the personal information protection and electronic documents act (PIPEDA) 2000, which focuses on data breaches. For public agencies, data privacy is governed by privacy act of 1983 (Privacy Act of 1983, n.d.). The privacy act allows people to access their information stored by the government. This law prohibits any government or private agency from disclosing personal information or using it for any purpose other than the original purpose of collecting it. The latter can be used without the individuals' consent (Office of the Privacy Commissioner of Canada, 2019). For provincial agencies, data security laws depend on the province. For example, the personal information protection act of 2004 was implemented by Alberta. The personal information protection act of 2003 was implemented by British Columbia, and the personal health information protection act of 2004 was implemented by Ontario.

France currently uses the France's data protection act 2 (Law No. 2016-1321). The data protection act of 2016 sets the conditions for the controller of data handling, data processing, and data owners. The law also requires that all data processing be carried out on a fair, lawful basis and for lawful purposes. Moreover, the digital republic bill protects personal data extensively by (1) creating an open environment to maintain the principles of network neutrality and transferability; (2) introducing the concept of a digital platform service; and (3) giving rights related to personal data (Explanatory Memorandum (Digital Republic Bill), n.d.). The government undertakes the right of individuals to decide how to communicate and use its data by giving citizens the right to access the data and to object to the data that others want to access.

The United States has several data privacy laws. In practice, the United States follows a sectoral approach to data protection and data privacy through the application of specific and state laws. Data protection and privacy laws are based on law enforcement combined with legislation, regulation, and self-regulation. There are about 20 specific federal-level privacy laws and more than 100 state-level privacy laws. Just in California, there are 25 laws related to privacy. The most important national laws consist of the privacy act of 1974, the privacy protection act of 1980, the Gramm-Leach-Bliley act of 1999, the health insurance portability and accountability act of 1996, the fair credit reporting act of 2018. Further, there is a special agreement of a privacy shield with both the EU and Switzerland called the EU-U.S./Swiss-U.S. privacy shield. The California consumer privacy act (CCPA) grants California citizens' the right to protect their data: "right to notice, right to access, right to opt-in (or out) and right to equal services." An organization that collects and stores the personal data of Californians is required to comply with the CCPA. In the U.S., the government recommends that companies implement their data privacy and security policies, develop their technology, and develop human skills to prevent the dissemination of their data.

In terms of data in public agencies, all datasets accessed through Data.gov are restricted to public data and must not contain national security data as required by law or other protected information by law (U.S. General Services Administration, n.d.). Data.gov is committed to protecting the privacy and security of

its website visitors by not collecting personal data unless the public chooses to provide it themselves. Data.gov's privacy policy will be amended or improved if a better method is developed. Related to Data.gov, there are several relevant acts to protect the privacy of citizens. The e-government act of 2002 is aimed at ensuring the privacy of data held by the public sector. Section 208 of this law requires government agencies to conduct specific privacy impact assessments for electronic systems. Government agencies are required to periodically conduct risk assessments and the magnitude of the harm if data are improperly accessed, if data are interrupted, if data are modified, and if data are destroyed. Data security assessments must occur throughout the lifecycle of the data system in each agency. In particular, the federal government requires government agencies to maintain information security by operating and maintaining programs to ensure that there is sufficient security for all data. Monitoring and security controls in each system should be conducted at least every three years (Office of Management and Budget of the United States of America, 2000).

The Australian Government has ensured to protecting the right to privacy of individuals (Department of Finance and Deregulation of Australia, 2013). The cornerstone of privacy protection law that applies to both the public and private sectors is the privacy act 1988 (Office of the Australian Information Commissioner of Australia, 2019). It provides guidelines for the “avoidance of acts or practices that may or might be interferences with the privacy of individuals, or which may otherwise have any adverse effects on the privacy of individuals”. The handling of personal data throughout the data lifecycle, from the collection, storage, security, exploitation, disclosure to destruction, has been identified by the act. It is based on “13 Australian privacy principles” covering “(i) the collection, use and disclosure of personal information, (ii) an organization or agency’s governance and accountability, (iii) integrity and correction of personal information, and (iv) the rights of individuals to access their personal information” (Office of the Australian Information Commissioner of Australia, n.d.). This gives organizations the flexibility to customize the handling of personal data to the business model and diverse needs of individuals. The Australian privacy principles apply to both public and private sectors (Australian Government, 2013). Besides, there is a state law, such as information privacy act of

2009, which is Queensland organizations that handle personal data are subject to the law.

In New Zealand, data privacy in New Zealand is governed by the privacy act of 1993, which focused on “the purpose of collecting data, how it is stored and accessed, and limits on the use and disclosure of personal data.” There are also legislations related to data privacy, such as credit reporting privacy code of 2004, health information privacy code of 1994, telecommunications information privacy code of 2003. Currently, New Zealand replaced the 25-year privacy act with the privacy bill of 2018. The key changes to the current law include breach reporting, compliance notices, and strengthening cross-border streams. New Zealand has developed OGD with a focus on citizens, taking into account the subject matter and how to prevent it from the misuse (Stats New Zealand, 2018a). The government aim to encourage disclosure of data, privacy, and freedom of use of data (New Zealand government, 2018).

The Japanese government has created free and secure cyberspace throughout the data cycle. In order to increase the safe use of data by the public and private sector, there is a must to strengthen cybersecurity measures. Since 2000, this guarantee of security and reliability for networks and protection of personal data have been based on the basic act on the formation of an advanced information and telecommunications network society (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society, 2000). The Japanese government has implemented a cybersecurity strategy to become a strong cyberspace leader, which made Japan a “cyber-security nation” in 2013 (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013; National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). Japan seeks to be the world's highest IT society. Strengthening cybersecurity is essential for managing data security and increasing Japan's industrial competitiveness through the use of IT and data. Japan reformed its privacy law in 2017. Currently, the new law is the act on protection of personal information of 2017 (the APPI 2017), which provides fundamental data protection policies. This law specifies requirements regarding third-party data transfer, data-recorded keeping, anonymity, infringement, and protecting the rights of individuals in

terms of their data. Any business in Japan that stores personal data must strictly comply with the APPI. The reformed law has placed Japan on the “white list” of EU countries with adequate data protection laws.

In the Netherlands, the protection of privacy and personal information is based on the personal data protection act of 2000 (Dutch government, n.d.-a). Privacy is a major concern for government organizations (Safarov, 2019). Personal data means data that can be traced to an individual, such as name, home address, or email address. This data protection is governed and protected in the general data protection regulation (Netherlands Enterprise Agency, n.d.). Citizen privacy protection and personal data on the Internet are also protected by this regulation. This regulation protects the privacy of citizens and also applies to personal information collected through the Internet. Under this regulation, personal data will be processed only with clear communication. It also needs to be clear on what purpose the data is stored for. This means that any place where individuals enter their name or address (email) will be clearly stated for any purpose of using the data. “Some dataset is not available for public reuse. If the dataset is "closed", it must be clear why the dataset will not be available or will be available” (Dutch government, n.d.-b).

Norway has a strong focus on data protection and data security (Ministry of Local Government and Modernization (KMD) of Norway, 2016)—data protection and security are integral components of the development and implementation of information and communication technology there. Citizens have as much control over their data as possible. Certain types of data are not be disclosed or open for further use, including sensitive personal data, confidential data, or copyrighted data of third parties. According to article 6 of the general data protection regulation (Norwegian Ministry of Local Government and Modernization, 2019b), “data sharing must be within the framework of a legal system and in the scope of the applicable personal data protection regulations.” Any use of any personal data is under article 6 of the general data protection regulation. Confidential data can no longer be used, such as personal data and business secrets under section 13 of the public administration act of 1967. In this context, “place of birth, date of birth, nationality, marital status, occupation, place of residence, or place of work” are not considered personal unless these data can be disclosed to a client relationship or are

specific to an individual. The preparation of data that may contain personal and business data should be carefully evaluated under both the personal data act and the public information act on a case-by-case basis. Cybersecurity must be considered from a broad perspective from all sectors in the context of administrative and civil protection activities (Norwegian Ministry of Local Government and Modernization, 2019b).

In South Korea, according to the act on promotion of the provision and use of public data of 2017, the head of each state agency must provide OGD that is collected and managed by public agencies to the public. The conditions of such disclosure do not apply to some of the data. For example, data under article 9 of the official information disclosure act must not be disclosed. OGD relating to the rights of third parties are protected under the copyright act or any other law. If the data user is likely to violate any terms of the use of OGD, such as the use of public data that greatly violates the rights of third parties, the use of public data for a crime or other offenses, its use is legally prohibited under applicable law. The head of public authorities can prosecute any person that fails to comply with the terms of the use of OGD (Act on Promotion of the Provision and Use of Public Data, 2017).

2) Implementing the Privacy Impact Assessment

Some of the leading countries have undertaken privacy impact assessment (PIA) to initiate and improve privacy. PIA is a tool that (i) explains how personal data flows in the data cycle; (ii) analyzes the potential privacy impact on individuals; and (iii) identifies recommended options to reduce or eradicate these effects..

In the United Kingdom, whenever new policies or initiatives are developed or revisions are made to existing policies related to the handling of personal data, all government entities are required to undergo PIA (Minister for the Cabinet Office and Paymaster General of England, 2012). PIA is now a part of the process of identifying and managing risks to prepare government agencies for potential threats. When risks are identified through PIA, government agencies need to combat disclosure risks by managing them appropriately. Government agencies must build the capacity to understand identification techniques and combine various data for identification purposes

In the United States, according to federal laws and regulations, privacy and protection issues must be considered for information technology systems containing personally identifiable data. The government uses PIA as a vital tool in meeting legal and regulatory obligations (U.S. General Services Administration, 2020). PIA operation ensures that the data collected are used only for the purposes for which they were intended, that the data are protected by law, and that the privacy impact of the individual is fully resolved.

Further, Norway has concretely assessed the need to amend the regulations when it is necessary to share data, such as in the case of interagency sharing. Protecting the privacy of users involves the appropriate opening of data and making use of the data (Norwegian Ministry of Local Government and Modernization, 2019b). Interestingly, Australian authorities have used design privacy practices to ensure that any privacy risks are adequately handled (Australian Government, 2013). Privacy by design needs to take into account technology, people, and process. Evaluating the privacy impact, the so-called privacy impact assessment, is one way to help with the use of privacy by design. In order to implement privacy by design, public agencies follow seven principles: “(i) proactively preventing privacy, not reactive or remedial; (ii) privacy as default; (iii) privacy as the embedded core system; (iv) full functionality for privacy with positive-sum, not zero-sum; (v) full lifecycle protection for privacy throughout the data cycle (end to end); (vi) visible and transparent privacy operations; and (vii) user-centric privacy” (Agencia Espanola Proteccion Datos, 2019).

4.1.2.3 Trust in the National Government

Trust in national governments is essential to implementing national reforms, especially those related to the development of OGD. The lack of trust from both government agencies and data users in the different stages of the OGD system may result in the lack of utilization of that data. In general, individuals are concerned about how their data will be used or how it is misused. Likewise, individuals are often concerned about their privacy that could be compromised. This paranoia can affect the integrity of the OGD collected. On the other hand, people are more likely to share

data with their governments or accept the use of it when they understand and trust how data are handled and feel that they can control its use.

Table 4.4 Trust and OGD Development

Country	Trust in national government	
	TG1	TG2
United Kingdom		
Canada		
France	*	
United States		*
South Korea		
Australia	*	*
New Zealand	*	*
Japan		
The Netherlands		
Norway	*	*

Note: TG1: Setting out a framework or requirements for OGD

TG2: Maintaining an understanding of the OGD process

1) Setting out a Framework or Requirements for OGD

According to the ten cases, some countries have perceived the importance of trust in government as a foundation of OGD development: France, Australia, New Zealand, and Norway. In France, in addition to promoting the use of digital technology for the development of OGD systems, the technology is also designed to build trust on the part of users. The government allows citizens to use electronic communications for all types of exchanges by requiring service providers to comply with legal conditions so that such communications are guaranteed to be safe and effective (Explanatory Memorandum (Digital Republic Bill), n.d.).

Like Australia, the government considers trust and citizenship to be critical to the operation of Australia's OGD infrastructure (Productivity Commission of Australian Government, 2017). Australians are generally concerned about the invasion of privacy through the misuse of data or the failure to handle sensitive personal data. Using data in a way that is intrusive where the person is

targeted can be merely a nuisance or can cause discrimination and exclusion; or, the most serious is the use of data for identity theft and fraud purposes. The open data commission noted that even though individuals are willing to share personal data, they are often concerned about the privacy and security of the data. The Australian government thus builds trust in OGD through improving civil rights, anti-theft systems, enhancing transparency, and effective risk management systems. Further, the New Zealand government also provides a framework and advises the New Zealand open access and licensing (NZGOAL) framework for public and private entities to distribute copyrighted and non-copyrighted data to other users. The development of this framework builds trust among the people as well (Stats New Zealand, 2018a).

In Norway, data driven public development takes into account the fundamental necessity of building and sustaining citizen trust (OECD, 2017). The government has mobilized its best efforts to show that citizens' data are handled in a secure manner based on data protection principles and respecting personal privacy. One of the best ways to develop and maintain people's confidence is to create a mechanism that allows people to access their data that the public sector holds. In particular, the data owner always knows who in the public sector has access to his or her data and for what purpose (OECD, 2017). At the same time, it is imperative to create a coherent accountability mechanism between governments and people in order to ensure that people have ownership and control over how they share data and with whom.

2) Maintaining an Understanding of the OGD Process

Understanding the whole process of OGD requires formal disclosure in order to maintain trust. The United States has invested in information technology (IT). Since 2009, the IT Dashboard (https://itdashboard.gov/) has released to the public detailing more than $ 70 billion in federal IT investments. The IT Dashboard shows IT technology investments, agency profile information, and agency performance (Office of the Press Secretary (The White House), 2016a). The Chief Information Officer (CIO) of each agency is responsible for regularly evaluating and updating data, which is done through the interface provided by the IT Dashboard. This can maintain the trust of the public.

In Australia, maintaining and building citizens' understanding and trust of concerning how OGD is collected, managed, and used is at the forefront of OGD reform policy and practices (Productivity Commission of Australian Government, 2017). The damage to the loss of trust is evident, especially in both the public and private sectors of poor management or practice. Similarly, in New Zealand, it is important to understand how personal data are used. New Zealand supports secure and efficient data and analytics. The New Zealand government provides guidance on the governance of OGD management and increasing transparency as a key mechanism for promoting trust, confidence, and integrity in the use of OGD held by the government in the name of New Zealanders (Stats New Zealand, 2018c). The New Zealand government supports the development of guidelines to support government agencies on best practices for using OGD and analysis for decision-making. Further, in Norway, data driven public development takes into account the fundamental necessity of building and sustaining citizen trust. The government does its best to demonstrate that citizens' data are handled securely, and respects data protection principles and personal privacy (OECD, 2017).

4.1.3 Implementation of the Principles of OGD in the Ten Leading Countries

The principles are relatively based on the definition of OGD perceived by a country. Each country defines these definitions differently. The definitions of each country guide their principles in opening up data in different ways. The definitions of OGD can be stated found as follows.

Table 4.5 The Definitions of OGD in the Ten Countries

Country	Definition(s) of open government data	References
United Kingdom	- Open government data as “public sector information that has been made available to the public as open data.”	Minister for the Cabinet Office and Paymaster General of England (2012)
Canada	- Open government is defined as “government	Government of

Country	Definition(s) of open government data	References
	data that is offered in useful formats to enable citizens, the private sector, and non-government organizations to leverage in innovative and value-added ways." - Open data refers to "government information that is factual and usually statistical in nature."	Canada (2012)
	- Open data as "the proactive release of government data in free, accessible and machine-readable formats, to encourage its use by businesses, the public and government."	The Office of the Information and Privacy Commissioner of Ontario (IPC) (2016)
France	NA	
United States of America	- Data means "recorded information, regardless of form or the media on which the data is recorded." - Open government data asset means "a public data asset that is-(A) machine-readable; (B) available (or could be made available) in an open format; (C) not encumbered by restrictions, that would impede the use or reuse of such asset; (D) based on an underlying open standard that is maintained by a standards organization."	Foundations for Evidence – Based Policymaking Act of 2018
South Korea	- Open data "refers to the data or information processed by optical or electronic methods, such as databases and electronic files, created or acquired by public agencies for purposes specified laws."	Ministry of the Interior and Safety of South Korea (2013b)

Country	Definition(s) of open government data	References
	- Public data means "any data or information, including databases and electronic files, processed in optical or electronic form, and created or acquired and managed by any public institution."	
Australia	- Open data refers to "data that freely available, easily discoverable, anonymous, accessible and published in ways and with licenses that allow reuse."	Department of the Prime Minister and Cabinet of Australia (2013)
	- Big data refers to "the vast amount of data that is now being generated and captured in a variety of formats and from many disparate sources."	Department of Finance and Deregulation of Australia (2013)
New Zealand	- Open government data are "non-personal, unclassified, and non-confidential government-held data that's easily accessible, openly licensed, and available in a machine-readable format (so it's easily reused by computer programs)."	Stats New Zealand (2018b)
	- Open data are "data anyone can use and share. It has an open license, is openly accessible, and is both human-readable and machine-readable."	New Zealand government (2020)
Japan	N/A	
The Netherlands	N/A	
Norway	- Public data includes "all types of information held by public enterprises. Open data are information made available so that it can be read and understood by both	Ministry of Local Government and Modernization of Norway (2017);

Country	Definition(s) of open government data	References
	machines and people, that everyone can access, use and share."	Norwegian Digitization Directorate (2020)

Note N/A: No information available

OGD are referred to differently in different countries. OGD are called "open public data" in Norway, "open data" in the United Kingdom, Canada, France, the United States, New Zealand, Japan, and the Netherlands, "public data" in South Korea, and "big data" in Australia. These keywords are often used interchangeably to refer to OGD in their policy. Based on these definitions, the ten governments have declared a policy of open data to ensure that data are made available and assessable in an appropriate manner as follows.

Table 4.6 Principles of OGD in the Ten Leading Countries

Principles	United Kingdom	Canada	France	United States of America	South Korea	Australia	New Zealand	Japan	The Netherlands	Norway
Completeness	●	●	●	●	●	●	●	●	●	●
Timeliness	●	●	●	●	●	●	N/A	●	●	●
Machine readability	●	●	●	●	●	●	●	●	●	●
Open standards / open formats	●	●	●	●	●	●	●	●	●	●
Openly licensing	●	●	⦿	●	N/A	⦿	●	●	⦿	⦿
Free of charge	●	●	●	●	●	●	●	N/A	●	●
Non-discrimination	●	●	●	●	●	●	●	●	●	●
Open by default*	●	●	●	●	●	●	●	●	●	N/A

Note ●: A principle that a country has fully implemented.

⦿: A principle that a country has partially implemented.

N/A: No information available

* New finding

The first principle is completeness implemented by the ten leading countries. For example, in the United Kingdom, it refers to the availability of public data and the ease in finding and using it. In Canada, the open data are a primary source and is as complete as possible. In France, open data will be available. Similar to the other countries, public data will be complete, available, and accessible in the United States, South Korea, Australia, New Zealand, Japan, the Netherlands, and Norway.

The second is timeliness. The countries that employ this principle are the United Kingdom, the United States, and South Korea. In the United Kingdom, public data will be timely and quickly based on government functions. For example, the weather forecast data should be done on an hourly basis. Government spending should be publicly released within 15 working days of the end of the month during which the individuals were paid. In the United States, “data are updated and available on the web portal not later than 5 days” after updating. Similar to other countries, data will be frequently and continuously kept up to date in an automated way as quickly as possible to ensure that the latest data are open in Canada, France, Australia, South Korea, Japan, the Netherlands, and Norway. Notably, the countries (Australia and Norway) provide their OGD via application programming interfaces (APIs) as the best way to make large and complex data available and frequently updated.

The third is machine-readable. All of the ten countries have similarly implemented this principle through the definitions and the guidelines of OGD. For example, OGD will be freely released in machine-readable form so that the public can easily and automatically read and processed by a computer, a software, or a machine for searching, indexing, modifying, and downloading without human intervention (the United Kingdom, Canada, France, the United States, South Korea, Australia, New Zealand, Japan, the Netherlands, and Norway).

The fourth principle is open standards/open formats. Similar to the third principle, all of them implement this principle. This principle is a consequence of the third one. The data from different public agencies will be published in the same standard open formats that are reusable and readable format forms by a computer or a

software (the United Kingdom, Canada, France, the United States, Korea, Australia, New Zealand, Japan, the Netherlands, and Norway). The open formats in each country are varied, such as MS Word, HTML, XLS, CSV, Zip, Atom, RDF(Turtle), RDF(XML), RSS feed or XML, JSON, Shapefile, etc. Notably, the New Zealand government mentions that PDF is a human-readable format, not machine-processable, as data are not structured. Further, the Netherlands uses the PDF format as the very basic open format that can be available on the web portal, but it is not categorized as a machine-readable format. The United Kingdom defines machine-readable covering the open formats according to five levels: the first level refers to “data available on the web portal in any format as a basis”; the second level refers to “data available as structured data in Microsoft excel format”; the third level refers to “non-proprietary formats such as CSV or XML”; the fourth one refers to “using open formats and using Uniform Resource Locators (URLs); and the last level refers to “using open formats and using URLs to link data to others.” The Netherlands also applies the practical framework used in the United Kingdom to qualify the openness of the data. There are five levels or stars of the data openness; one star for available on the web with an open license in PDF, for example; two stars for machine-readable formats, Excel, with an open license; three stars for data in open file format, CSV; four stars for the mentioned stars (one, two, and three stars) and open format, RDF, and five stars for all previous stars and linked data with an open format, RDF.

The fifth principle is license-free. The public freely uses and proceeds to open government data with a free and open license throughout the government without restrictions. Data must not create copyright issues or contain any regulatory or patent issues (the United Kingdom, Canada, the United States, New Zealand, and Japan). These countries have guaranteed open licenses legally. Other countries partially implement the principle. For France, the policy of data open licenses is also performed, but data can be subject to licenses due to the contributing publisher. Like Australia, the government uses an appropriate open license. Agencies are encouraged to make data openly licensed, or minimize the license issue. In the Netherlands, they have implemented both open licenses and limited licenses depending on the data. The government determines the degree of license for open data use. For example, OGD on data.overheid.nl is mostly with a free license, but some licenses have restrictions

regarding data use. In Norway, data are freely used, but still are under the conditions of the Norwegian Public Data License (NLOD). Data must be clear about the terms of open standard licenses. Based on the findings, it does not mean that South Korea has no policy of an open license; it means here that available documents on the issue were not found during this research.

The sixth principle is free of charge. The important requirement of OGD is "free access and use" by the public. The public can use open data at no charge. Most countries have this principle of being free of charge by default (the United Kingdom, Canada, France, the United States, South Korea, New Zealand, the Netherlands, and Norway. Further, data are also free of charge but only charged for specialized data services in Australia. However, no available document was found about this issue in Japan while this research.

The seventh principle is non-discrimination. OGD are proactively available for everyone without mandatory registrations, restrictions, requiring information of a user, or applying for any permission. OGD can be used by anyone, from anywhere, and for any purpose (the United Kingdom, Canada, France, the United States, South Korea, Australia, New Zealand, Japan, the Netherlands, and Norway).

The last principle is being open by default, which was a new finding from this research. Open by default can refer to proactively publish open data and provide easy access to the data as well as meaningfully respond to citizens' request for both government data and their data. It allows citizens to easily access a single web portal. In the United Kingdom, this principle is mentioned on the OGD web. Similar to Canada, the country has committed and declared the principle of being open by default with the access to information act. In France, open by default was declared by the law for digital republic in 2016. Additionally, the United States government has indicated this in the open government data act. It states that "public agencies have the responsibility to make data open by default to the public that should be in machine-readable and no harm privacy or security." Furthermore, the Australian government has stated that non-sensitive data will be open by default, reliable, free, and easy to use from 2009. Similar to the Netherlands, the government has committed to proactively making data available with the principle of open by default. In Japan, the strategy of open government data is open by default as the first fundamental principle.

In South Korea, public agencies have permission to provide public data to the public According to the act on promotion of the provision and use of public data. New Zealand has released its OGD by using "open by design." It refers to "the ability to open data will be embedded as the first fundamental part of open government data process." Notably, although there is no mention of open by default in Norway, the government has actively performed sharing and publishing their data with the public.

4.1.4 The Key Mechanisms to Unleash the Power of OGD in the Ten Leading Countries

Since there are few systematic studies of OGD utilization or its impacts, we lack knowledge of how and when it is put into practice. Through rigorous literature reviews, this research has identified seven key activation conditions, each of which helps us to determine how data can be unlocked for their power.

Table 4.7 The Key Mechanisms for Unleashing the Power of OGD in the Ten Leading Countries

Countries	ACT	POGD	MOGD	DC	GS	RD	CE
United Kingdom	●	●	●	●	●	●	●
Canada	●	●	●	●	●	●	●
France	●	●	●	●	●		●
United States	●	●	●	●	●	●	●
South Korea	●	●	●	●	●		●
Australia	●	●	●	●	●	●	
New Zealand	●	●	●	●	●	●	●
Japan	●	●	●	●	●	●	●
The Netherlands	●	●	●	●	●		●
Norway	●	●	●	●	●	●	●

Note ACT: Administrative Cultural Transformation

POGD: Policy of OGD

MOGD: Management of OGD

DC: Data Cooperation

GS: Government Support

RD: Research and Development

CE: Citizen Engagement

4.1.4.1 Administrative Cultural Transformation

As discussed in the literature review, traditional cultural organizations do not seem to unlock the value of OGD. While governments around the world are now trying to disclose as much OGD as possible to the public, they have little idea about how to create and make use of it. Many countries see this challenge. The analysis of the documents shows that open governments are needed to be able to unleash the power of OGD; that is, the more open the government, the more people can participate in the use of OGD and unlock its value. The open government is seen as a new global movement of administrative culture change for the public sector.

In the United Kingdom, the government cultural organization necessary needs to be changed (Minister for the Cabinet Office and Paymaster General of England, 2012). In the digital government toolkit to improve government digital service, an open culture is embedded in UK public agencies to promote digital ways of working (OECD, 2014c). The British government is working with agencies to ensure that IT makes it easier, better, flexible, and smarter to access the public sector. In driving cultural change, many government agencies currently have ongoing “sector boards” to encourage organizations to continue to disseminate OGD and to ensure that they understand the benefits of each release. Still, the sector boards are also aware of the challenges that local authorities face when trying to make a cultural change and implement the OGD disclosure necessary for digital transformation. The sector boards promote broad community engagement from businesses, educational institutions, civil society, and the media to inform them of the experiences of leveraging OGD published by each sector. For example, the London case demonstrates that the open culture of the government is now necessary (Suzuki & Finkelstein, 2019). The city government predicts how OGD can drive and transform its economy, service, and society, or how it will drive products and services that contribute to making smart city progress. The city's valuable data have been taken through appropriate and collaborative approaches to coordinate and share OGD in London's public and private services. A culture of sharing OGD in both the public and

private sectors must be promoted. This will transform current OGD management practices and improve the utilization of the city data in all city policies and activities.

Similarly, open government in Canada plays a key role in ensuring that people will receive their services in a responsive, efficient, and fair manner (Government of Canada, 2018). Open government is a governance approach that emphasizes transparency, responsibility, and civic engagement. Open government connects the people with the government and helps to shape more citizen-centered policies and services. It can show how the government works, how it is trying to understand the needs of the people, and how it responds. The Canadian government acknowledges the importance of an open government that helps it keep transparent, honest, and accountable. For example, in Ontario, Canada, the open government focuses on three related components (Government of Ontario, 2015): "(i) open dialogue - using new ways to provide the public with a meaningful voice so that the government can better understand the public interest, capture novel ideas and partner on the development of policies, programs and services; (ii) open information - proactively releasing information about the operation of government to improve transparency and accountability and promote more informed and productive public debate; and (iii) open data - proactively publishing some of the data collected by the government in free, accessible and machine-readable formats and encouraging its use by the public as well as within government." Early open government reforms focus more on disseminating OGD. More and more, the government recognizes that it needs to provide tools that make OGD useful and renewable for everyone. An open government culture fosters greater openness and accountability, enhancing civic engagement in policymaking and service design. It also implicitly transforms the capabilities, behavior, and processes of the government.

In France, opening OGD legally does not mean that it will be used in practice (Apolitical Group, 2018). A bureaucratic culture is a big challenge in driving OGD. A culture of openness has begun to emerge in some government entities in France, but it has not happened in all departments, mainly due to the reluctance of senior management (Savy, 2017). The French government is increasingly supporting administrative bodies and public offices to launch OGD and develop their strategies. Open data have never been as easy as searching for the data and putting it online. It is

essential that public servants find the data first and then sort and distribute it in a standard format in order to work effectively. Creating a complete dataset can mean gathering data from different departments, which makes collaboration necessary. As well as making use of data, it requires cooperation from all sectors. The French government has brought together examples of how data are leveraged and has demonstrated the impact of OGD policies to drive change. The commitment to release OGD has made the French government more open to empowering the French citizens to take advantage of it.

In the United States, the government indicated that “open government was a means, not an end” (The White House, n.d.-a). Open government has highlighted three key areas: transparency, participation, and collaboration (The White House, 2009). Transparency fosters accountability by releasing OGD. Participation allows citizens to contribute ideas and expertise by leveraging OGD. Collaboration increases government effectiveness by promoting cooperation across sectors. In building and creating an open government culture, the U.S. government requires that openness be the basis for the work of all federal government agencies. Each agency has been asked to develop and publish an open government plan detailing the agency's efforts to improve openness. Internal departments, such as street bureaucrats, law, procurement, finance, and technology, are required to work together to formulate and develop open government solutions (The White House, 2009). A planning framework should be created, taking into account the use of emerging technologies to disseminate OGD. Open government policy, which is regulated by the office of management and budget, will be updated to provide guidelines for public agencies. The development of such policy has elevated the levels of openness within public agencies (The White House, n.d.-a).

The South Korean government prefers the administrative process to be open. Opening a procedure refers to the structure and approach of the management to be open, such as opening the decision-making process to the public for investigation and participation (Republic of Korea, 2016). Being an open government allows the Korean government to become more transparent and accountable, helping to provide quality public services and flexible responses to the changing environment. The Korean government aims to implement and disseminate government operations with

the core value of openness, sharing, communication and collaboration across the government through open data. The Korean government is implementing a variety of practical policies and programs by opening OGD to citizens and ensuring services that are customized for each citizen through the use of OGD. Through being an open government, the Korean government also supports its citizens and private sectors to access OGD and utilize the power of OGD. Being an open government makes it possible for the public and the private sector to leverage more of OGD benefits.

The Australian Government agrees that government agencies should create a dynamic culture through the use of OGD, such as discovery, implementation, evaluation, recommendation through leveraging the data, in particular, by stakeholders. Stakeholders will help the agency realize the potential of OGD and avoid over-investment risks. Being an open government enables stakeholders to reach the government and support the government in the public service. It is also necessary to model a culture of discovery, experimentation, practice, and evaluation in identifying possible values from OGD. However, Australia generally lacks a culture of sharing OGD and proactive dissemination of OGD. Major obstacles to changing the culture to be more open are; "(i) protection of privacy, (ii) the resources needed to ensure that data are of sufficient quality for policy evaluation, (iii) and concerns by governments about unfavorable findings on policy effectiveness" (Australian government, 2014). In order to address those critical issues, a strong governance framework developed by the Australian government includes reasonable risk management, data security, privacy management, and unit-specific legal obligations that are related to data use, acquisition, and confidentiality. Australia is now in the early stages of formulating the third national action plan 2020-22, being developed jointly by the government and civil society to help the government be more open, transparent, accountable, and engaged publicly (Australian Government, 2013; Department of the Prime Minister and Cabinet of Australia, 2020).

In New Zealand, the government signed up to be a member of the Open Government Partnership in 2014 (New Zealand government, 2018; Rashbrooke, 2017). Open government enables OGD to validate the suitability and strength of relevant infrastructure, laws, and policies. Open governments help to point out whether these key points are sufficient for implementing OGD over the long term and

unlocking its results. Likewise, OGD are the primary launcher for open governments. The adoption of OGD is a long-term cultural shift in government (New Zealand government, 2018). With options for openness, governments can be more open at various levels, from public participation in policy decision-making processes to encouraging citizens to develop policies and services and opening up governments to increased transparency and responsibility for the country (New Zealand government, 2018; Rashbrooke, 2017). The open government assures New Zealanders that everyone is in a position of connection and ownership of their country. It strengthens ties between the New Zealand government and citizens by opening up their contribution to the country's development (New Zealand government, 2018). Throughout the OGD development supported with open government, the government becomes more open, transparent, and inclusive. Consequently, people are aware of and understand what the government does and why it is done. The feeling of ownership will connect and support each other on issues that affect communities, and engage with the government in their communities to exchange ideas and solve problems.

The Japanese government has transformed its culture to be more open, and more accessible. The public sector has moved away from a traditional paper-based culture to online accessibility of administration and public services, intending to reform data systems and encouraging the public and private sectors to make use of the data (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). The Japanese government has implemented a policy that requires ministries to regularly make government administrative data available to people online through their websites (OECD, 2014b). The data, including organizations, laws, budgets, procurements, proposed laws, statistics, organizational performance, evaluations, and so on, need to be released in online formats. The Japanese government empowers open OGD policies related to flexible data usage rules in order to accelerate better data sharing, with an emphasis on greater use, transparency, stricter security, and dual communication with the people. Accelerating government openness thereby encourages more empirical uses of the data.

In the Netherlands, the government has recognized the need to make the government open as a result of the unrelenting speed of social media (Open

Government Partnership, 2001; Safarov, 2019). However, previously, many organizational cultures were protected and not disclosed. The government has made data play a greater role in organizations. The Dutch government has insisted that it be open (Netherland government, 2014). The need for openness influences the role and the way that government works and affects legal agreements and data-based principles. OGD are suitable for open-minded governments. This requires a change in thinking, and more openness is created by doing it (Netherland government, 2014). Openness is a fundamental value of Dutch democratic society, which is based on the rule of law. Openness is practiced not only by the government but also by other key players (Netherland government, 2014). It contributes to transparency and accountable action. It improves the efficiency of the government and empowers informed citizens, and provides economic opportunities by leveraging government data. Open government can help stakeholders take part in solving social problems and responding to a changing society. By fostering an open government, the government becomes more transparent about government activities and is open to socially responsible initiatives and using innovative technologies (Netherland government, 2014). All of this will lead to the ultimate goal: to be more open to citizens so that they can access more and better data and feel more involved and heard.

In Norway, society has fundamental values as an open society. People can be involved in the decision-making process before any action takes place. People, organizations, and businesses can express their opinions and control the public sector's duties and activities. In addition to the traditional Norwegian culture, open government has been implemented by many laws and regulations (Norwegian Ministry of Local Government and Modernization, 2019a). The laws and regulations that open up public administration build a greater foundation and enhance OGD implementation. For example, the freedom of information act (Offentlighetsloven) gives everyone access to government data. The environmental information act (Miljøinformasjonsloven) helps individuals contribute more easily to environmental information to protect the environment, to protect themselves from injury or damage to their health, and to influence the public and private decisions. Government openness encourages people to participate in the decision-making process by taking advantage of relevant data.

Table 4.8 Administrative Cultural Transformation to Support OGD Development and Utilization

Country	The roles of open government	How government works on transforming its administrative cultural to be more open
United Kingdom	• Promoting and improving governmental digital service • Enhancing public engagement • Getting feedback from the public in utilizing OGD	• Promoting an open culture in organizations • Promoting OGD sharing culture both in public and private sectors • Publishing more data and ensuring that government agencies understand and realize OGD's impacts • Providing an avenue for public engagement • Ensuring that future IT allows for easy, better, flexible, and more intelligent accessibility
Canada	• Ensuring that citizens are served with more citizen-centered: responsive, efficient, and fair • Informing citizens what and how the government works • Getting more understand citizens' needs and taking steps to address and meet the needs • Keeping government honest and accountable • Fostering greater openness and accountability • Strengthening citizen engagement in policy development and service design • Creating the government more efficient and responsive to problems and needs	• Promoting an open culture in public sector • Publishing more government data and information to the public • Providing tools that make government data useful and reusable for everyone • Shifting the capabilities and behaviors of public servants to be more open • Making governmental agencies to be open by default • Improving three main components of open government: o open dialogue: using new ways to enhancing public participation in planning and decision-making o open information: proactively releasing information o open data: proactively disseminating OGD in a free, accessible, and machine-readable format while

Country	The roles of open government	How government works on transforming its administrative cultural to be more open
		encouraging the utilization of OGD
France	• Ensuring and enhancing open government data	• Promoting an open culture • Committing to improve OGD and encouraging government agencies to open up their data • Supporting the understandings and skills to public servants to be able to support the process of OGD • Bringing stories, using examples, and showing the data impacts on social and economic

United States	• Enhancing government transparency, participation, and collaboration
	• Helping the government get citizens' ideas and expertise and citizens' feedback and assessment of data quality
	• Boosting up public agencies to open up their data
		• Promoting and institutionalizing open organizational culture with three main principles as the cornerstone of open government;
		  ○ transparency: providing government data and information
		  ○ participation: supporting the public to express ideas and expertise
		  ○ collaboration: encouraging partnerships across all government levels and between government agencies and private units
		• Requiring public agencies to develop and publish an open government action plan
		• Creating a working group among all public agencies to discuss and help each other regarding open government development

Country	The roles of open government	How government works on transforming its administrative cultural to be more open
		• Creating, developing, and updating the policy framework to publish more open data • Supporting other instruments to achieve a more open government – such as procurement, finance, and technology laws
South Korea	• Enhancing transparency and responsive government • Contributing to the improvement of citizens' recognition rights and their participation in policy-making • Ensuring the government responsibility and efficiency	• Promoting an open organizational culture • Implementing a variety of practical policies and programs to support OGD implementation
Australia	• Supporting public engagement in the OGD policy • Realizing the potential of OGD from stakeholders • Improving risk management with a focus on data security, privacy management, and legal obligations • Specifying government organizations to respect privacy and be responsible for the use of OGD with a clear, transparent privacy policy and ethical leadership	• Promoting more transparency, accountability, and public engagement • Modeling a culture of discovery and experimentation based on OGD development and utilization

Country	The roles of open government	How government works on transforming its administrative cultural to be more open
New Zealand	• Supporting public participation in democracy and in developing policy and services, transparency, and accountability • Ensuring and empowering all citizens have a place to stand, connectedness, and ownership • Strengthening the positive relationship between the government and citizens	• Promoting open organizational culture on many different levels of the government • Providing OGD as a core enabler for open government
Japan	• Enhancing the government more accessible by the public • Supporting the flexible use of OGD	• Promoting an open organizational culture to be more open and more accessible • Providing online access for OGD and administrative procedures • Adopting policies requiring ministries to make their agencies accessible and available • Developing and empowering the policy of OGD

The Netherlands	• Making governance more accountable, transparent, efficient, publicly engaged
	• Creating informed citizens to be more active
	• Offering economic opportunities by reusing OGD
	• Contributing to find solutions to social issues
	• Supporting core value of democracy
		• Promoting an open organizational culture as the core value of Dutch democracy
		• Promoting and supporting OGD
		• Implementing three priority areas:
		  ○ Implementing open decision
		  ○ Strengthening the transparency of policy party funding
		  ○ Supporting network partners

Norway	• Supporting the public to involve in the	• Promoting an open organizational culture

Country	The roles of open government	How government works on transforming its administrative cultural to be more open
	decision-making process by stating their opinion and control their government • Ensuring that citizens will receive and access accurate and clear data, as well as will be invited to participate in policy formulation, and other activities.	• Establishing laws and regulations to support open government

4.1.4.2 The Policy of OGD

The ten countries under discussion here recognize that the world of data is changing rapidly with the demand for new sources of data, new advanced technologies, and the increasing capabilities of data users. In order to create commitment and clarity in OGD, relevant policies are very necessary. Each country has guidelines for developing such policies. The ten countries have established laws to declare and certify the right to use or reuse OGD. This research describes the development of OGD policies for each country in order to ascertain the common characteristics of the policies.

The United Kingdom government has strong OGD policy and strategy. The political will of the UK government is to open more data (Safarov, 2019). This leads to public policy reform by releasing OGD to the public (Yoon, 2017). The beginning of OGD just began in 2000 through the freedom of information act (FOIA), which indicated that citizens have the right to access government data as the owner of the data. Under the FOIA amendment, accessible datasets can be reused without further request for reuse. The open data portal was initiated in late 2009, framed as a commitment to greater transparency and openness (Davies, 2014). Another mechanism for promoting access to OGD is the environmental information act, which provides a framework for public access to OGD (Minister for the Cabinet Office and Paymaster General of England, 2012). Along with the freedom of information act, the local government transparency code (2015), and the transparency code for smaller authorities (2015), all of these regulations have protected and supported data openness in the UK. According to the local government transparency code (2015), the code establishes guidelines and requirements and the recommended practice for OGD. Using or reusing OGD is regulated by the reuse of public sector information act regulations 2015. For protecting personal data, the essential legislation is the data protection act 1998. According to Safarov (2019), many experts agree that the UK government has succeeded in effectively formulating and implementing OGD policies to encourage government agencies to release more OGD and to use it in developing the country. Currently, the UK government is using the government transformation strategy 2017 to 2020 in order to drive OGD policy. The government's strategy is to strengthen digital capabilities and better data utilization to build world-class digital

services and transform the way that governments operate in modern and efficient ways (European Commission, 2019).

In Canada, OGD was introduced when the government established the access to information act (1983) and the privacy act in 1985. The access to information act ensures that Canadians have access to a wide variety of official data and other information and specifies when those that ask for such data are expected to receive the data. However, at that time, it was applied to federal agencies only and permitted agencies to charge fees for information retrieval. In 2006 the access to information act was reformed to expand the coverage of additional government bodies (Public Servants Disclosure Protection Act, 2005). There are relevant regulations such as the public servants disclosure protection act of 2007 amended to the access to information act," the privacy act, and the personal information protection and electronic documents act to limit the rejection of data requests of government agencies and to narrow the time frames during which any government agency can refuse a request for data (Public Servants Disclosure Protection Act, 2005). Currently, the Canadian government ensures that Canadians' right to know is respected through transforming government data into digital platforms. All of the documents under the access to information act will be published online in order to avoid duplication and to encourage data sharing. The Canadian government's proactive OGD releasing is free, accessible, and machine-readable in order to encourage the use by businesses, citizens, and governments (The Office of the Information and Privacy Commissioner of Ontario (IPC), 2016). Moreover, many provinces in Canada have also developed legislation—the freedom of information and protection of privacy act"—such as Alberta, Manitoba, Newfoundland and Labrador, Nova Scotia, Ontario, Saskatchewan, and Quebec.

The French government has long supported the principle of OGD. The right of citizens to access government data was inscribed in the declaration of rights of man and of the citizen of 1789: "the society has the right of requesting account from any public agent of its administration." France has laid the groundwork for today's open data transformation since 1978 and has established a law supporting online accessibility, which was implemented in 1999. Many laws provide frameworks for OGD release. The digital republic act was passed in 2016 designating OGD as one

of the pillars of digital transformation (Radu, 2020). Importantly, the bill on a digital republic (Republique Francaise, n.d.) has stepped up access to OGD by expanding the government data online and by specifying principles of OGD disclosure so that the data can be reused freely. Especially, it presents new possibilities of reusing OGD for its positive development and growth. The legislation expands the scope of automatic administrative data dissemination from central and local governments and public and private legal entities serving the public. The law establishes the principle that the reuse of governmental data is free. The bill also establishes a new public service that requires governments to provide and release their data in standard formats to foster its utilization (Explanatory Memorandum (Digital Republic Bill), n.d.). There are three main standards: "building champion data and knowledge dissemination, helping protect individuals in the digital society, and providing universal access to digital technology" (Explanatory Memorandum (Digital Republic Bill), n.d.). This bill heralds a breakthrough for OGD in France.

In the United States, the federal policies on OGD have a history that dates back to before the modern OGD movement (Tauberer, 2014). The OGD movement of the U.S. began with the freedom of information act (FOIA) in 1966. The FOIA has created the foundation for OGD disclosure by requiring agencies to respond to public requests for data. The inspiration and expansion for FOIA came during and after World War II (Parks, 1957). The FOIA enactment was inspired by the ideal principles of informed citizenship. The people's right to know and access information technology was first stated in a Clinton administration memorandum in 1994 (Tauberer, 2014). Later, freedom of government data utilization was approved in the electronic freedom of information act (1996) (Yoon, 2017), where government agencies prepare and disseminate their data in electronic format (H.R.3802 - Electronic Freedom of Information Act Amendments of 1996, 1996; Privacy Act of 1974, 2015). Significantly, OGD was successfully implemented when the Obama administration issued an executive order that established OGD policy along with a memorandum from the office of management and budget, which supported that policy in 2013 (The U.S. General Services Administration (Technology Transformation Service), n.d.). In Obama's administration, the digital accountability and transparency act of 2014, or data act, requires the federal government of the United States to

convert spending data to open data. The federal government has officially adopted the principles of open by default, offering guidance of OGD initiatives and stipulating agencies to begin releasing their data in open, online, and machine-readable formats (Office of Management and Budget (OMB), 2013; Office of the Press Secretary (The White House), 2013). Currently, the foundations for evidence-based policymaking act of 2018 is perceived as an OGD act. The act has revised Evidence-based policy through promoting OGD sharing among agencies and improving access to OGD for statistical purposes while protecting confidential information. The United States has taken strongly its commitment to OGD. The country has made great progress in releasing OGD, ensuring the ethics of open by default, releasing large amounts of high-quality government data, and ensuring that all OGD can be used or reused by the public for improved governance (Castro & Korte, 2015).

In South Korea, the act on disclosure of information by public agencies (the RTI Act) was enacted in 1996. South Korean citizens have the right to request government agencies to disclose the data they hold, and the government must comply with citizens' data requests as required by law. Not only that; the act allows citizens of all countries to be able to demand information held by government agencies under the law. The Korean government is keen to promote e-government services to improve access to data and to combat corruption. Since 2013, the Korean government has announced a vision for a government action called Government 3.0, which emphasizes openness, sharing, communication, and collaboration. Government 3.0 is based on big data and is the starting point for managing OGD (Yoon, 2017). The Korean government is focused on its ability to use massive amounts of data, from terabytes (TB) to petabytes (PB) and exabytes (EB). The government has enacted public data laws and has provided support for a wide range of policies and techniques. The Korean government adopted the act on promotion of the provision and use of public data in 2013 and promoted the opening of OGD at all government levels (Act on Promotion of the Provision and Use of Public Data (2013), 2013) to "prescribe matters for promoting the provision and use of data held and managed by public institutions to guarantee citizens' right to access public data, and to contribute to improving their quality of life and to developing the national economy through the utilization of such public data in the private sector" (Act on Promotion of the

Provision and Use of Public Data, 2017). This act established the right to use OGD by defining the activation, provisioning, and use of OGDs compiled and administered by government agencies. Especially, this act requires a machine-readable format and OGD provision explicitly used for disclosure and use of the data. Based on the act, the OGD use policy is clearly described. OGD offered from an open data portal are available to anyone under the law, and can be freely used including for the purpose of profit. Under this vision, the government has shifted the paradigm from a government-led approach to a more citizen-oriented approach.

In Australia, the beginning of OGD arose from the digital transition policy 2011, developed by the department of the prime minister and cabinet (National Archives of Australia, 2011). The digital transition policy focused on moving Australian government agencies toward efficient digital and records management. Most agencies' data and records were digitally created, stored, and managed. The OGD policy in Australia is simple but clear: every government agency should release non-sensitive data by default and should be free, easy to access, and reliable in leveraging its value (Department of the Prime Minister and Cabinet of Australia, 2013). Government agencies should publish anonymous data with descriptive metadata linked to data.gov.au for discoverability and availability in a machine-readable, high-quality format, with easy and free access and use, and an automated way to keep the data updated (Australian government, 2019a). The agencies' OGD policy identifies how the government's commitment to open its data within each agency. Each agency can use OGD strategies to identify the value it places on the data, how it will act regarding OGD commitments, which data will be available or will not be available, how it will respond to citizens' requests for data openness, and how it will communicate and interact with its stakeholders as data users.

In New Zealand, the government has recognized the power of data. The New Zealand government knows that better results can be achieved by using appropriate data to make informed decisions throughout New Zealand (Stats New Zealand, 2019e). New Zealand has many policies that are adopted to support the open government and the dissemination of OGD (New Zealand government, n.d.-a). To date, laws have been reviewed, creating new data and statistical laws to increase the use of OGD and innovation. New data and statistical legislation are required to:

“ensure data are collected, managed, shared, used and re-used in ways that are safe, transparent and trusted, support government agencies to work together by collecting, sharing and using data to deliver better outcomes for New Zealanders” (Stats New Zealand, 2018d). The more modern legislations are the official information act 1982, the privacy act 1993/privacy bill 2018, and the public records act 2005.” Since the official information act came into effect in 1982, it was the beginning that government data should be made publicly available unless there is a good reason to halt disclosure (Stats New Zealand, 2019a). It lets New Zealanders access data and information that help them participate in government, and hold their government and agencies accountable. The public records act 2005 ensures reliable record-keeping to provide accountability, and to maintain the integrity of government records. The privacy act 1993/privacy bill 2018 manages how individuals and organizations collect, use, disclose, store, and provide access to personal information. Further, New Zealand has developed a data strategy and roadmap to provide a common vision for New Zealand by harmonizing OGD initiatives (Stats New Zealand, 2019a). This is on a responsive and flexible basis, supporting New Zealand's data usage, reducing redundancy and costs (Stats New Zealand & New Zealand government, 2018). The roadmap enables organizations, both inside and outside the government, to connect data initiatives, and collaborate and align their efforts to maximize value through data. Moreover, the data investment framework was created to guide the way in which investment in the data system could be made to deliver to government priorities, while also building the foundations required to ensure that New Zealand’s data system can meet future needs (Stats New Zealand, 2019b).

In Japan, the government had been committed and adherent to freedom of information law since 1999 under the act on access to information held by administrative organs (Ministry of Justice (Government of Japan), 2009). The law gives citizens the right to request data from a government agency, where the agency has to respond to the request within thirty days. For almost a decade, Japan’s government has had an overarching OGD strategy designed to promote the use of OGD as an asset for citizens. In 2004, the Japanese government implemented a policy that requires ministries to make their administrative data available to the public online regularly through its website (OECD, 2014b). Since then, several official documents,

including the new strategy in information and communications technology, the basic action plan for the promotion of e-government, and the policy on reforming regulations and systems for promoting the use of telecommunications technologies, have offered best practices for enhancing the reuse of OGD. Finally, the IT strategic headquarters released the open government data strategy in 2012. It indicated that the government data that will be released should be in machine-readable formats and offered in a timely manner. High-value data for businesses and the public need to be released. Japan's pledge to release high-value key datasets represents a promise for the future of the nation's burgeoning OGD policy. The Japanese government was actively improving OGD initiatives in 2013 as mentioned in the declaration to be the World's most advanced IT nation (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). At that time, the Japanese government encouraged the utilization of OGD, which would be able to automatically build new businesses from a wide variety of data and create new services through public-private collaboration that uses the link and use of public data. In 2015, the Japanese government renewed and empowered the policy framework to accommodate the development of ICTs and to promote its new open data policy (OECD, 2014b). This involved rules for flexible use of website content, offering a machine-readable format that can be automated proceeded by API, and mobile and smart-phone applications. It also aimed to better share information with the public through the website, with an emphasis on better usability, transparency, rigorous security and two-way communication with citizens. The government has established a government action plan based on the digital government strategy (as approved by the Strategic Conference for the Advancement of Public and Private Sector Data Utilization, IT Headquarters) in 2017 aiming to achieve 100 percent of an action plan for the combined ministry and government agency that incorporate an open data by design approach (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). The government has developed rules for the use and application of OGD both in public and private sectors, with many players involved in investigating systems related to the flow of data (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). Japan has made the most rapid progress with OGD among the G8

countries (including France, Germany, Italy, the United Kingdom, Japan, the United States, Canada, and Russia).

The Netherlands has more than 200 years of history of freedom of information and is an open society (Meijer, 2015; Safarov, 2019). The ministry of the interior and Kingdom relations published the government data agenda as an intergovernmental agenda, which sets out what the government will do to better deal with personal and open data (Netherland government, 2014). The main laws regarding open government and transparency are as follows: (i) the government information public access act (government information act) (Wet openbaarheid van bestuur, WOB) (1991) that ensures an administrative agency shall disclose information to the public and ensures that citizens can access and retrieve data from government agencies; and (ii) the reuse of government information act (2015) that citizens and companies can request the provision of government information for reuse. During 2016-2017, the Dutch government was committed to popularizing OGD by implementing initiatives from federal government agencies and public organizations (Safarov, 2019). The government launched the "NL DIGIbeter: Dutch Digitalization Strategy" in 2018, a comprehensive strategy for everything related to going digital (Ministry of the Interior and Kingdom Relations of Netherlands, 2019). In 2019, the ministry of the interior and Kingdom relations in the Netherlands launched the agenda, so-called NL DIGITAAL: Data Agenda Government (Ministry of the Interior and Kingdom Relations of Netherlands, 2019; Netherland government, 2014). This is the successor to the national open data agenda, an intergovernmental agenda. The agenda sets out how the public can use data better in order to improve policy-making and address social issues, beginning with what the government can do to better deal with personal, open, and big data (Netherland government, 2014). OGD makes governments and processes more transparent to the general public (Open Government Partnership, 2019); and it helps the private sector to build new applications, products, and services through the use of OGD. Therefore, every ministry is working to make OGD available to society as a whole.

Among the European countries, Norway has one of the most digitized governments. Since the 1990s, the Norwegian government has carried-out considerable efforts to optimize the benefits of ICT strategic adoption and to integrate

it into public sector reforms (OECD, 2017). In 2006, the government enacted the freedom of information act (indicating the right to access data held by government bodies and the right to reuse the data) (Act Relating to the Right of Access to Documents Held by Public Authorities and Public Undertakings (Freedom of Information Act), 2006) to "facilitate an open and transparent public administration, and thereby strengthen freedom of information and expression, democratic participation, legal safeguards for the individual, confidence in the public authorities and control by the public." The act supports the utilization of OGD and it supports the vision of the country to be a digitized government as an essential agenda of Norway (Norwegian Ministry of Local Government and Modernization, 2019b). Then they launched the digital strategy for the public sector 2019-2020. The strategy defines common goals and focuses on areas for digitization work until 2025 (Norwegian Ministry of Local Government and Modernization, 2019b) in investing in digital service delivery that provides more visibility to citizens. Improving processes (e.g. ICT infrastructure, and coordinating among key enablers) advances the digital evolution of the Norwegian government (OECD, 2017). The digital agenda for Norway defines the principle that public administration must reuse OGD as well; it needs to be better prepared to reuse the data. The reuse of OGD will empower businesses, researchers, and civil society in terms of accessing OGD, which will allow them to leverage the data in new contexts and drive added value. In order to reuse OGD for administrative processing purposes, an organization must first know where the data are and what they can be used for. Norway has continued to improve its clear and digital-friendly regulations to facilitate increased sharing of OGD and a seamless service (Norwegian Ministry of Local Government and Modernization, 2019a). The regulations will support and facilitate the digital agenda for Norway regarding smooth and data driven services while protecting the privacy and other trust requirements.

Table 4.9 Summary of OGD Policy from the Ten Countries

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
United Kingdom	• The public has the right to access government data. • Using and reusing the government data is guaranteed by laws without registering or making any request. • The framework to access data or information is provided to the public. • Data or information openness is protected by laws. • Setting out requirements and recommended practice for open data is provided to public agencies. • No specific legislation to control the open data activities. • Almost every agency and ministry has its own OGD strategy. • Developing and implementing open data standards • Supporting stakeholders to improve data quality together • Prioritizing OGD and its use to digitize the government	• The freedom of information act • The environmental information • The local government transparency code (2015) • The transparency code for smaller Authorities (2015) • The reuse of public sector information act (2015) • The data protection act (1998) • Government transformation strategy (2017 - 2020)
Canada	• Giving Canadians access to a wide variety of OGD and other government information • The government ensures the right to know. • Protecting the privacy of individuals is guaranteed. • Online, free, accessible, and machine-readable data is guaranteed by laws. • Using/reusing data by business and the public is guaranteed encouraged by the government.	• The access to information act (1983) • The privacy act (1985) • The freedom of information • The federal accountability act (2006) • The public servants disclosure protection Act (2007) • The personal information protection • The electronic documents act • Freedom of information and protection of

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
		privacy act of provinces
France	• The right of citizens to access government data or information is granted. • Freely re-usable open data are guaranteed. • Open data are one of the cornerstones of digitizing the country • Positive impacts of open data resulted from its reuse are acknowledged in OGD policy. • Defining the scope of government data disclosed by central, local governments, and public and private legal entities that have the power to provide public services • Principles of data reuse with free are set • OGD policy supports government agencies available and disseminating benchmark data to foster its re-use.	• The declaration of rights of man and the citizen (1789) • The creation of the Légifrance website (1999) (refers to online access to legal information) • The digital republic bill (2016)
United States	• The right of people to know government data is guaranteed by laws. • Public data utilization is guaranteed by laws. • Public agencies are required to make data or information available in electronic formats. • The Federal government and public agencies are required to open up government data by open by default, free, machine-readable formats, free of charge, and reusable. • Open data as a strategic asset for evidence-based policy • Furthering interagency data sharing	• The freedom of information act (1966) • The electronic freedom of information Act (1996) • The digital accountability and transparency act (2014), or data act • The foundations for evidence-based policymaking act (2018)

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
	• Improving access to OGD • Protecting confidential data and privacy	
South Korea	• The public's right to know and access is guaranteed by laws. • Imposing an obligation on public agencies to actively provide data or information • Openness, sharing, communication, and collaboration are implemented. • Actively opening of public data in machine-readable formats is promoted at all government levels. • Big data are a resource for the government. • Public data utilization is guaranteed and promoted by laws. • Freely using public data is provided through an open data portal that is available to anyone. • Data positive impacts are acknowledged by laws.	• The act on disclosure of information by public agencies (1996) • The government 3.0 policy • The act on promotion of the provision and use of public data (2013)
Australia	• The public's right to know and access to government data is guaranteed by laws. • Government agencies are supported to move from paper-based records to digital records. • The majority of the agency is supported to create, store, and manage digital data and information. • Non – sensitive data should be open by default, free, easy to use, machine-readable, and reliable. • Public agencies are supported to create their open data strategy.	• Right to information act (1982) • The Australian government digital transition policy (2011)

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
New Zealand	• New Zealand keeps developing the relevant laws to respond to a changing world. • Access to data and information hold by the government is guaranteed by laws. • Ensuring reliable data and information records of government and public agencies • Identifying how individuals and organizations collect, store, use, and provide access to personal data • Supporting high-quality statistics, safe management, sharing, use, or reuse of data for research and analysis • The power of open data is acknowledged in OGD policy. • Promoting a shared vision for New Zealand's data • Guiding the way investment in the data system of an agency	• The statistics act (1975) • The official information act (1982) • The privacy act (1993)/privacy bill (2018) • The public records act (2005) • The data strategy and roadmap • The data investment framework
Japan	• The right to request paper or electronic documents is legally certified. • Enforcing local governments to take measures to enact freedom of data • Adopting a policy requiring ministries to OGD and information online constantly • Committing to releasing key and high – value datasets • Promoting the use of OGD as an asset for citizens • Indicating open government OGD principles • Developing interlinking OGD • Setting rules for flexible use of website content and machine-	• The freedom of information act (1999) • Law concerning access to information held by administrative organs (promulgated in 1999, enforced in 2001) • The basic action plan for the promotion of e-government • The new strategy in information and communications technology • The policy on reforming regulations and systems for promoting the use of telecommunications technologies

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
	readable data • Encouraging public engagement in the use of OGD • Promoting rules for OGD utilization by public and private sector	• Open government data strategy 2012 • 2013 declaration to be the World's most advanced IT nation • Open data policy 2015 • The advancement of public and private sector data utilization 2017
The Netherlands	• Ensuring that public agencies both from central and other public organizations will open their data to the public • Ensuring that everyone can access and retrieve data and information from public agencies • Promoting data utilization to improve policy and solve social problems • Promoting protection of public values and rights • Indicating what the government will do to better deal with personal data, open data, and big data. • Data positive impacts are acknowledged in the OGD policy. • Supporting and assisting public agencies and data users	• The government information public access act (1991) • The reuse of government information act (2015) • NL DIGIbeter: Digitalization strategy (2018) • NL DIGITAL: Data agenda government (2019)
Norway	• Guarantying the right of citizens to access OGD • Re-using of OGD is guaranteed by laws. • OGD are one of the main drivers of digitized government. • Establishing the principles of how public agencies shall reuse data • Improving the better provision of reusing OGD • Allowing OGD to be used in new contexts to create new services	• The right to information act (1970) • The freedom of information act (2006) • The digital agenda 2019-2025

Country	Features of OGD policy	Important relevant laws/regulations/policy regarding OGD
	and drive value creation • Improving clear and digitalization – friendly regulations to facilitate increased data sharing, support data utilization, and protect privacy	

4.1.4.3 The Management of OGD

The United Kingdom government has provided evidence of the political will to open up more data. The commitments have been further embedded in many departments (Davies, 2014; Safarov, 2019). In 2017, the UK government launched a digital strategy focused on building better tools, processes, and governance to unleash the value of OGD to support and certify digital projects as well as to start and grow digital businesses and to help digitize every British business (European Commission, 2019). Almost all agencies and ministries have their OGD strategies in the UK. Local government agencies, such as municipalities and other local authorities, have developed their own OGD repositories as well as promoted OGD usage. The government digital service in the Cabinet Office is responsible for coordinating OGD activities. The OGD policy in each public agency is related to other policies, such as social and economic policy, by indicating how OGD can support those policies. For example, London's data plan is clear about the role of data in connecting infrastructure effectively and in supporting utility providers for business planning (Suzuki & Finkelstein, 2019). Using the London's data plan with energy policy under the London energy plan defines future scenarios for energy demand and supply. The government has built sophisticated data models from different data sources as the key to better understanding the future of energy, as well as providing households with information so that they can manage their energy use. Additionally, the future smart London report sets city-data as the foundation: the London data store as the center of smart city development. London has developed a consistent approach to developing platforms and data architectures in the city, allowing them to integrate data streams and to leverage the data across advanced technologies, such as the Internet of Things, and censorship technology. City governments are increasingly committed and coordinated regarding the data they need and their use. Better access to city data increases the opportunity to use insights that can lead to better city services, better city policies, and to foster innovation.

In Canada, the government has improved the quality of open data available on open.canada.ca. Canada's national open government action plan was developed in a 2-year cycle. So far, Canada has completed three plans. Currently, the 2018-2020 national action plan has been implemented (Government of Canada,

2018). This plan was announced in many strategies, many of which are related to OGD: “user-friendly open government, corporate transparency, open science, access to information, reconciliation and open government and open government community.” The Canadian government has developed digital standards, which are the foundation of the government's transition toward greater flexibility, openness, and user-focused (Government of Canada, 2020b). These digital standards are built with people and key stakeholders. The standards will continue to evolve as the government understands better the complexities involved in their implementation. The highlights of the 2018-2020 national action plan for OGD development and utilization include (Government of Canada, 2018; OECD, n.d.): “open by default, universal open government license, completed access to information, easy access, and analysis, open data exchange as a national marketplace for open data, launching the suggest a dataset web page, developing a memorandum”.

In France, according to the law for a digital republic 2016, OGD service is gradually being created in a repetitive format with government agencies and data users. Each agency must publish its commitment to the terms of the datasheet, update frequency, performance, and availability of the provision. Etalab is responsible for managing, promoting, and assisting OGD for the entire country (Radu, 2020). Importantly, each public agency has established a chief data officer to provide data to enhance the effectiveness of OGD policy, to support better data management, and to enhance the quality of data as public service to the public. France’s open data plan essentially lays out the main priorities, including: “progressing towards publishing data openly by default, building an open platform to encourage innovation and transparency, developing open data policy in consultation with citizens and civil society, supporting open innovation in France and throughout the world” (Etalab, 2013). Etalab plays an important role in helping administrative and other public bodies release and develop the OGD system. Etalab educates administrative units about the benefits of OGDD, and regularly organizes OGD camps for civil servants and training activities (Savy, 2017). Etalab's mission statement will publish OGD availability indicators on the site (data.gouv.fr) and generally verify compliance with indicators.

In the United States, OGD must be available in an open, machine-readable format while maintaining privacy and security under the open government data which is Title II of the foundations for evidence-based policymaking act." At the federal agencies, the chief financial officers of each agency are required to catalog its assets to better manage and use the data and to set up and develop a public response mechanism. The federal agency's commitment is listed on Data.gov to ensure that all Data.gov users have access to all functionality and all content (The U.S. General Services Administration, n.d.). The Data.gov site is also reviewed regularly for compliance with the latest web accessibility initiatives and is updated frequently to make it the most accessible. Currently, Congress has launched the fourth U.S. national action plan. Within the plan, there are eight principles that the U.S. will pursue. First, the utilization of OGD as a national strategic asset and resource helps the federal government to perform its mission more efficiently, ensure accountability, better manage operations, promote economic growth, and improve the quality of citizens' life. Second, encouraging grants to state and local governments, universities, non-profit organizations, and small businesses will improve the quality of OGD and the creation of data value. Every year, the federal government spends approximately $ 700 billion on grants and cooperative agreements regarding the issue. Under this commitment, federal agencies can review OGD standards as they are published in order to ensure that they are complete and accurate. Third is support for access to federally funded research. Fourth is promoting the expansion of personnel information standards. Fifth is establishing a chief data officer at the agency-level to provide appropriate levels of competence, experience, and training to improve agency performance in managing OGD. Sixth is using OGD to drive innovation to improve public health, and seven is implementing the enterprise objective intelligence community in matters of privacy, rights, civil liberties, and transparency. Last is expanding the participation of citizens as co-creators to develop the future of OGD and to generate ideas, encourage public input, and contribute to the use of the data (Official Guide to Government Information and Services, 2019).

In South Korea, open data held by government institutions have recently been recognized as a strategic resource. According to the act on promotion of the provision and use of public data 2017, the government has formulated a master

plans for promoting provision and use of public data (or a master plan) by the Minister of the Interior and Safety every three years, in consultation with the Minister of Science and ICT to integrate OGD plans between the state and local governments. In order to implement the master plan, the date and local government will establish an action plan at the organizational level following the relevant master plan (Act on Promotion of the Provision and Use of Public Data, 2017). The minister of the interior and safety will set and announce a guideline for OGD management (so-called guidelines for management of public data) and the head of state institutions will follow the guidelines (Ministry of the Interior and Safety (South Korea), 2016). The guideline covers comprehensive standards, formats, and policies that are essential to OGD. According to act on promotion of the provision and use of public data 2017, in order to effectively provide public data, the minister of government administration and home affairs must establish and manage an integrated provision system (as an open data portal), promote its utilization, and request cooperation in linking and providing the public data to the open data portal. Importantly, continuously maintaining and improving the open data quality requires systematic management and activities. In order to ensure proper control of the quality stability and quality level of OGD, the minister of science, ICT and future planning and the minister of security and public administration will define and implement the policies necessary to diagnose, evaluate, and support the quality improvement of OGD. Further, the minister of security and public administration will diagnose and assess the quality of OGD, which has a profound effect on society and the economy. Moreover, the minister of the interior and safety will annually evaluate the development and utilization of OGD and report the findings to the state and the public. Such a ministry may reward any public agency for the best practice.

In Australia, the government has launched a comprehensive reform of Australia's data infrastructure framework for sharing and dissemination to signal that active data sharing and dissemination are permitted (Productivity Commission of Australian Government, 2017). The reforms present clear signs of changing attitudes and allow a proactive approach to leveraging OGD. In order to realize the potential of OGD, agencies need to systematically develop available OGD, identify high-value sources, and establish and maintain a register of the data assets. The government

provides an open data toolkit to provide data administrators and users with a central source of OGD dissemination (Department of the Prime Minister and Cabinet of Australia, 2013). The Australian government has used commonwealth data, including data used by the analytics project that must be true, accurate, and reliable if they are to be used to support the agency's responsibilities and decisions. Building a reliable and secure OGD management framework across the public sector allows more agencies to work together and to improve data collection and use, as well as providing public services (Government of South Australia, 2018). To develop and manage the OGD system, the government also conducts annually assessments through the open data 500 Australia survey. The survey helps with the understanding of how Australian organizations use OGD. It is also the basis for the social and economic valuation of open government datasets (Department of Communications of Australian government, 2015).

In New Zealand, the government has implemented a data governance to oversee and manage the entire OGD system (Stats New Zealand, 2019f). The key to maximizing the value of OGD is consistency in how the data is collected, saved, and shared (Stats New Zealand, 2018a). The government continually verifies that OGD are truly open in an open format, open licensing, bulk download, or free availability (New Zealand government, 2018). The OGD management principles were approved by the New Zealand government cabinet in 2011 include: “(i) open for public access, (ii) protect for personal, confidential and classified data and information, (iii) readily available, (iv) trusted and authoritative, (v) well managed, (vi) free charging, but reasonably priced if necessary, and (vii) reusable” (New Zealand government, 2016). The government developed the New Zealand open data action plan to develop OGD environment that accelerate the release and reuse of OGD so as to enable New Zealand to maximize the value of OGD (Stats New Zealand, 2018a). The vision of the plan is to “maximize the value of OGD by increasing access to government – held data, increasing the use of data, and building an open by design culture” (Stats New Zealand, 2018b). Importantly, the future of OGD action plan in New Zealand works towards the following issues (New Zealand government, 2018): “(i) buy – in (government ministers and chief executives are familiar with the concept of open government data and see the value and potential

benefits), (ii) organizational (government officials have the relevant required skills for working with open data, including technical, statistical, analytical, business insights/domain knowledge; and there is coordinated stakeholder management between data providers and users), (iii) legal (clear and specific legal frameworks for working with open government; privacy constraints are actively managed), (iv) technical (the relevant quality standards; data are easy to find and access; it has consistent metadata; is published in machine- and human-readable formats; and follows consistent standardization requirements, (v) funding (sufficient funding is available to enhance operational processes and development of new services/products; sufficient investment in infrastructure, people and processes), and (vi) awareness (ongoing cultural change including understand the value drivers, knowledge of specific needs of users, and understanding of business needs)".

In Japan, the Japanese government has the political power to require each federal ministry to take measures to disclose OGD, but the central government has no mandate to direct local government agencies (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2013). Hence, local governments release OGDs at their discretion, with the federal government encouraging best practices. Since the traditional administration and information systems are not based on OGD, the concept of OGD is applied to ministries and government agencies (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). Since 2014, the chief information officer was appointed to continue implementing plans for reforming the public data system. Technically, the structure of Japan's IT dashboard allows citizens to quickly verify the status of IT investments carried by individual ministries and government agencies. General rules related to the provision of OGD systems and project management will be applied. The government has developed a system for assessing monitor functionality for large and high-risk projects. In addition to promoting IT human resources within the government, a training program will be held for ministries and departments, and personnel exchange between government CIO staff organizations will be implemented. Importantly, under the act of public and private sector data utilization 2016, the Japanese government formulated: (1) a basic plan for the advancement of the act, (2) a prefectural plan for the advancement of the

act, and (3) a municipal plan for the advancement of the act by each municipality (obligation to make efforts). In particular, the government is responsible for implementing comprehensive measures to advance data utilization.

In the Netherlands, the government provided an action plan for the open government year 2018-2020 as an integrated part of the democratie in actie (democracy in action), which included open data action (Netherland government, 2014). The plan supports open decision-making at municipalities and provinces through required open data in a standardized manner for open data. The action plan consists of actions taken by priority from network partners. Making OGD accessible in a standardized way will encourage residents and community organizations to optimize decision-making, leading to transparency and accountability. It is important to strive to create an open culture for government agencies to share knowledge and experiences, inspire, and work together to create as much value from OGD as possible. Pioniersnetwerk's goal is to unite authorities that are passionate about OGD disclosures in order to exchange knowledge, experience, best practices, to collaborate and develop innovation, and inspire and empower municipalities to open up.

In Norway, the relevance of digital technology, which is increasingly becoming a part of the daily life of citizens and private sector business models, has been reinforced by exponential advances in the production, storage, processing, and sharing of data. It is necessary to create an environment in which governments can capture the strategic value of OGD for government digital transformation (OECD, 2017). The Norwegian government has developed a national resource center for OGD sharing, specializing in the application of technology laws and management processes as a learning environment and knowledge base for all sectors of the government (Norwegian Ministry of Local Government and Modernization, 2019b). The government guides OGD in its web portal (Norwegian Digitization Directorate, 2020) with the 2025 goal to perform more tasks digitally and with more seamless services (Norwegian Ministry of Local Government and Modernization, 2019b). The government developed data lake, a data storage method for all data types, and a central data warehouse for all types of data: structured or unstructured. The data lake serves as a comprehensive resource accessible to multiple users, a tool for improving learning efficiency, and as a foundation for machine learning and artificial

intelligence. It can be built in as a general solution for multiple departments. The data lake can be created in-house or as a general solution to facilitate efficient and standardized sharing of data with secure access mechanisms (Norwegian Ministry of Local Government and Modernization, 2019b). In the future, the value of OGD will depend on each organization that defines the principles of data explanation, the concept of the data model, its APIs, and the active sharing of OGD according to the criteria. Further, the government continues to develop new measures to increase progress and to achieve goals, to increase capacity in regulations, data-sharing frameworks, and compliance with laws and technologies. Additionally, adjusting the infrastructure for data sharing requires further knowledge and skills in both the central and local government sectors. Forums that can assist data providers and users in sharing their experiences and to discuss how to improve the data in the government sector are required (Norwegian Ministry of Local Government and Modernization, 2019b).

Table 4.10 Main Key Procedures of OGD Management

Country	Features of OGD management

United Kingdom	• Government agencies have committed to implement OGD.
	• Almost every agency and ministry has its OGD strategy.
	• The government digital service in the cabinet office is responsible for systematizing OGD activities.
	• Features of OGD plan and relevant approaches:
	  ○ It connects with other development policies or other policy areas.
	  ○ It is a clear and coherent plan.
	  ○ It allows and supports to integrate a comprehensive OGD management and advanced technology to enhance the power of OGD.

Canada	• The government has committed to implement OGD. • OGD are embedded in open government national action plan • Features of OGD plan:

Country	Features of OGD management
	○ It is a consistent plan developed and updated every two years. ○ It announces OGD commitments and standards. ○ It specifies activities to support OGD.
France	• Government agencies are required to release OGD. • The French government founded Etalab responsible for promoting OGD between ministries and agencies in the dissemination of their data, such as: ○ Presenting step-by-step guidelines, ○ Organizing training for civil servants and regular training activities, ○ Disseminating OGD readiness indicators, ○ Monitoring the implementation of OGD, ○ Promoting the re-using of OGD, ○ Promoting OGD communities, ○ Managing government OGD platforms (data.gouv.fr) • Appointing chief data officer in government agencies • Features of the French OGD plan: ○ Implementing the OGD based on the principle of open by default ○ Building an OGD platform to promote the use of its ○ Developing OGD policy by engaging with citizens, the private sector, and civil society ○ Raising open innovation in France and throughout the world
United States	• The federal government and federal public agencies commit to implement OGD. • State and local governments are supported and encouraged to implement OGD. • Chief financial officer of each agency is required.

Country	Features of OGD management

	• Features of open data plan:
	  ○ Leveraging data as a strategic asset and valuable national resource
	  ○ Ensuring accountability for grants
	  ○ Providing public access to federally funded research
	  ○ Fostering the expansion of workforce data standards
	  ○ Creating agency-level chief data officers
	  ○ Using open data to fuel innovation to improve public health
	  ○ Implementing intelligence community on privacy, civil liberties, and transparency
	  ○ Expanding public participation as co-creation

South Korea	• Government agencies have committed to implement OGD. • The central government must establish a master plan to promote the acquisition and use of OGD. • The state and local government heads must develop an annual action plan to promote the acquisition and use of OGD under the relevant master plan. • The minister of interior and security annually assesses the OGD management implemented by government agencies for selection and awarding • The minister of interior and security establishes and announces guidelines for OGD management • The minister of government administration and home affairs shall build and manage an integrated provision system (hereinafter referred to as open data portal) and promote its utilization and may request cooperation from the heads of public institutions. • The heads of government agencies must take necessary measures to ensure adequate control of the quality of OGD.
Australia	• Government agencies commit to implement OGD.

Country	Features of OGD management

	• The government launches the data infrastructure framework:
	  ○ Clear, assertive, and consistent leadership
	  ○ Transparency and accountability in risk management
	  ○ Identifying policies and laws that reform for change
	• Developing high-value data systems and maintain data assets
	• The government provides a set of tools, legal requirements, regulations, policies, and government plans.
	• The government conducts annually an assessment.

New Zealand	• Good data governance is used to manage open data • Setting key requirements of OGD: (i) open for public access, (ii) protect for personal, confidential and classified data and information, (iii) readily available, (iv) principle: trusted and authoritative, (v) well managed, (vi) free charging, but reasonably priced if necessary, and (vii) reusable. • Features of the OGD action plan should be based on (i) the timeline of activities, (ii) milestones for the agency, and (iii) describes the methods for OGD • Future of open government data action plan: (i) buy-in, (ii) organizational, (iii) legal, (iv) technical, (v) funding, and (vi) awareness
Japan	• The central government commits to open data and other government levels are encouraged and mandated by law to open data. • The government launches an implementation plan of data system and relevant common rules. • The chief information officer is appointed to be responsible for the plan. • Developing “IT dashboard” to enable members of the public to monitor the development of open data.

Country	Features of OGD management
	• The government develops assessment systems for monitoring the functions of open data, and training programs. • To support the public and private sector to utilize data, the government formulates (i) a basic plan of the utilization, (ii) a prefectural plan, and (iii) a municipal plan. • Regularly identifying measures related to public and private data utilization
The Netherlands	• The government develops the action plan for open government. • The government sets up a standardized manner of open data. • OGD management focuses on building and enhancing network partners to join in improving open data and utilizing it.
Norway	• The government has developed the relevance of exponential progress in terms of production, storage, processing, and sharing. • The government guides open data in the web portal. • The government develops Data Lake, a method for storing all types of data and a central data warehouse for all types of data. • Harmonizing data management systems so that OGD can be shared

4.1.4.4 Data Cooperation

More open data are the political will of the United Kingdom government. Its commitments have been further embedded in many departments to release OGD (Davies, 2014; Safarov, 2019). Almost all agencies and ministries have their OGD strategies based on the digital strategy since 2017, the government digital service under the cabinet office, which is responsible for coordinating OGD activities of all government entities at all levels (European Commission, 2019). The local government association also supports local agencies in OGD activities by providing guidance materials to encourage local authorities to release OGD in a standard format (Safarov, 2019). Importantly, the local digital declaration was established as a joint endeavor between the Ministry of Housing, Communities and Local Government, the

government digital service, and a group of local agencies across the UK to declare that that the use and sharing of OGD are secure (OECD, 2014c). With this support, it enables municipalities and local authorities to develop their own OGD repositories and to use the data to develop their areas. Still, they recognize the challenges that local agencies face when trying to use and embed essential OGD in their organizations. This collaborative dissemination of OGD at all levels provides the UK with comprehensive data on all areas, enabling it to be utilized for development at both the local and macro levels.

In Canada, the government tacitly adheres to the principle of being open by default. The Canadian federal government and other Canadian governments are required to provide online access to OGD (Act to amend the parliament of Canada act and the access to information act (transparency), 2014). The federal government collects, stores, and releases large amounts of data, from air traffic and public health data to household and crime statistics. Many of Canada's local governments are leading the way of OGD, including Vancouver, Edmonton, Toronto, Alberta, British Columbia, Ontario, Prince Edward Island, Newfoundland & Labrador, Northwest Territories, Nova Scotia, Québec and Saskatchewan (Government of Canada, n.d.). The federal government has released a wave of innovations for both economic and social development through opendata.gc.ca by releasing as many different datasets as possible in an open and standardized format. Last year, the federal government worked with provinces to identify high-value datasets to disseminate and exploit. The federal government continues to improve cooperation with provinces and municipalities to develop data standards and for a consistent user experience. The federal government cooperates with local governments on a regular and active basis.

In France, all government levels and ministry executives have to rethink their actions to make France a digital republic. The OGD strategy begins at the local level before it becomes part of the national strategy, such as open data platform start-ups, and data set releases (Savy, 2017). Later, the prime minister's decree 2011 established the principles of free and open access for the reuse of government data. That year, an OGD policy in France was formally developed and the agency called Etalab was the main driving force under the prime minister's office (Radu, 2020). Etalab is responsible for introducing OGD guidelines, such as a list of

standardized data sets (Socle com-mun des données locales), a step-by-step approach for OGD development and utilization, and a series of resources for OGD (Les explorateurs des données territoriales) to ministries and helping local governments and citizen technology organizations gain access to OGD (Chausson, 2014; Etalab, 2013). In 2016, France passed the digital republic act, a pivotal law that made it the first in the world to direct local and federal governments to automatically publish government data to the public, as releasing OGD is the essential foundation that digital transformation needs. The digital republic act expands the scope of the automatic dissemination of OGD at the federal, local, and non-governmental levels that provide public services (Republique Francaise, n.d.). The bill enforces federal and local governments and public and private legal agencies in providing public services to make OGD available to the public in a standardized online format. It also enhances the local government's access to digital technology in terms of usage.

In the United States, public agencies such as federal agencies are required to publish and release their data under the freedom of information act." The federal agencies, such as the department of health and human services, the department of energy, and the department of transportation, have hosted datapaloozas, conference-hackathon hybrids, to boost the connection between the government and program developers in leveraging OGD (U.S. Department of Health and Human Services, n.d.; U.S. General Services Administration, 2012). Moreover, the public agencies have hosted open data roundtables with private sectors in order to explicitly prioritize their OGD to correspond with private sector demand. Additionally, the federal government provides an OGD template, Data.gov, for public agencies to be able to host their OGD (U.S. General Services Administration et al., n.d.-a). State and local governments publish OGD on Data.gov in order to make it more discoverable (U.S. General Services Administration, 2009). It also gives local and non-federal governments access to OGD resources (U.S. General Services Administration et al., n.d.-b). Furthermore, at local levels—states, cities, and counties, they also have launched their OGD sites. To support this movement, the federal government launched the software development kit, CitySDK, to support OGD improvement at the state and local levels across the nation. The project bridged the gap of the OGD system between federal, state, and local data. Further,

under the opportunity project, federal agencies engage with outside developers, nonprofit organizations and communities to support the ease of access to federal and local government data. This project has developed additional tools for specific demographics and issues based on access to and utilization of OGD (Office of the Press Secretary (The White House), 2016b). Available OGD at all levels enable citizens to voice their opinions and to offer technical solutions that benefit their communities through the interactions of academics, industry, entrepreneurs, and the government

In South Korea, the act on national informatization requires public institutions - any state agencies, or local governments - to seriously disclose any information that they maintain, based on the people's right to know (Act on Promotion of the Provision and Use of Public Data, 2017). Due to article 21 of the act, the minister of the interior and safety may ask the heads of government agencies to support the cooperation necessary for the creation and operation of the OGD. The head of the government agency must comply with it. The article 24 of the same act, which refers to the establishment of foundation for provision of public data requires: "(1) the head of each public institution shall endeavor to maintain public data in a machine-readable form to ensure the efficient use thereof; (2) the head of each public institution shall devise a means to provide public data utilizing various information technologies to ensure that such public data are accessible and available to users; and (3) the government may provide the administrative, technical, and financial support necessary to improve the forms to provide public data and to devise a means for provision".

In Australia, the government policy on public data is simple: "all government agencies should make non-sensitive data open by default, and it should be free, easy to use, and reliable" (Department of the Prime Minister and Cabinet of Australia, 2013). Governmental organizations at all levels, which collect data for administrative purposes, need to make plans for improving OGD (Australian Government, 2013). Government organizations can conduct self-assessments in developing open data or use case studies to prepare their open data strategy (Australian government, 2019a). Each government agency's OGD strategy is a practical strategy that identifies its commitment to releases and leverages OGD. Each

agency can employ its strategies to identify OGD's value they want to release, how they will implement their OGD development, what data will or will not be made available, and how they communicate and work with OGD's stakeholders. Currently, New South Wales, Queensland, South Australia, Victoria, Western Australia, Tasmania, Glenorchy, City of Melbourne, and Brisbane City Council have their OGD policies and OGD portals.

In New Zealand, the key to maximizing the value of OGD is consistency in how the data are collected, recorded, and shared. The government allows agencies, both central and local agencies, to create guidelines that are "open by design" (embeds the ability to release OGD into their processes from the ground up) in data management and governance. In order to increase and maintain consistency in OGD development and utilization, Stats New Zealand is responsible for this significance. Stats New Zealand has partnered with government agencies to co-design and implement new methods of managing and using data (Stats New Zealand, 2019d). Consistency increases the value of OGD, creates richer perspectives to inform government policies and investment decisions, and enables faster and efficient sharing of the data with other entities and data reconciliation (Stats New Zealand, 2019c). The government collaborates with government agencies to co-design, develop, and implement data standards to enable faster, more efficient sharing and utilization of the data, and saving time and money (Stats New Zealand, 2018a). The government works with other government agencies to ensure that better-quality data are published and utilized.

The Japanese government comprehensively reformed its public data systems nationally and locally when investing in IT (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Each ministry and state agency will adopt a detailed reform plan of the government for developing services and enhancing the efficiency of operations. Due to the basic act on the advancement of public and private sector data utilization 2016, the state and local governments are required to release OGD to the public. According to the act, the state and local public authorities must take necessary measures regarding self-organized public and private data so that people can easily use it over the Internet or online platforms. Local authorities are responsible for defining and implementing

measures to improve the use of OGD according to the basic act on the advancement of public and private sector data utilization 2016. The act provides the promotion of the use of OGD at the provincial and municipal levels. In order to promote the adoption of the OGD guidelines by local governments, 279 local governments have implemented initiatives to adopt the OGD guidelines (as of May 2017), about fifteen percent of all local governments in the country (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). The government also tried to achieve a 100 percent participation rate of OGD disclosed by local governments by fiscal year 2020 through the support of the technological environment, the capacity of local officials, and the establishment of an agency for intergovernmental coordination between the central and local governments. The government has promoted OGD practices by national and local governments to facilitate public and private use of OGD by various stakeholders in order to support the initiative of business organizations regarding OGD in the local areas.

In the Netherlands, the government published the Dutch digitalization strategy which is the overarching strategy for everything relating to going digital in 2018 (Ministry of the Interior and Kingdom Relations of Netherlands, 2019). In this regard, the central and local governments have joint responsibilities for implementing the data policy. All public sector bodies are developing policies related to datafication—utilizing OGD in public services. For example, the municipality's shared vision is to implement a data driven approach. However, although local authorities have made disclosure OGD efforts, some of the data are still not machine-readable (Open Government Partnership, 2019). In this regard, the ministry of the interior and Kingdom Relations plays a coordinating role in supporting and pushing higher standards and quality of OGD at local levels. The government also encourages cross-departmental collaboration with departmental autonomy to enable data connectivity. Coordination between data-related initiatives and OGD policies is important; this will ensure that actions support each other to make progress. For example, the government supported a pilot project of OGD between the ministry of the interior and Kingdom Relations and the association of Netherlands municipalities to carry out a project in which local organizations will produce and publish OGD in a

standardized and machine-readable format. This pilot project will establish the basic principles for OGD.

In Norway, all Norwegian organizational levels have implemented the digital transformation approach (Ministry of Local Government and Modernization of Norway, 2016b). The national digital collaboration is perceived in the country (Norwegian Ministry of Local Government and Modernization, 2019b). Since 2011, it has been the official starting point for OGD operations requiring government agencies to publish raw data in the most machine-readable format. The goal for the digital agenda in 2025 is for all government levels, both local and central, to develop their public services on digital platforms and collaborate in their operations in a digital ecosystem (Ministry of Local Government and Modernization (KMD) of Norway, 2016; Ministry of Local Government and Modernization of Norway, 2016c; Norwegian Ministry of Local Government and Modernization, 2019b). In order to achieve and support digital transformation, the government at all levels collaborate better in delivering digital services and streamline resource use through increased coordination in digitalization (Norwegian Ministry of Local Government and Modernization, 2019b). Government institutions, politicians, policymakers, and government managers of Norway, both at the central and local levels, are required to experiment with new technologies while using OGD to drive their learning. The goal of digitalization is to work together to serve websites and OGD in municipal, county, and federal agencies (OECD, 2017). The agencies will share data and provide services to users seamlessly. Norwegian ministries and agencies gain benefits from connected data, data sharing between institutions and across borders, and interoperability. The coordination of local digitalization activities has sufficient influence on national digitalization. With this coordination, the federal government can examine digital initiatives and drive more strategic approaches to digitalization.

Table 4.11 Data Cooperation and its Supports

Country	OGD in federal/state governments, local governments, or governmental organizations	Government supports for OGD cooperation
United Kingdom	• Almost all agencies and ministries are committed to making their data public. They have their data strategy and website. • Local governments have developed OGD repositories and promote the use of OGD.	• The cabinet office is responsible for coordinating OGD activities for the whole country. • Local government associations support local authorities in OGD activities. • Local government associations make recommendations to encourage local authorities to publish the dataset in a standard format. • Establishing the local digital declaration to improve government digital service
Canada	• All government levels are encouraged by the principle of "open by default" to provide online access to free and open data in an open and standardized format. • Many local governments have their open data strategies such as Vancouver, Edmonton, Toronto, Alberta, British Columbia, Ontario, Prince Edward Island, Newfoundland & Labrador, Northwest Territories, Nova Scotia, Québec, and Saskatchewan.	• Encouraging all government levels to open their data • Collaborating with provinces and municipalities to improve data standards and data experiences • Collaborating across jurisdictions regularly and enthusiastically to identify a set of high-value datasets
France	• Since 2016, Local governments have normally initiated their open data strategies with their autonomy such as open data platforms, published datasets. • Local governments and government agencies are mandated by the Digital Republic Act (2016) to	• Establishing the principle of free and open access for the reuse of government data • Establishing an organization responsible for promoting OGD between ministries, small government agencies, different governments, and

Country	OGD in federal/state governments, local governments, or governmental organizations	Government supports for OGD cooperation
	automatically publish and release public data	civic organizations to leverage the data • Publishing guidelines for agencies to help them open up OGD, such as a list of standard datasets that should be prioritized, recommendations for OGD implementation • Broadening the scope of automatically OGD release in both federal and local governments • Boosting access to digital technology in local government in terms of usage
United States	• Public agencies under the federal agencies must release their data based on the OGD concept. • Public agencies need to prioritize their data to correspond with the private sector or the public's demand. • State, local and tribal governments are encouraged to open their data to the public through the open data portal • State, local and tribal governments can create their platforms to release OGD.	• Offering a template for public agencies to host their open data • Supporting, encouraging, and guiding state, local, and tribal governments to open data through the portal (Data.gov) • Launching a project to support the development of open data at the state and local levels
South Korea	• Government institutions (state agency, local government, and public institution) are required by laws to actively OGD to the public. • Government agencies cooperate in the creation and operation of OGD portals. • Government institutions are required to maintain OGD in a machine-readable format to ensure the efficient use of	• Enforcing government institutions to comply with relevant laws to open data • Offering collaborative management for creating and operating OGD portals • Providing the support needed to update the form to provide OGD such as administrative, technical,

Country	OGD in federal/state governments, local governments, or governmental organizations	Government supports for OGD cooperation
	its, and to devise a mean to provide data utilization.	and financial
Australia	• All government agencies are committed to publish and release government data with the principle of open by default. • The agencies can develop an OGD strategy, make plans for improving its level of open data, and make open data self – assessment. • Many local governments - New South Wales, Queensland, South Australia, Victoria, Western Australia, Tasmania, Glenorchy, City of Melbourne, and Brisbane City Council - have their open data policy and open data portals.	• Enforcing government agencies to implement OGD based on open by default • Providing guidelines and recommendations to government agencies to OGD
New Zealand	• Government agencies are a co-design with their government to implement and use OGD. • Maintaining data and information management with consistency (collection, recording, and sharing) based on the country's standards. • Government agencies collaborate with their government to ensure better quality data.	• Enhancing collaboration across government to support co-design • Supporting agencies to create open-by-design methods for OGD • Developing and implementing data standards • Supporting agencies to maintain consistency in data and information management • Ensuring better quality data
Japan	• State and local public authorities are required to make their OGD public. • Endeavoring to establish a basic plan for measures related to the promotion of the use of OGD	• Forcing government agencies to implement OGD • Preparing a local government plan template • Requiring local authorities to make relevant plans • Promoting OGD practices by national and local

Country	OGD in federal/state governments, local governments, or governmental organizations	Government supports for OGD cooperation
	• Taking necessary measures on OGD for its use by the public and private sectors • Making it easy for citizens to use the OGD at all government levels while ensuring the right and security are protected	governments • Additional supporting as required by local governments • Improving the cooperation domain to help the public interest grow and to open data business initiatives
The Netherlands	• The central and local government jointly implement the OGD agenda. • Agencies within national governments are developing policies relating to datafication. • Municipalities join vision shared on taking a data driven approach. • Participating in coordination between the various initiatives	• Promoting a joint vision with municipalities in implementing a data driven approach • Implementing and coordinating cross-departmental collaboration with departments • Supporting a pilot project of open data to provide a testing environment • Producing and publishing OGD in a standardized, and machine-readable form
Norway	• All organizational levels undertake open data implementation. • Collaborating in the digital ecosystem with all other organizations • Increasing stakeholders' engagement to join in open data implementation	• Supporting all organization levels to digitize their work process • Increasing collaboration in the digital ecosystem • Providing specialists, common solutions, or standards in the ecosystem • Prioritizing local levels in national digitalization activities • Supporting financing mechanisms

4.1.4.5 Government Support

In the United Kingdom, the government has strengthened the UK's digital capabilities by involving the right people, skills, and culture since they want to make their government more digital. In order to unlock the power of OGD, the government recognizes that digital skills are the decisive factor for the use of OGD (European Commission, 2019). One of the UK government's digital strategies is to underscore the need to build the skills and ability to effectively use and leverage OGD (Safarov, 2019). The UK government holds annual meetings, conferences, and workshops to foster a culture of innovation using OGD (Hujiboom & Broek, 2011). There are three main organizations that support the UK government's strategy of building the skills and ability to effectively use OGD. First, the government digital service serves as a center of digital expertise for other government organizations, explores new ideas in digital, information, and technology, and ensures that expertise is applied effectively (European Commission, 2019). Second, the open data institute and open knowledge foundation offers open data-intensive courses and training programs for data users. Advanced data science tools and skills for government officials working with data are also encouraged. Last, the government statistical service has developed computer-based training to help statisticians and other government officials in terms of how to make data available in an open format (Minister for the Cabinet Office and Paymaster General of England, 2012).

In Canada, the government is implementing a strategy of train-the-trainer, where governments work with highly advanced data users that are responsible for conveying knowledge to others and making use of the OGD system. This training will be tailored to the specific expertise of the particular organizations. Government officials thus gain knowledge along with adjusting their operating methods based on the utilization of the data (OECD, 2014a). This strategy ensures that each organization is responsible for disseminating its data and leveraging data for the public. In order develop user-friendly OGD, the government of Canada promotes OGD utilization stories and guidelines and provides training and guidance to enhance the soft skills required for OGD (Government of Canada, 2018). Further, the government strengthens international cooperation in exchanging knowledge and ideas about OGD (OECD, 2014a). For example, the government of Canada has partnered with the

international development research center and the World Bank to host the international open data conference. The conference brings together OGD experts from around the world to share their views on the global impact of open data and to collaborate on initiatives to empower its potential internationally. Further, the government sponsors OGD workshops designed as a platform for OGD conversations where new and creative ideas for OGD can be demonstrated.

In France, OGD's role is at the heart of the government's digital development. France was the first country to authorize a national chief data officer (Administrateur général des données- - AGD) (Chausson, 2014) to coordinate government actions in terms of data storage, data governance, data circulation, organizing the use of data, disseminating data, creating tools and skills to support data utilization, advising agencies on data technology, and suggesting data reuse strategies. Etalab plays a key role in helping government agencies open their data. Etalab follows a step-by-step approach to educating agencies about the benefits of OGD for their jobs, such as regularly organizing OGD camps for civil servants and organizing training events (Savy, 2017). France, through Etalab, has supported on literacy and has sought to raise awareness among administrative authorities about the benefits of OGD for their jobs. The French national action plan mentions about the diffusion of a culture of opening, data and digital. The government supports a culture of OGD innovation through competition and funding. Etalab regularly organizes hackathons and other national and local events to promote the reuse of OGD and to promote the development of OGD new applications, data visualizations, and other tools. In order foster external collaboration, Etalab hosts an annual Dataconnexions competition that awards the best use of OGD (Republique Francaise, 2017).

In the United States, the federal government has launched a wide range of contributions under the opportunity project data studied by research and innovations in social, economic and environmental equity at Boston college school of social work to provide accessible scientific and public reports on data-generated opportunities to develop different social dimensions (Office of the Press Secretary (The White House), 2016b). Under the project, the government has committed to increasing technology training programs. For example, in a coding boot-camp students are encouraged to use OGD in the final project to create apps and tools that

consider people and community needs. The cross-functional hackathon held by the General Assembly is open to graduates, including web and Android development, user experience, data science, and product management to collaborate using data to build applications. The national consortium for data science will coordinate mentoring and internships in multiple cities, which will use the opportunity project data and new technology to support young people to learn and meet the needs of the local community through technology, to establish the involvement of data professionals, to identify key data challenges, to coordinate data research priorities, to support research in industry, academia, and government, and to train young data professionals. For example, the RENCI project 2004 was a collaboration involving UNC Chapel Hill, Duke university, and North Carolina state university to enable research discoveries and practical innovations (Renaissance Computing Institute (RENCI), n.d.). Federal agencies work with external developers to create ease of access to federal and local government data made available through the opportunity project data, which allows them to develop additional tools specific to specific populations and issues (Office of the Press Secretary (The White House), 2016b). The White House presented the CitySDK project, bridging the gap between federal, state, and local data to support software development kits with OGD platforms used by cities across the country to deliver innovative social solutions (U.S. Department of Health and Human Services, n.d.; U.S. General Services Administration, 2012).

In South Korea, the government provides administrative, technical, and financial support needed to improve OGD and determine how it is prepared under the act on promotion of the provision and use of public data of 2014. The public data utilization support center has practically supported the dissemination and use of OGD based on the act. The center is a public institution dedicated to exposing OGD enabling the private sector to take advantage of the data. The center specializes in the provision of OGD policy, the creation of OGD, diagnosing the OGD quality, leveraging OGD through researching, promoting OGD utilization, providing consultation, supporting education and training, and connecting public and private sectors to be a partnership in utilizing OGD. Moreover, according to article 14 of the act, the government needs to support data utilization with following activities: raising citizens' awareness about the value of OGD; promoting the use of OGD; discovering

and rewarding the success case of using OGD; holding conferences and workshops about OGD; promoting start-up business using OGD; supporting knowledge, skills, and tools through providing education; and training programs (Act on Promotion of the Provision and Use of Public Data, 2017). In addition, the government may take steps to educate data users to promote the proper use of OGD and to prevent the misuse of OGD that could harm the public interest or the rights and interests of the people. The government may conduct large-scale surveys to identify the types of high-value data and data that people need to develop government agencies' data platforms to provide such data (Government of the Republic of Korea & Open Government Partnership, 2018).

In Australia, government agencies must establish good procedures and practices that create a data analysis environment in order to ensure that data analysis is in the best interests of the community and is ethically based (Australian government, 2014). The government has initiated a strategy for developing personnel skills by communicating a clear vision for the opportunities and benefits of the OGD it will generate. The government increases staff skills based on the nature of the development and use of OGD, such as data management professionals, data scientists, project managers, and data communicators. The availability of personnel with data management and analysis skills will support the development of technology and competence in the process of developing and utilizing the data. Personnel must be proficient in big data technologies as they differ from traditional data and analytics. The Australian government encourages personnel to be trained and familiar with the obligations of OGD and the strengthening of data security to innovate, embrace new skills, and apply new technologies to their operations. Supporting a community of analytics professionals within government agencies will increase learning and identifying opportunities for collaboration.

In New Zealand, based on the OGD action plan, the government fosters an “enabling environment for agencies (establishing a clear mandate and principles for releasing open government data), equipping agencies to proactively release and maintain a high value, in-demand data (establishing a ‘front door’ for support and consultancy services, training, information, and tools), motivating agencies (raising awareness of the value of open data, defining their open data aspirations and plans,

enabling agencies to benchmark their data maturity and measure progress)" (Stats New Zealand, 2020). The government offers data consultancy services, meaning that other agencies can ask data professionals to work with them at different times to provide practical support so that they can be managed to better and securely share the data they store (Stats New Zealand, 2018a). Also, the government supports data users by developing analytical skills and capabilities to maximize the value of data (Stats New Zealand, 2019d). Particularly, the national statistical office of New Zealand supports and empowers government agencies to use information more effectively by building tools, financing, training, and assistance to support the public agencies to be proactive in releasing OGD and able to deliver better results for New Zealand (New Zealand government, 2018; Stats New Zealand, 2018b). The government appointed the government chief data steward to facilitate and enable an integrated approach among government agencies for setting standards and building joint capacity, including developing data policies, strategies, and planning to ensure that agencies are capable to unleash the power of OGD (Stats New Zealand, 2018a). The government also established the data capability hub to encourage organizations to apply good practices, advice, resources, and tools to manage their data. In addition, the data capability hub serves to easily discover OGD usage practices, establish and embed appropriate data management behaviors to ensure that the data are consistently described and recorded (Stats New Zealand, 2019a).

The Japanese government recognizes the importance of government capabilities in government, private, and public organizations (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society, 2000). Based on the declaration to be the World's most advanced IT nation since 2013, human resource development and education have been fundamental factors for expanding the use of information technology (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). The government encourages the use of IT in educational environments such as high-speed broadband connections to schools, the introduction of electronic blackboards, the creation of a wireless Lan environment, and the use of electronic messages and learning materials to raise IT literacy. The government has increased and improved IT literacy for everyone, and has provided qualified IT human resources that can lead to

innovation. According to the basic act on the advancement of public and private sector data utilization (2016), the government needs (i) to implement necessary measures to develop human resources with the knowledge or technical skills in the use of data; and (ii) to promote education and learning about the use of public and private data in order to ensure that people are more interested in and understand the use of public and private data (Basic Act on the Advancement of Public and Private Sector Data Utilization, 2016). Moreover, the government promotes standardization of public and private data linked through the development of cross-field service platforms based on data standards, linking APIs, and authentication functions as a foundation for data circulation. For government agencies, there will be a training program to promote IT human resources within the government (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Ministries and agencies will exchange personnel related to OGD. The government promotes OGD through activities such as administrative surveys, and organizing public and private roundtables to promote an OGD approach that meets the needs of the private sector (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017).

In the Netherlands, the Dutch government places great emphasis on technical skills and knowledge for the use of OGD (Safarov, 2019). The support is divided into two groups: support for new users to produce innovations and supporting government agencies to improve OGD systems in collaboration with OGD users. The Dutch government holds an academic conference every year, competitions, and data hackathons to support and encourage the utilization of OGD. The government has established the Stuiveling open data award for the best application designers taking advantage of OGD both in public and private sectors using OGD in new ways to address today's social challenges. This award encourages both the public and private sectors to learn from each other's experiences (Open Government Partnership, 2019). The Netherlands develops the skills of public officials to become professional government officials in working and learning alongside their citizens, and the government is also working with international OGD programs and private institutions to improve OGD policies and initiatives (Safarov, 2019).

Norway has continuously built its digital capabilities across all demographic groups (Ministry of Local Government and Modernization (KMD) of Norway, 2016). Digital competence has become a key skill for government agencies' digital transformation and their ability to realize the benefits of digitalization (Norwegian Ministry of Local Government and Modernization, 2019b). The Norwegian government requires organizational knowledge and the availability of specialized skills and competencies, particularly among government officials (OECD, 2017). Increasing digital talent is not just about hiring professionals, it is also about developing the talent of employees and managers within public sector organizations. It is also about developing work processes and cultures that support digital transformation for the benefit of citizens.

Table 4.12 Government Support in Developing Human Capital both in Administrative Agencies and Citizens

Country	Government support for administrative agencies	Government support for Citizens
United Kingdom	• Setting up a center of digital expertise to provide digital, data, and technology consultation • Providing data-oriented courses and training programs focused on the use of OGD • Providing advanced data science tools and skills • Developing computer-based training to help statisticians and other government officials create data in an open format	• Setting up a responsible organization to help the public understand the importance of OGD and utilize it • Empowering the right digital skills and culture to effectively use OGD • Providing several open data-oriented training courses • Annually forming conferences, sessions, and workshops
Canada	• Training the trainers to work with key super-users and to transfer knowledge for how to design, implement, and ultimately use the open data system • Showing leadership on open government • Encouraging the experience and benefits of OGD • Providing training and guidance to enhance the necessary skills • Strengthening international co-operation with other governments to exchange knowledge about open data	• Assisting data users • Hosting the International Open Data Conference to share perspectives on the global impact of open data, and to collaborate on a roadmap for maximizing its potential internationally • Supporting OGD workshops

France	• Appointing a national chief data officer to:
	  ○ coordinate government actions
	  ○ organize the best use of the data
	  ○ recommend strategies for government agencies to make it easier to reuse OGD
	  ○ Build tools and methods to support OGD mining and discovery
		• Supporting competition and funding to build a culture of OGD innovation
		• Promoting the development of new events such as hackathon and other events at national and local levels
		• Holding the annual Dataconnexions competition

Country	Government support for administrative agencies	Government support for Citizens
	○ Provide advice to promote the ability to work on leveraging OGD • Establishing a responsible organization to support public authorities in OGD to: ○ assist administrative and other public bodies to OGD ○ regularly organize OGD camps for civil servants and training events ○ work on knowing data literacy and trying to raise awareness	
United States	• Supporting state or local governments to use and release their data through the open data portal (Data.gov) • Hosting “datapaloozas”, conference-hackathon hybrids • Offering a template for other agencies hoping to host data or relevant events • Supporting software development kits with an open data platform	• Supporting OGD activities under the opportunity project to: ○ make scientific reports and publicly accessible ○ increase tech-training programs ○ cross-functional hackathon ○ build applications and resources to strengthen their data usage community ○ coordinate mentoring and internship programs in multiple cities ○ engage with developers outside, nonprofit organizations, and community members to facilitate access to federal and local government data
South Korea	• Establishing an organization to be responsible for practical support for the dissemination and use of	• Establishing a responsible organization to be responsible for the practical support for the

Country	Government support for administrative agencies	Government support for Citizens

	OGD
	• Providing administrative, technical and financial support needed to update the form to make OGD happen
		dissemination and use of OGD
		• Promoting activities to raise public awareness about the use of OGD:
		  ○ awards and publicity for successful cases involving the use of OGD
		  ○ holding forums and seminars regularly to promote the use of OGD
		• Facilitating the use of OGD to promote starting up businesses
		• Mattering necessary for eligibility, methods, procedures
		• Providing education and training about public data
		• Finding on demands data by regularly conducting demand surveys and establishing channels for direct communication with the public

Australia	• Promoting skills in management and data analysis of personnel	• Establishing procedures and guidelines for the public • Communicating with all OGD stakeholders
New Zealand	• Supporting and empowering government agencies to use data more effectively by creating tools and resources to increase data access capacity and reduce costs • Providing funding, training, and assistance • Appointing a responsible organization • Appointing New Zealand Chief Executive	• Supporting data users with the right data and analytic skills and competencies to maximize the value of data • Improving the ability to discover and access OGD • Sharing information with the OGD community • Developing online resources for promoting utilization of OGD such as case studies, training, support information, and tools

Country	Government support for administrative agencies	Government support for Citizens
	• Offering related advisory services to OGD • Creating an enabling environment for OGD development and utilization such as explicit authorization and principles, mentoring, training, tool support	• Offering OGD to the attention of potential users • Sharing of user experience, tools, and code of OGD • Deepening understanding of data users' needs and work with them • Designing a user-centric system for OGD development • Supporting two-way connection between citizens and government, • Being actively involved with the international OGD community to increase citizen participation
Japan	• Providing training programs • Implementing personnel exchanges with government Chief Information Officer • Promoting OGD through various activities, such as conducting a survey of administrative data, holding public-private round-table conferences	• Encouraging the use of IT and OGD in educational environments • Raising the academic abilities of students and increase IT literacy. • Implementing necessary measures to develop human resources • Enhancing standardization linkages for public and private sector data
The Netherlands	• Encouraging government agencies to update OGD policies to publish additional datasets and work with potential OGD users • Developing the skills of public sector staff to be the public officer as professional • Providing professional courses, building professional	• Empowering new users, innovators, and greater civic engagement • Organizing annual conferences, contests, and hackathons to support the reuse of OGD • Providing massive open online courses (MOOC) related to OGD

Country	Government support for administrative agencies	Government support for Citizens
	skills, reviewing actual case studies, and sharing management experience through OGD-related training	• Establishing incentives for data driven new applications, products, and services (such as the Stuiveling Open Data Award) • Cooperating with international OGD projects and nongovernmental institutions
Norway	• Increasing digital competence in the government – recruitment, developing the competence of employees and managers, developing work processes and a culture	• Strengthening digital competence and inclusion to the continuous improvement of digital competence and inclusiveness throughout all life phases, and across all population groups

4.1.4.6 Research and Development

Data hold a crucial commitment to knowledge and science, helping researchers explore on social issues. More specifically, it has become increasingly clear that data are fundamental to understanding and responding effectively to people's social and economic challenges through evidence-based policies or data-based research processes. The following countries are noted for this importance.

In the United Kingdom, OGD that are collected and used regularly have the potential to drive research to improve the country (Minister for the Cabinet Office and Paymaster General of England, 2012). Using OGD to generate clear evidence reduces deficits because policymakers can define policies and resource utilization with a clear understanding of what works, which can help drive better service outcomes and reduce costs. The government has funded research to leverage the benefits of the data. In this case, public-funded research is viewed as a public good that benefits the public interest. While intellectual property should be protected, publicly funded research should be disclosed with as few restrictions as possible. The country recognizes the social and economic benefits through published research. Funding agencies define explicit access to published research and ensure that relevant data are provided and shared as appropriate. Government agencies in the UK are committed to opening their research data and placing them in the public domain as far as possible, subject to legal and confidentiality restrictions.

In Canada, connecting OGD and people is proceeded by doing research (Treasury Board of Canada Secretariat, 2018). The government sees that having OGD does not always mean it is understandable or always makes an impact. Sometimes it is difficult to use or make decisions based on OGD alone unless the data are analyzed systematically and flawlessly. To accommodate a wide variety of data uses, OGD are supported with additional context and suggestions of the data utilization. Importantly, the Canadian government insists that “not only opening up data, it is but also open up scientific research – especially, all federally-funded science – to contribute to public researchers, businesses and interested citizens as the government of Canada has committed to open by default”. The launch of a platform that connects people to research and working closely with the scientific community will create an open science ecosystem. Open by default, in both OGD and open

research, is a good start from Canada as it's been into a transformation to be better (Government of Canada, 2018).

In the United States, releasing OGD can drive more research and development (Office of the Press Secretary (The White House), 2016a). For example, sharing cancer data through the genomic data commons by national cancer institute can stimulate the transmission of cancer data, make it a wide range of data, support compatibility for cross-study analysis, and provide access to data for researchers. The sharing of biomedical data by the national institutes of health supports the likelihood of the discovery and reuse of biomedical data. Open geospatial data and science are critical to the protection of life and economic growth, and the scientific quest. Disclosure of weather-related datasets helps share and research how data are used for climate resilience. The release of agricultural and nutritional OGD supports the sustainable development goals of "ending hunger, achieving better food security and nutrition and promoting sustainable agriculture". In addition, OGD expands the concept of open science (Office of the Press Secretary (The White House), 2016a). Federal-funded scientific and medical research must be more accessible. The concept of OGD enhances the public's access to digital scientific information. Since 2013, all federal agencies are designated by the White House office of science and technology policy to spend more than $ 100 million annually on research and development in order to improve access to digital academic information (Sheehan, 2016). Most of the research done by industry, universities, and other NGOs is funded by the federal government. The government also provides further guidance to researchers for the appropriate management and repository of data for the preservation and access of research data. Agencies both in the public and private sector with complete access to the data are putting the knowledge into practice.

In Australia, the government funds research organizations and the Australian statistical office to develop long-term databases and to provide registered users with confidential unit records (Australian Government, 2013). The government is also investing in developing data links that can combine OGD with information stored elsewhere, such as surveys. By linking the data with other factor data, it is possible to analyze the pathway for individuals and families who are at certain risk. OGD can identify events such as loss of work, or incapacity that affect an individual's

transition to social exclusion. Reform of OGD use, access, and sharing processes enhance researching the country (Productivity Commission of Australian Government, 2017). Many state governments have committed to providing OGD for research and development to leverage its power. For example, the data sharing (government sector) act 2015 (New South Wales) established a data analytics center and contains many mechanisms to "facilitate data sharing to identify issues and solutions in policymaking, program management, and service delivery". The public sector (data sharing) act 2016 of South Australia provides OGD to other agencies for purposes relating to policymaking, program management, and service delivery. The Victorian government launched an IT strategy for 2016-2020, including a commitment to establishing OGD to facilitate the sharing of the data between departments, businesses, universities, and communities. Better research can improve social outcomes (Productivity Commission of Australian Government, 2017). Research improvements could be driven by the increased availability of OGD. Open research data creates opportunities to stimulate new research networks and partnerships and to facilitate knowledge transfer to the industry to review or revise performance.

In New Zealand, Stats New Zealand is recognized as a world leader in the link (or inclusion) of data for individual and corporate research and analysis through providing the following: (i) integrated data infrastructure containing data about people and households; and (ii) the longitudinal business database containing data about businesses (Stats New Zealand, 2018d). More than that, OGD are available for research and analysis with appropriate safeguards to recognize and protect one's privacy, sensitivity, trade, and other interests. A linked OGD dataset can provide richer insights and support better decision-making. Research and analysis based on the data can help identify patterns and trends and show relationships between different data (such as environmental, social, and economic data) (Stats New Zealand, 2018d). Research can lead to new insights and knowledge about things that are important to New Zealand. For example, researchers from Motu economic and public policy research have used the longitudinal business database to explore the yields of dairy and sheep/beef farms. Their research shows that dairy farms benefit the most from their focus on production in their core activities. Researchers at Massey university

have used OGD to explore the link between the natural environment and asthma. They tracked 50,000 New Zealanders born from 1998 to 2016 and found that children living in green spaces were less likely to develop asthma. Research into the public view of the use of OGD reveals that the use of OGD is encouraged in the public interest, including (i) improving results with personal or public interests; (ii) improving the quality of life of the individual and the collective of the Maori (cultural, economic, social, and environmental); (iii) providing a fair allocation of taxpayer-funded services; (iv) improving and providing more efficient public services; and (v) supporting public discussion, community development and social collaboration, and economic development and environmental sustainability. The use of OGD for research and analysis creates new knowledge of a group of individuals, households, or organizations and the relationships between factors and their change over time. They provide data to make decisions, develop policies, improve service design and delivery, and understand better what works and what needs improvement (Stats New Zealand, 2018d). Research can lead to new insights and knowledge critical to New Zealand.

In Japan, according to the 2013 declaration to be the World's most advanced IT nation, the government aims to develop human resource and education through promoting research and development as one of the best ways to develop their citizens (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society, 2000; National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Since 2013, they have encouraged research and development cooperation. Research and development are vital to the use of IT and OGD in ways that contribute to the improvement of society and industry and how it is applied in society. In order to create the most modern IT-based society in the world and to keep developing it, it is necessary to carry out research and development while pursuing developments in a telecommunication-based society. Further, the research results must be quickly and accurately linked. According to the basic act on the advancement of public and private sector data utilization (2016) in Article 16, "the government implement necessary measures to promote research and development as well as verification with artificial intelligence-related technology, internet of things utilization-related technology, cloud

computing service-related technology, and any other advanced technology, and disseminate the outcomes thereof in consideration of the importance of maintaining self-reliant technical capabilities for public and private sector data utilization in Japan.” By implementing the measures, research and development can help countries promote the use and application of OGD (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017).

Lastly, in Norway, providing access to OGD means that researchers, businesses, and civil society can leverage the data for innovation, value creation, business development, and social openness. The government encourages the use of OGD and allows the use of its in new contexts to initiate new services and drives data-value creation (Norwegian Ministry of Local Government and Modernization, 2019b).

Table 4.13 Research and Development for OGD Utilization

Country	Benefits of OGD on research and development	Government support for research and development regarding using OGD
United Kingdom	• Having more opportunities to research as open data drives doing research • Researching with strong evidence	• Providing fund for research • Supporting public-funded research as public goods produced for the public to be open with as few restrictions as possible • Requiring government departments to open up their research data • Having clear open access arrangements for opening up research
Canada	• Having more opportunities to research • Opening up a scientific research and an open science	• Providing fund for research • Requiring publicly-funded research to open by default to contribute to public researchers, businesses, and citizens
United States	• Boosting up conducting a research • Opening up scientific and medical research more accessible so-called open science to support the concept of open data	• Provide funding for research especially run by industry, universities, and other non-profit organizations • Supporting federally-funded scientific and medical research to be more open and accessible to develop plans to increase access to digital data and academic publications • Providing further guidance to researchers for the proper handling and preservation of data, and provide access to research data
Australia	• Driving evidence for doing research	• Providing fund for research

Country	Benefits of OGD on research and development	Government support for research and development regarding using OGD
		• Supporting opening research data to build opportunities for repurposing and reusing research data. This encourages new networks and collaborations of specialists.
New Zealand	• Helping researchers obtain more insights into social issues	• Developing safely shared across government and linked (or integrated) for research and analysis as linked datasets can provide richer insights and support better decision-making
Japan	• Leading the research improvement	• Encouraging research and development and collaboration to utilize open data to improve society and industry
Norway	• Driving a research for value creation, increased efficiency, innovative public services	• Supporting using data for doing research

4.1.4.7 Citizen Engagement

Simply disclosing OGD may not benefit or release the power of OGD. All governments need to prioritize OGD users in terms of clearly defined roles and participation strategies to support the use of OGD. Of the ten cases, the documented analysis revealed that the following nine countries placed a focus on letting data users take advantage of the power of OGD.

First, the United Kingdom has perceived that data users play crucial roles in improving government digital services as third parties. In this regard, the government focuses on user needs and develops a clear engagement strategy to support their engagement (Minister for the Cabinet Office and Paymaster General of England, 2012). The primary OGD users are developers, small businesses, citizens, academics and large companies. They can tell which data sets they want to see matter, notify the government when there are any anomalies or errors in OGD to help the government deliver the services more efficiently, and keep the government perceiving of OGD utilization. They also help to improve data quality by giving feedback through various methods provided by the government (Safarov, 2019). The government ensures that its agencies have a strong engagement model to enable two-way conversation between the state and its people. Working together among the government, citizens, and private sectors ensures the dissemination of the dataset, in what time frame, and in a form that can help the government engage in different activities and become more agile. Communication between governments and data users is empowered in both ways for the common good. Improving data quality by recognizing better feedback from stakeholders is one of the UK government's top goals (Safarov, 2019). For example, the London case admits that they do not have all of the answers, and they cannot find the best solution without a collaborative and open approach (Suzuki & Finkelstein, 2019). Citizens help the government create the true value of the city's OGD for the benefit of everyone—business, government, and the people. Simplicity and alignment for data stakeholders are fundamental to unlocking the value of OGD, such as London public services, public utilities, and private citizens. This promotes technical advances in OGD sharing, synergies, interoperability, open standards, and resolution of urgent policy issues such as privacy and data security.

Canada has been recognized for progress on public engagement for OGD. The Canadian government aims to improve the collaboration between the government and its people by listening to the people and making the public sector more accessible (Open Government Partnership, 2018). The Canadian government continues its approach to open government through working with Canadian citizens, businesses, and civil society with collaborative governance as a key theme for the future (Government of Canada, 2020a). In releasing OGD, the Canadians are seen as co-chairs. People agree on a new kind of relationship between stakeholders and between stakeholders and the government. For example, Canada's national action plan on open government 2018-2020 is a product of extensive co-creation done by the public engagement (Treasury Board of Canada Secretariat, 2018). Canada's current national action plan (2018 - 2020) on the open government was developed in consultation with over 10,000 Canadians and received more than 5,000 comments through in-person roundtables, online consultations, social media outreach, and expert panels and reviews held in 14 cities across Canada (OECD, n.d.; Open Government Partnership, 2018). The specific platform the government has used is the multi-stakeholder forum (Government of Canada, 2020c), which is composed of twelve members, “eight from civil society (such as private-sector organizations, NGOs, universities and colleges, and data/service consumers) and four from the government of Canada” (Government of Canada, 2018). It supports ongoing participation and dialogue between the government and civil society. Through this approach, the role of the government is reshaped to be facilitator aiming to support any condition to work together effectively, such as common standards for data collection and release. The private sector plays a role as the specialist to make value-added services, universities and colleges play a role as a trainer for students to create the proper skills, citizens play a role as more informed participants.

In France, OGD empowers citizens to hold their government institutions accountable. OGD helps citizens understand and participate directly in the decision-making process of policy development. This requires the government to promote the use of cooperation so that people can use OGD more effectively (Savy, 2017). Citizens and civil society organizations actively support OGD as a means in the fight against corruption. Etalab, a French open data unit, is committed to

supporting the use of OGD and works with anti-corruption organizations. Many associations have worked on OGD in recent years such as Regards Citoyens, Démocratie ouverte, LiberTIC, Open Knowledge France, OpenStreetMap France, and République citoyenne by utilizing OGD for anti-corruption, giving the government feedback, or requiring the government to release more data. This is called “civic tech,” which includes data and democratic initiatives, small businesses, and non-profit organizations. More and more traditional NGOs are beginning to find the potential of OGD to support their work and goals. The French government developed an OGD portal in 2018 with advanced functionality enabling the interactions of data providers and data users (Radu, 2020). This advanced feature helps to review and improve OGD quality through the exchange between data providers and data users, and it promotes better dissemination of demand-driven OGD.

In the United States, OGD increases civic engagement by providing knowledge and understanding (Office of the Press Secretary (The White House), 2016a). More open governments are helping to find new ways through the use of information based on American knowledge and experience that can strengthen the country. Then, as smart and informed citizens, they can give their opinions, suggestions, and ideas to the government. At the same time, the government encourages and initiates methods of gathering their voices. Challenge.gov, for example, used the shared intelligence of the crowd, talent, and interests of more than 50,000 Americans in more than 300 competitions with prize money of $ 35 million to help solve the most pressing and challenging problems. Hackathons, data jams, and conferences are new types of citizen engagement with new kinds of gateways: civic hacking, such as program developers, program designers, data scientists, entrepreneurs, government workers, and anyone that wants to solve the problems. Cities across the United States are using this trend to collaborate with local volunteer developers to initiate exciting new citizen applications. For example, New York City initiated its big apps competition; Chicago launched its hack nights; and Datapoloozas was created to show a return on investment for developers and entrepreneurs to build apps and businesses. Hundreds of powerful citizens work together to create technology solutions to address local challenges using OGD. For example, the Civic's hacking challenge is focused on using visualizations to help tell the story of promise

zones, communities in high poverty that are targeted areas for driving economic growth. Additionally, the data science bowl partners with data scientists to broaden the value of OGD to make a real change (Data Science Bowl, n.d.). Further, at the state level, the city of Boston encourages young proposal developers in the participatory budgeting process using open data through the opportunity project. This process encourages young people to vote on how to spend Boston's $ 1 million budget. OGD gives participants access to data on community areas in order to assess neighborhood projects and to assess community need (Office of the Press Secretary (The White House), 2016b).

In South Korea, OGD have fostered communication and collaboration between citizens and governments, which make great efforts to provide personalized public services. The government has encouraged the private sector to take advantage of OGD. For example, open data master policy plan 2013-2017" is a key component of the Korean government's 3.0 policy. OGD increases accountability since people can better assess government performance. OGD increases citizen participation by encouraging citizens and businesses to leverage the data in improving society and the economy. The Korean government has been using various policy tools to support the disclosure and utilization of OGD. The act on promotion of the provision and use of public data of 2017 serves as "a legal mechanism that ensures citizens' right to use public data and facilitates private sector's use of public data." Article 3 of the act declares that "every public institution shall endeavor to enable anyone to readily use public data and shall take measures necessary to promote universal access to the use." Additionally, according to the Article 15 of the act, which supports cooperation with the private sector, "the head of a public institution may provide services to promote the provision and use of public data in cooperation with individuals, enterprises, organizations, etc." Public and private consultative bodies, whose members include companies that use publicly OGD for their businesses, will receive private recommendations from the private sector and comments as well as give feedback on the government OGD sharing policies. The Korean government will also continue to develop best practices in the use of OGD in private organizations, such as Naver (Naver Map), Daum (Daum Maps), SK Planet (public transport information security camera), and so on. The Korean government hopes that more and more companies

will utilize OGD for their businesses to support public services (Open Government Partnership, 2014). People and businesses enable OGD to analyze, understand, and deliberate in detail the government's OGD policy, which ensures efficiency in policy formulation and also helps save money in the government budgets. The use of OGD by a wide range of users can lead to the development of creative services through public and private partnerships (Republic of Korea, 2016).

In New Zealand, the government has developed a data strategy and roadmap (Stats New Zealand, 2019a). This roadmap has resulted from multiple rounds of consultations, key stakeholders participating in many workshops and interviews, such as central governments, local governments, businesses, community organizations, NGOs, and the public. Independent technical advice and expertise come from stakeholders. They rigorously test roadmap directions to ensure that the roadmap will be efficient, functional, and adaptable to different resources and applications. The New Zealand government engages with data users and suppliers, such as the business community and the government, in order to ensure a better quality of published data (Stats New Zealand, 2018b). Consulting data users allows for the proactive prioritization of OGD that should be published. Additionally, the government and civil society have worked together to prioritize the most pressing social issues and the need for more OGD to support the country’s development. This will promote the ability of data users to leverage OGD to solve economic and social problems as part of a long-term open information strategy (New Zealand government, 2018).

In Japan, recognizing a society in which all citizens participate is defined as a space to be strengthened and promoted through cooperation. The rules for handling data have been improved for the use and application of data (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). The Japanese government hosts an e-government open data executive meeting, a group of private-sector experts as a means of engaging users (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2013). The e-government open data executive conference requests opinions from experts in the private sector. Additionally, the government also actively promotes regional cooperation, such as Hackathons activities, which will facilitate the

exchange of knowledge and opinions with users and data developers on issues such as additional measures, organizing OGD formats, and supporting guidelines for OGD utilization. The release and utilization of OGD will promote the delivery of public services through public-private partnerships (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2012). This will enable them to quickly and efficiently provide diverse and innovative public service and be able to respond appropriately to various situations. A large variety of OGD is published on the Internet in a machine-readable form that allows unlimited processing and utilization to facilitate the use of OGD generated through public and private cooperation (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013).

In the Netherlands, the Dutch vision of OGD sharing between the public and business is a vital asset of the 21st century to present economic and social opportunities (Ministry of Economic Affairs and Climate Policy of Netherlands, 2019). The government puts its vision into practice in the following ways: “ministries bring the data sharing principles into practice in their policy field; ministries supports research, cooperation and knowledge exchange; and ministries propagates the Dutch data sharing principles in Europe. The government will be guided by three basic principles: “voluntary data sharing is preferable. Market parties are often best placed to identify and exploit opportunities for data sharing. If companies wish to share data the government may consider facilitating this by offering financial or organizational support; and people and businesses will retain control of their data”. The public administration act (Wet Openbaarheid van Bestuur) entitles a stakeholder to submit a requesting certain data (Open Government Partnership, 2019). Data must be shared responsibly, concerning the rights and interests of those concerned about privacy and confidentiality. Responsible sharing of data is essential to building confidence between individuals and businesses in their contribution to data sharing, which has helped the Netherlands make economic and social progress. This is why the government believe that those involved are extremely important in co-investigation, supervision, access to, and use of the data. At the provincial level, local governments and stakeholders, the private sector, civil society organizations, and individuals are joining forces to find ways in which OGD can help solve social problems.

In Norway, the Norway digitalization council is concerned with government stakeholders (at all levels), the private sector, and the third sector, which is useful in establishing a strong foundation for further leveraging collaboration in order to digitize the country (OECD, 2017). The goal for work towards 2025 is “all citizens, businesses and voluntary organizations that can do so, shall communicate digitally with the public sector” (Norwegian Ministry of Local Government and Modernization, 2019b). Before 2019, digital transformation in Norway lacked civil society involvement (Norwegian Ministry of Local Government and Modernization, 2019a). The ministry of local government and modernization therefore attaches greater importance to civil society inclusion, which was invited to participate in commenting on administrative process and commitments. The ministry has released information on the work of the collaboration online. Other ministries are encouraged to cooperate with relevant civil society organizations at higher levels. The co-creation and participation of users are tightly integrated into the Norwegian public administration. Cooperation between public administration and civil society often takes place as it is guaranteed by law. At the local level, local governments offer counseling services for citizens in need of free assistance and advice on accessing and utilizing OGD. However, not everyone is connected to the digital lifestyle. The government, therefore, accelerates the creation of digital capabilities, providing equal opportunities for people (Ministry of Local Government and Modernization of Norway, 2016c, 2016b).

Moreover, the private sector, NGOs, and citizens can request government agencies to disclose other government data which is not yet published on www.data.norge.no for their benefit. Likewise, government agencies must proactively prepare and disseminate the data (Norwegian Ministry of Local Government and Modernization, 2019b). The government has increased partnerships with the private sector to determine what needs to be achieved to create sustainable digital services (Norwegian Ministry of Local Government and Modernization, 2019a). Public-private digital cooperation was established in 2016 by Brønnøysund register center, the Norwegian tax administration, and finance Norway. The cooperation between public and private digital approaches is about improving the exchange of data required by parties. Building cooperation brings significant economic and social benefits. In this

matter, the public sector must avoid developing digital solutions that compete with the private sector but must take advantage of the private sector's innovative power to develop public digital solutions and services. This digital partnerships make it possible to better services for citizens and businesses by sharing data between different sectors.

Table 4.14 Citizen Engagement in OGD Development and Utilization, and How Government Supports the Citizen Engagement

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
United Kingdom	• The public as third parties. • Creating knowledge and insights from OGD. • Identifying what data should be prioritized to be released • Informing any mistake in public data provided by the government • Involving with the government to improve data quality • Giving feedback and keeping the government abreast of data usage	• Developing a clear engagement strategy for primary data users • Enhancing engagement model to ensure two-way conversation to maintain the relationship that can build the great benefit for the public good	• Non - government agencies • Individual developers • SMEs • Citizens • Academics • Business/Companies
Canada	• The public as co-chairs; the government as facilitator • Giving comments, ideas, and suggestions on Canada's national action plan • Assessing and reviewing the OGD approach • For the private sector, focusing on value-added services for consumer and business markets • Using the OGD to support public discussions in social issues – climate change, sustainable resources	• Renewing OGD approach on open government through working with the public to make the government more accessible and accountable • Developing collaborative governance as a key theme for the future • Consulting with the public through various ways – in-person roundtables, online public consultation sessions, social media outreach, and expert panels and reviews – to get their comments, ideas, and suggestions	• Citizens • Business • Experts • Private-sector organizations • NGOs • Universities and colleges • Data/service consumers

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
		• Developing self – assessment reports • Providing online progress of open government that includes open data improvement	
France	• Enabling themselves to hold their government agencies more accountable • Demanding and advocating for OGD to guide participation in dealing with corruption • Meaningfully participating in the decision-making process in the government • Informing the demand for OGD • Enhancing data quality through working with their government	• Encouraging the use of OGD • Committing to promote the use of online collaboration • Improving mechanisms, procedures, and reports regularly of open data • Establishing close working relationships with anti-corruption organizations through using OGD	• Citizens • Civil society organization • Anti-corruption organizations • Civic tech, such as data- and democracy-related initiatives, start-ups, and non-profit organizations
United States	• Giving opinions, suggestions, and ideas to the government about the OGD approach • Citizens as specialists initiate interesting citizen application for leveraging OGD (i.e. volunteer developers) • Citizens and professionals help create technology and research solutions to local challenges by using OGD to amplify the	• Supporting and initiating the methods to collect the citizens' voice, such as competition events, conferences, and so on • Supporting a fund and giving an award to competition events • Collaborating with specialists to facilitate new and interesting	• Citizens • Civic tech community • Civic hackers (volunteer developers); developers, designers, data

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
	impact of data for change, such as using visualizations to tell communities at a high poverty, change how to diagnosis, and increases economic opportunities • Better having public participation	participative applications to use OGD, such as in Hackathons or civic hackers' project, Data Science Bowl. • Committing to deepen community engagement through creating projects, such as opportunity project, neighborland project, code for America	scientists, communicators, civic organizers, entrepreneurs, government employees
South Korea	• Better communication between the public and the government • Meaningfully participating in the policy-making process • Using OGD to better access the performance of government • Utilizing OGD to create economic and social values • Giving feedback and reflecting their views on data sharing to the government • Better understanding and deliberating on their government policies	• Promoting and supporting collaboration between the government and businesses in the use of publicly available OGD to foster economic and social benefits • Implementing a range of policy tools to facilitate the release and utilization of OGD, such as establishing relevant laws to ensure the right to use OGD of citizens and private sectors • Taking necessary measures and activities to promote universal access to OGD • Working to develop best practices in the use of OGD	• Citizens • Businesses
New Zealand	• Participating in multiple rounds of consultation to develop the OGD strategy	• Providing multiple rounds of consultation with the public such as	• Citizens • Businesses

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
	and roadmap in a series of workshops and interviews • Providing independent technical guidance and expertise for OGD use • Giving the government what data should be prioritized • Making a better-informed decision about their lives by using GD	interviews, workshops • Upgrading OGD roadmaps as needed to promote and enable more efficient use of data, reduce costs, and foster innovation • Engaging with OGD users and OGD providers to ensure better quality data is released • Consulting OGD users and prioritizing what data citizens and OGD users want	• Community organizations and NGOs
Japan	• Attending regional OGD events to exchange opinions as a user with developers such as Hackathons • Using the OGD to create and provide innovative public services together with the public sector • Voluntarily and actively developing the use of OGD in connection with their business activities • Collaborating on measures formulation to improve the sharing and using of OGD among all partners of all sectors • Proposing necessary OGD measures that can be easily applied by all sectors for the	• Providing data events to encourage the exchange of knowledge and ideas with users and developers • Holding executive meetings of experts from private sectors • Offering the collaboration between public and private sectors to use the OGD to initiate public services • Examining the connections between different types of OGD to create and share value between governments and the private sector, at large and small scale • Supporting the OGD utilization to	• Citizens • Business enterprises

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
	public interest	create private services • Responding to needs and issues of OGD development and utilization • Developing the foundations and rules for the use and application of OGD • Reviewing of data circulation systems and the development of related laws • Carrying out and adding relevant measures such as reviewing rules, organizing data formats to expand the dissemination of OGD to the public • Developing the required environment to support OGD utilization by the public • Promoting R&D and inventing human resources • Maintaining compatibility the data system	
The Netherlands	• Retaining control of the public data • Requesting more OGD • Exploring ways in which OGD can help to address and resolve social issues • Identifying and exploiting opportunities for data sharing	• Doing research, cooperation, and knowledge exchange • Communicating the Dutch data sharing principles in Europe • Facilitating financial or organizational support if there is a company wish to	• Citizens • Private sector • Civil society organizations

Country	Roles of Citizens on OGD	Government supports for citizens engagement on OGD	Examples of the public as primary data users
		share their data • Being responsible for data sharing to enhance participation from individuals and business • Protecting citizens' privacy by regulating relevant laws	
Norway	• The public as co-creation • Participating in reviewing the OGD proposal made by the government • Giving their comments on the OGD proposal proposed by the government • Requesting more data to be published and available to the public	• Creating and developing the data portal • Encouraging and cooperating with the civil society organizations • Enhancing digital cooperation with the private sector • Providing digital competence to citizens • Proactively providing the requested data from public and private enterprises to be available and accessible	• Citizens, • Businesses • Voluntary organizations

4.1.5 The Taxonomy of the Impacts of OGD

4.1.5.1 The Taxonomy of Economic Impacts

OGD have made countries' economic development thrive in different ways. OGD are essential to building a base of evidence to support incremental improvements, enabling governments and businesses to deliver customized, coordinated, or timely products and services. The possible value of OGD is enormous. The relationship between OGD providers and the private sector can unleash its true value and provide opportunities from using OGD. By analyzing those OGD project cases, opening up the data has had eight economic impacts: (i) economic growth, (ii) innovation, (iii) business model development, (iv) operation improvement, (v) smarter decision-making, (vi) better marketing, (vii) boosting public-private partnership, and (viii) supporting corporate transparency.

1) Economic Growth

Data create economic growth through increasing economic value, investment, new jobs, and new opportunities. Many industries and businesses have identified the practical business opportunities that result from the use of data analysis. Multiple drivers influence the economic value of OGD: operational optimization, better decision-making, managing and mitigating risks, developing new business models, new businesses created through apps and websites, and more efficient interactions between public and private sectors. All of these lead to increased productivity and innovation. Many countries have estimated the increasing economic value driven by using open data as follows.

For example, the project of the city as a platform of London aimed to organize city data for making an impact, created approximately 60,000 jobs during the year 2012, developed more than 40,000 business in digital platforms, and created opportunities for over 200,000 jobs in London's technology sector as estimated by the center for economic and business research (Suzuki & Finkelstein, 2019). Further, the ordnance survey open data (or so-called OS open data) directly delivered about £ 13 million-£28.5 million increase in GDP in 2016. Real consumption and real investment increased as a result of OS open data." Since then, the GDP increase was a net of £3.7 million per year as estimated by using the Computable General Equilibrium model. Another interesting project is the HM land

registry. Its impacts have been estimated in economic value at $ 1.4 billion for prop tech start-up investment in 2014 (Young & Verhulst, 2016).

Additionally, the FinCom or DataPublica project implemented in France was estimated at around 0.5% of the GDP (Iniciativa Aporta, 2017). Also, Additionally, launching weather data in the U.S. was able to increase economic impact by approximately $ 485 billion (3.4% of the gross domestic product) in 2008 (National Center for Atmospheric Research (University Corporation for Atmospheric Research, 2011). The project of NOAA, aimed to release global weather data, has greatly reduced the economic and human costs of climate-related damage. It increased billions of dollars in the climate industry based on seasonal records. It has fuelled the growth of million dollar tools and applications from NOAA's real-time data (National Oceanic and Atmospheric Administration (U.S. Department of Commerce, 2011). Moreover, GPS data, which are the base of the industry in the United States, are expected to generate revenue of $ 90 billion per year (Gurin, 2014).

In South Korea, Kimgisa, using OGD such as traffic data, addresses, and traffic signs to navigate smartphones for drivers in Korea, has earned more than $ 56 million (or 62.6 billion KRW) (Republic of Korea, 2016). Further, GoodDoc, an app for finding hospital information, has helped increase the employment rate by 20 times. In Australia, the value of OGD is hugely valuable to the Australian economy. According to an open data 500 Australia study, $ 67 billion of data driven innovations was added to the economy, or 4.4 percent of the GDP (Department of Communications of Australian government, 2015). The 2014 report assessed by Lateral economics pointed out that the Australian government's open data value is $ 25 billion annually, both combined directly and indirectly. In the same year, the economic report for the year 2014 indicated that the OGD policy added approximately AU$16 billion annually to the Australian economy (Department of Communications of Australian government, 2016).

In New Zealand, the ANZ Bank project combined OGD from customs, data on alcohol sales and consumption, and business demographics to generate an insightful report of the craft beer industry (New Zealand government, 2017b). The project added value to the food and beverage industry with the potential to export 80%, worth $ 1.6 billion as a major New Zealand export. The MarineMate

app is an assessment app to reduce accidents and costs from boating activities that occurred in the water with approximately 16,000 accidents per year at an estimated cost of $ 33 million per year. The app helped state authorities save by reducing the number of regulatory and paper copies from about $ 27,000 to $ 5,500 (New Zealand government, 2014b). In the Netherlands, the quantitative studies conducted by TU Delft show a ratio between costs and benefits of OGD from 1: 1.6 to 1:70. This means that the benefits of opening up government data are more than 1.5 to 70 times greater than the costs (Dutch government, n.d.-c).

2) Innovation (Business Activities, New Services)

OGD drives innovation by creating new business models and promoting more strategic investments. Governments in many countries are encouraging people and businesses to use their information to create and develop innovative applications. Open access to OGD creates new services, more business, and social activities. Large corporations, small businesses, and start-ups can also develop innovations.

A striking example is in the United Kingdom, where the government encourages the public and businesses to use OGD for both commercial and non-commercial purposes. The use of OGD has a positive economic impact on products and services. The government has made great strides in releasing OGD for stakeholder innovation through dataset prioritization processes, funding support for data driven start-ups, and hosting events or activities to promote the use of OGD (Transparency and Accountability Initiative, 2015). Since OS open data was released in the UK, it has been downloaded over a million times. Many projects have been developed using OS open data. For example, carbon profits compiled soil test results used in conjunction with OS open data in mapping an operating system to enable farmers to monitor soil carbon levels. This helps to improve operations in agriculture. OS Minecraft, a map game created using more than 22 billion block maps through OS open data, accounted for 224,000 square kilometers of the UK in 2013 (Rogawski et al., 2016). The game received over 100,000 downloads within a few months of its release. With this success, OS open data promotes learning tools by reaching the community through its most popular video games. With this astounding success, it has

created enthusiasm for open data mapping for government agencies. It has also aroused interest in the use of OGD for products and services. For continuous improvement, OS open data collects user analytics, such as the number of downloads, downloaded datasets, and user characteristics, for example (Verhulst & Young, 2016b; Young & Verhulst, 2016). Another example in the UK is transport for London (TfL) (Davies et al., 2019). TfL knew that customers wanted access to more data about transport services through smartphone platforms, so it developed smartphone services with a payment component, keeping users' payment details secure.

Similar to the Canadian government, the Open.canada.ca portal launched developer's corner through supporting a wide range of developer information and documentation, as well as a beginner's guide for using OGD, introductory guides, and a detailed guide to using the application programming interface (API) in both multiple programming languages and visual descriptions (Castro & Korte, 2015). Further, a large amount of OGD about air traffic, public health data, household statistics, and crime has been collected by both governments and municipalities, such as Vancouver, Edmonton, and Toronto. OGD have fueled innovation and economic growth by enabling Canadians to create exciting new services and applications from using OGD (Government of Canada, n.d.).

In the United States, since 2009, innovation has been one of the main goals of the U.S. open government action plan, taking into account the commitment to disseminating OGD for innovation (Office of the Press Secretary (The White House), 2016b). The United States has made a strong commitment to proactively publish high-valued datasets for innovation (Chan, 2014). In releasing and using OGD for innovation, many federal agencies have prioritized the dissemination of OGD to meet the needs of the private sector (The U.S. Department of Health and Human Services, n.d.; The U.S. General Services Administration, 2012), such as (i) the department of health and human services, (ii) the department of energy, (iii) the department of transportation, (iv) the department of commerce, (v) the department of agriculture, and (vi) the food and drug administration. The U.S. agency also holds meetings and roundtable discussions between the public and private sectors (The U.S. General Services Administration et al., n.d.-b). For example, an open patent database is published in the PatentsView program provided by the patent and trademark office

of the United States of America (USPTO), which enhances the discovery and accessibility of innovative information, and the ability to use public patent and trademark information. Through the data, data users can answer forecasts about technology trends and innovations. The USPTO also helps innovators by providing data and giving them a more in-depth view of the competition in business. Further, the opening of Energy data released by the ministry of energy encourages investment and innovation creation in the areas of energy, environment, and climate sectors. Energy data lead to the clean energy economy, providing the foundation for new ideas to improve energy and modernize the global energy solution and bring new solutions to the energy market.

In South Korea, Kimgisa is a very famous innovative smartphone navigation app for drivers in Korea. It uses OGD such as traffic data, addresses, and traffic signs as a navigation database for analysis. Likewise, GoodDoc is an application that provides information about hospitals and medical facilities. In addition, it also offers a health insurance audits and assessment services (Republic of Korea, 2016).

In New Zealand, inspirational stories about innovation and challenging data driven projects are showcased at data.govt.nz (Stats New Zealand, 2018a). Innovation based on data utilization allows interested parties to easily discover case studies and demonstrate how OGD can lead to innovation, including new tools, services, and knowledge (Stats New Zealand, 2018b). For example, data from ANZ bank craft beer (New Zealand government, 2017b) report the results and trends of investment in the craft beer industry and show brewers how unique each brand is. Potential investors can use these insights to take a detailed look at the craft beer market in New Zealand, growth trends, and revenue growth. The database also provides a discussion of trends and recommendations for craft beer options, where producers and consumers can see where potential breweries are located in New Zealand. The greatest benefit of these data are to add more funding to the craft beer industry.

Another example in New Zealand is HERE Maps, an autonomous vehicle or driverless car application, using data from thousands of sources, including New Zealand land data and local government agencies, such as

roads, traffic, and geographic characteristics (New Zealand government, 2017c). It generates high-resolution live maps with cloud-based vehicle sensor processing and unmanned vehicle user experience. Four out of five car navigation systems use high-quality data from HERE to power highly contextual and accurate navigation solutions that are optimized for vehicles to make them more automated and efficient. The transport ministry has stated that vehicles of high potential could make a huge contribution to New Zealand's goal of having safer vehicles on roads. Additionally, Nest finder has developed maps and accommodation data for New Zealand travelers both through and without an Internet connection. It uses OGD from the department of conservation and land information New Zealand to help tourists travel comfortably (New Zealand government, 2015c).

The MarineMate app was developed by using open data from multiple sources, such as tide schedules, boat ramps, mooring zones, maritime safety updates, and regulations (New Zealand government, 2014b). With this app, boat users will be aware that they can cross to another region that may create compliance issues. It is a more efficient way to reduce printing costs and access to marine regulations, which provides water safety to boat users. By developing this app, it has helped reduce accidents and expenses for water activities. ANZ truckometer uses state highway traffic data as an indicator of the momentum of New Zealand’s economy. The monthly economic report of the project is based on OGD on both light and heavy traffic indexes analyzed with gross domestic product growth. ANZ found that heavy traffic showed a strong correlation with GDP; that is, when heavy traffic increased over three months, GDP also increased during those three months. It can also determine which areas are growing from the traffic density index (New Zealand government, 2012a).

Japan has promoted the adoption of third-party technologies and knowledge from various fields and industries without adhering to internal technologies to fuel interdisciplinary open innovation. This effort has created new businesses and new services that enable Japanese companies to compete globally (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). Like the Netherlands, the government has used OGD to create the enormous social and economic opportunities it provides. This endeavor has

enabled private companies that leverage OGD to set standards of service excellence to consumers with a focus on speed, simplicity, privacy, and availability at all times (Ministry of the Interior and Kingdom Relations of Netherlands, 2019).

3) Business Model Development (Start-ups, New Market, New Business Models)

The ten countries under study here consider OGD for enhancing and generating business development in the form of new markets, new business models, or start-ups. Start-ups and small businesses are agile and are able to "spin" and try new products that use OGD. This gives them more scope to pursue innovations. Large businesses can also use OGD externally in their products to provide new insights into business issues and to save money on data purchases. Small businesses and start-ups in order to become corporations in the network with big-company products, can also be used to analyze the specific market or new market. This is tied to the growth benefit with reduced resource use.

In the United Kingdom, OS open data supports the growing routes program by helping businesses map and identifying opportunities on the Welsh Coast Path through presenting new jobs, products and services, and new opportunities to residents. Further, HM land registry supports proptech and develops digital tools that use HM Land Registry data. Transport for London (TfL) also stimulates new markets in the form of application development based on transport data. It has greatly helped the market for developing apps using transport data. TfL is open and predicts how the market will reuse shipping data (Davies et al., 2019; Hogge, 2016b). The city as platform in London program provides a wide range of cross-domain data services that enable users to take advantage of new business models impacting the city (Suzuki & Finkelstein, 2019); and in France, FinCom or DataPublica (Iniciativa Aporta, 2017) program has long promoted a culture of innovation through the promotion of the Startup State Program. Those data simplify access to public procurement and allow new entrepreneurs to obtain public aid or access to financial data. The French government has distributed 7 million euros across 42 projects, with half of the new businesses based on OGD in 2015.

In the United States, the opportunity project encourages the creation of data driven digital tools to help communities navigate data about the resources everyone needs, such as quality schools, jobs, housing, and transportation (Office of the Press Secretary (The White House), 2016b). The New York city business Atlas, developed by the office of data analytics, helps to connect market research data between small and large businesses in New York. Small businesses have access to high-quality data on the economic environment to help them decide whether to build a new business or expand an existing one (Young & Verhulst, 2016).

In South Korea, there are examples of where OGD adoption has allowed the private sector to use the data, expand new businesses, and create new jobs. In June 2020, there is a total of 2,403 cases driven by suing open data - Education (137) Homeland Management (181) Public Administration (225) Financial Finance (78) Industrial Employment (137) Social Welfare (69) Food Health (65) Culture & Tourism (596) Health Care (206) Disaster Safety (71) Transportation Logistics (341) Environmental Weather (323) Science and Technology (84) Concentrated Fisheries (130) Unification Diplomacy (16) Law (29) (Korea Intelligent Information Society Promotion Agency, n.d.). Over 17,000 useful data in South Korea, the private sector, and corporations are profiting from these public data, and people's lives have become more convenient. For example, Modu parking uses parking lot data to provide information on nearby parking lots and parking fees. Naver map uses real-estate information on 38 million lots of land to provide the fastest route to the destination searched. Good doc uses hospital and disease information to provide appropriate hospital search services for different situations. K-Weather uses neighborhood weather forecast service and weather information to provide weather broadcasts and customized weather information service. Red table uses national tourist data and business data to provide recommendations on local cuisine to foreign tourists.

In New Zealand, the OGD of ANZ bank craft beer is useful to potential investors through in-depth reporting on the craft beer market, business growth figures, and revenue growth (New Zealand government, 2017b). The greatest benefit of these data is to add more funding available to the industry. In addition, OGD in Japan supports the initiation of new businesses and services activities. The

activities can add economic value for the country (Basic Act on the Advancement of Public and Private Sector Data Utilization, 2016; National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013).

In the Netherlands, the Dutch government has the vision to share OGD between businesses as it is the natural resource of the 21st century to provide economic and social opportunities leading to the development of new business models and innovative services (Dutch government, n.d.-c; Ministry of Economic Affairs and Climate Policy of Netherlands, 2019). For example, a potato farmer can increase yields by checking information about his or her soil and crops. If a potato farmer can get information from other farmers, he or she can use that information to improve the work processes. On farmer's experience indicated the following: "on our farm, we use precision agriculture; for example, we use sensors and drones to gather information about the crops. This allows us to determine exactly how much water and fertilizer the potato plants need. As a result, we use 30% less water per ton of potatoes and 20% less fertilizer. We also share our data with TU Eindhoven: they use this data in their research and that enables our sector to continue to innovate. The government makes a lot of open data available. If I want to lease a plot of land, I can use Boer&Bunder, for example. This is where I can find out exactly what type of soil it is and which crops have been grown there before: this is very important information for a farmer" (Ministry of the Interior and Kingdom Relations of Netherlands, 2019). Further, if doctors can use patient data from multiple medical institutions, a better diagnosis can be made. Patients have to fill in fewer data.

4) Operation Improvement

The use of OGD helps to compare key performance indicators and to use them to drive internal change. Small businesses often have limited resources. Therefore, accessing OGD, as a free source, is particularly helpful because no subscription is required for expensive data. Potential new product developments and cost reductions in innovation are realized through OGD, giving greater scope to trial new ideas, products, and services. OGD can be used internally to transform operations within a business

In the United Kingdom, OS open data is used by CH2M HILL engineers to create an automated tool to analyze cost-effectiveness in order to extract

multiple bus networks from all areas of Great Britain (Verhulst & Young, 2016a). This helps to reduce the time required for analyzing the entire county bus network by 90 percent. Additionally, OS open data in the United Kingdom is used by healthcare providers to better identify patient locations, enable more accurate analysis, and make decisions to save and improve service efficiency.

In the United States, the NOAA project opens up climate data, which significantly reduces the economic and human costs of climate damage through forecasting (Young & Verhulst, 2016). Moreover, GPS data have made widespread commercial applications across different industries and sectors to increase new efficiencies and to reduce operating costs (Young et al., 2016). The use of GPS technology improves safety, response time, and quality, as well as offers many more quantitative benefits.

In Australia, OGD can drive operations to dramatically improve cost efficiency and market agility (Productivity Commission of Australian Government, 2017). The growing use of sensor data will give businesses a clearer view of the inside of their organization through tracking from one end of the supply chain to the other. Data save time and money with better machine maintenance and smarter planning. Increased access to OGD can facilitate the development of products and services. Better access and use of OGD benefits businesses and governments through operational and productivity improvements. OGD regarding the quality or efficiency of inputs can be used to improve the manufacturing process. OGD on consumer preferences enable the development of specific products that are more relevant to what consumers want. It helps logistics businesses increase efficiency and capacity planning, and reduce total costs on real-time routes.

5) Smarter Decision-Making.

The open energy information (OpenEI) program in the United States delivers the most up-to-date data necessary for making informed decisions on energy, investing in markets, and developing smart technology. In addition, OpenEI creates new businesses and creates innovative and inspiring new analytical tools (Office of the Press Secretary (The White House), 2016a). In addition, the city energy profile tool project allows users to download energy-related data, such as electricity consumption data, natural gas data, fuel consumption estimates, electricity sector data,

utility rates, renewable energy potential, and transportation data on more than 23,450 US cities (North Central Texas Council of Governments, n.d.). In addition, the project helps decision-makers better understand the power of their city and gives them more strategic decision-making power.

In Australia, OGD can be used to launch commercial and non-commercial purposes through research processes, data driven decision-making, and complex problem-solving. Citizens, corporations, researchers, both public and private, can use OGD to help them analyze, research design, forecast, and make decisions to create or develop products and services (Department of Communications of Australian government, 2015). Personal finance decisions and corporate decisions to find the right product and "get a better deal" can be enhanced with OGD (Productivity Commission of Australian Government, 2017).

In New Zealand, ANZ bank craft beer helps investors make the right decisions as craft brewers can find industry trends, labor productivity data, successful export data, delivery properties, exporting data, selling options, and discussion about selling price trends. Craft beer consumers can also find the best stores and what to check when buying, even talking about quality and freshness (New Zealand government, 2017b). The Homes.co.nz program empowers "Kiwi" residents to make informed decisions about real estate by delivering real estate market performance, and fair value for real estate (New Zealand government, 2013b). The project aims to provide these residents with an easy and free way to find real estate data to make real estate decisions based on accurate and accurate data. The key to making informed real estate decisions is to understand the market correctly. OGD through this project can help make this happen. The project creates a more efficient real estate market and increases the visibility of the buyer to determine the true market value. It also ensures the relationship between oneself and the government where information and the flow of information are easy and secure. MRCagney combines OGD and a mapping interface to enable people to find the suburban area for their residence that best fits their conditions. Just like ANZ truckometer, it helps investors plan their investment decisions when they know the momentum of economic growth. Understanding what areas in which the economy is headed for over the next six months can help businesses plan ahead of time regarding which areas to invest in in

retail or how much more staffing should be planned for new open spaces. People can better understand when to spend with confidence and when to save (New Zealand government, 2012a).

6) Data Driven Marketing

In the United Kingdom, T4 media, an advertising company, uses OS open data to automatically identify suitable outdoor spaces, which allows employees to analyze points from their desks to install advertisements (Rogawski et al., 2016). Additionally, citrus analytics, a customer analytics and marketing company, uses OS open data to improve data by presenting customers on a map, which serves as the basis for an accurate and effective qualitative research group that has the right customer segments with the product or service. In Australia, businesses can use the OGD to identify new customers or improve their satisfaction and spending (PricewaterhouseCoopers Australia (PwC), 2014). They can identify groups of consumers that are common and provide useful product recommendations to future customers. This shows how data can drive marketing.

7) Boosting Public-Private Partnerships

Many governments have improved their collaborative efforts with the private sector as stakeholders to continually develop OGD to add high value and improve the use of OGD for innovation. Working together helps to increase the understanding of how OGD can be maximized and can ensure that the dissemination of OGD can generate maximum value for the end user. For example, the Cabinet Office of the United Kingdom has established a recommendation mechanism for stakeholders in the private sector through the open data user group (ODUG) (Transparency and Accountability Initiative, 2015). ODUG is an independent group of consultants representing data users that provides advice on funding for OGD initiatives and undertakes to identify and prioritize datasets for release (Rogawski et al., 2016). The department for business, energy and industrial strategy of the United Kingdom seeks to encourage open data innovation through grants to create direct engagement with the developer community. Start-ups can receive support funds up to £ 5,000 for mentoring and OGD services (Knight Foundation, 2013).). Moreover, collaboration on behalf of the open data challenge series, managed by the open data institute and an innovation charity, Nesta, has led to a competitive event to promote

OGD innovation in the private sector and awards £ 400,000 annually (Castro & Korte, 2015). A £ 2 million fund was created for the Innovation Voucher program in 2015. The voucher offered £ 5,000 for small or medium UK startups to work with outside experts and to gain new knowledge to help their businesses (Department for Business et al., 2012). Further, the contracts finder project supports businesses to search for public sector contract information with more than £ 10,000 (Government of the United Kingdom, n.d.-a).

The United States pledges to distribute "high value" open datasets to remain effective and innovative for the American public (Chan, 2014; Office of the Press Secretary (The White House), 2016a). Government agencies have prioritized the release of open information to meet the needs of the private sector (Goddin, 2013; U.S. Department of Health and Human Services, n.d.; U.S. General Services Administration, 2012). Organized meetings and roundtable discussions between the public and private sectors to disseminate and use OGD for innovation are committed to by many federal agencies (The U.S. General Services Administration et al., n.d.-b). For example, the opportunity project is a collaboration between federal agencies and local communities to create tools to help address local challenges, such as linking unemployed and unskilled Americans to poor families, helping them to find affordable homes near transportation (Office of the Press Secretary (The White House), 2016b).

In Australia, the Sense-T program outlines the potential benefits of a partnership between the private, public, and research sectors (Productivity Commission of Australian Government, 2017). The project is predetermined to generate data collected by sensors for researchers and industry to use. In addition to integrating existing sensor networks, the project uses new cutting-edge sensors with historical and spatial data. This innovation provides data on such matters as weather, real-time forecasts, growing conditions, and high-risk event warnings. The project has benefited many industries, such as commercial salmon fishing, which assesses fish behavior and the environment to improve feeding practices (resulting in lower feed costs), better decisions, and a better understanding of the effects of fish farming on environmental variables.

8) Supporting Corporate Transparency

Participation in opening the OGD of private entities (people or business units) needs to be transparent. The private sector tends to share its information to facilitate greater connectivity with the public sector. In particular, large organizations are required to distribute their information for regulatory and corporate social responsibility reasons. Disclosure of such information provides transparency in business activities.

The HM land registry is a United Kingdom-based trade fund that has launched commitments to its members, such as corporate entities, or holders of land and property, to disclose their information for transparency (Government of the United Kingdom, n.d.-c). This project identifies who the true owners of the organization are, and who the real holders of the land and assets are. The fund eliminates anonymous organizations that may work to hide financial corruption. The HM Land Registry protects £ 7 trillion of land and property holdings. It brings in over £ 1million in personal and commercial loans across England and Wales. The project currently contains more than 25 million land titles, showing proof of ownership of more than 87% of England’s and Wales' land. This is one case of open data engagement that fosters transparency and prevents corruption as governance reforms rather than OGD.

Australia is also encouraging companies to increase transparency so that consumers can decide which companies to buy from (Productivity Commission of Australian Government, 2017). For example, Nike publishes a large amount of information, such as corporate responsibility reports, a complete list of contracts with suppliers, and working condition data, including wages and working hours in factories, suppliers, etc. Several other companies have similarly tried to increase transparency, despite the absence of a legal obligation.

4.1.5.2 The Taxonomy of Social Impacts (Public Services)

Improvements in public services resulting from OGD utilization are evident in six aspects: (i) citizen-centric service (user-driven services); (ii) innovation (apps development, innovative, and creative service delivery); (iii) real-time or up-to-date service; (iv) better and smarter public services; (v) boosting public-private partnerships; and (vi) sustainability.

1) Citizen-Centric and - Driven Services

Using data and technology drives and supports citizen-centric and citizen-driven services that make public service seamless and integrated with elements that simplify everyday life. OGD have made it easier and more direct to interact among citizens, businesses, and governments. Citizens and businesses expect public services to be designed and delivered simply and intuitively, based on a user-driven perspective, and with leveraging previous data and results.

For example, Norway has its core mindset in “digital strategy” to develop from citizen-focused to citizen-driven services (Ministry of Local Government and Modernization of Norway, 2016b; OECD, 2017). The Norwegian state educational loan fund project uses data and machine learning to recruit students to award scholarships. Students applying for the scholarship are required to verify their current residence and the program will verify their parents' addresses. Students to be selected need to live away from their parents. This shows that data and machine learning make it easier to identify students that are away from home, and it means that the Norwegian state student loan fund can verify those that are living away from home and are eligible for a loan or an educational grant.

In Canada, the government has committed to creating a user-friendly open government to become a more digital government (Treasury Board of Canada Secretariat, 2018). The government seeks to improve open.canada.ca to make it more user-friendly and to take advantage of digital tools such as webinars to get in touch with Canadians and to tell the public more about the work that the government is doing. The opening of government data makes it easier for everyone to access and understand it, and to more easily connect between the government and citizens. Canada's commitment to "digital governments and services" is a user-driven digital service. Canadians are at the center of the development of OGD and digital

governments. The government releases service performance data dashboards for all departments. Therefore, a user-driven service is meant to provide users with the necessary data to understand what standards they want or what kind of standards they will gain. Direct citizen opinions are a key mechanism for improving services (Digital Transformation Agency of Australia, 2016).

Likewise, the guardian good GCSE guide project in the United Kingdom, operated through the open public services network and the guardian, has created data to guide and help parents find and research local schools in England (Cabinet Office of the United Kingdom, 2013). Parents that wish to select a secondary school can use the data of the project to search the school that best suits their child's readiness and educational needs. In the United States, the college scorecard is a program that offers and releases OGD on college performance, education costs, and grants to students and families to help them compare costs and outcomes of colleges (Office of the Press Secretary (The White House), 2016a, 2016b). The OGD from the program helps U.S. citizens identify which colleges provide quality and an affordable education for students of all backgrounds. The program is designed to collect insights, to disseminate the data, and increase transparency about the performance of federally and locally funded colleges compared to the academic results of students from that institution. Millions of parents also use the MyStudentData data to view their child's class notes, school information, grades, assignments, test results, attendance, school discipline, and data on grades. This represents a citizen-centered service in America.

In New Zealand, the Dumpark project is driven by data based on the survey of household labor in New Zealand (New Zealand government, 2012b). The project will turn the data into visual narratives to share and help officials and citizens understand more easily the complex data. The Human Rights Committee uses the data from the project to monitor equality in work and to provide evidence for fairness in the work place. Rather than a manual and time-consuming process, they collaborated with Dumpark to access the data and open other relevant data. Similarly, the tracking equality at work project, a web-based interactive tool that measures workplace equality, includes data on employment, pays, leadership and discrimination to be able to compare fairness and equality of work outcomes (Human Rights Commission of New Zealand, n.d.). This web-based tool allows tracking inequality

over time and whether it has evolved into equality. The tool can also be used to categorize the demographic characteristics that make it possible to track the results of a particular group.

Japan has faced many important social problems, including an aging population and large-scale natural disasters. Since then, Japan has known that the use of OGD can create an environment in which the needs of citizens are carefully addressed at all levels (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2017). Restoring local communities (including remote islands) with the utilization of IT and OGD can address social problems and address the needs of children and the elderly according to local characteristics. Using relevant OGD on local resources, local industries, and local agriculture can help local development take place appropriately. Measures to build a community based on OGD increase efficiency and improve public services. The integration of advanced technologies such as sensors, cloud computing, and telecommunication infrastructure is deployed in times of disaster with the use of geospatial and other data (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013).

2) Innovation (Apps Development, and Innovative and Creative Service Delivery)

OGD can help achieve many social benefit goals. OGD makes it possible to develop new public services or products operated by both public and private sectors. Developing OGD-based public services can create and increase social value. In Norway, farm maps (https://gardskart.nibio.no) openly publishes statistical data on land and land resources for agricultural properties for all (Ministry of Local Government and Modernization of Norway, 2014). The farm map supports farmers' work related to operational planning, implementation, and the enhancement of agricultural management. According to this project, data users, i.e. public agencies, business units, and citizens, can initiate innovative development. The Norwegian tax administration and the a-ordning scheme project simplifies and coordinates reporting from employers across the country. The data from this project are likely to be used in the public and private sector to improve innovative public services (Norwegian Ministry of Local Government and Modernization, 2019b). The eBevis

(eDocumentation) service simplifies the procurement process by allowing the tenderer to not need to submit documents that the government already has, such as tax certificates and basic company information (Norwegian Ministry of Local Government and Modernization, 2019b).

In Australia, the national map is a website for accessing Australia's map-based data and that is designed to provide reliable and other geospatial information easily accessible to governments, businesses, and the public (Australian government, 2019a). The use of OGD has provided an open framework for geospatial services that support innovation. This project provides a valuable set of insights to build new applications and a new business entity model (Department of the Prime Minister and Cabinet of Australia, 2013). Another example is energy rating tools, providing energy data for more than seven million households in Australia and New Zealand every year (Australian government, 2019a). The department of industry has used these data to create a mobile app to bring energy-efficient appliances options to households.

In New Zealand, GeoNet offers a real-time geological hazard monitoring system that includes a collaborative network of geophysical instruments, applications, automation software, and professionals in the detection of and response to earthquakes, volcanoes, landslides, and tsunamis (New Zealand government, 2013c, 2013a). This project discloses the data that have taken place. The data from this program provide new products, services, and business knowledge. One of the innovations developed from the GeoNet's data is Coffey Geotechnics, which is a geotechnical consulting project for infrastructures, such as roads, tunnels, railways, bridges, marinas, dams, and so on (New Zealand government, 2013c). Moreover, local governments and the ministry of civil defense and emergency management also make use of the above data to provide advice, hazard investigation, and emergency and risk management. Universities and research organizations use the above data for geophysical research and teaching.

3) Real-Time or Up-to-Date Services

In the United Kingdom, a firm, i.e. archeology Rubicon Heritage Services, uses OS open data (Rogawski et al., 2016) to map for surveys and checks in real-time concerning whether archaeological and cultural heritage data are

collected accurately, regularly, and publicly. Further, local fire departments, e.g. West Midlands Fire Service, are using OS open data to develop integrated open source solutions to capture data and maps that reduce costs and optimize rescue decisions consistent with emergency events. In the United States, the U.S. energy information administration through an application programming interface provides hourly electricity usage data (The U.S. Energy Information Administration, 2020). The program provides real-time demand data, information on national and regional electricity supply for all power systems, and analysis and visualization of hourly, daily, and weekly electricity usage. The energy information administration's OGD, which is available in machine-readable formats, continues to facilitate national and regional data analysis and policy decisions. The private, non-profit, and government sectors can leverage the OGD to innovate and create value-added services (The U.S. Energy Information Administration, n.d., 2020).

In South Korea, Kimgisa is a smartphone navigation app for drivers that use public data such as traffic information, addresses, and traffic signs. It helps drivers to plan their trips more efficiently (Republic of Korea, 2016). GoodDoc is a location-based service for searching for hospital data through using hospital and pharmacy information services to provide health insurance assessment services. The project has expanded the scope of the health business, contributing to more than a 20-times increase in employment. In Australia, data support better monitoring and resource utilization at present. The project Tasmania's Sense-T (Productivity Commission of Australian Government, 2017) is a smartphone real-time data app about the weather. It predicts air quality by analyzing data from various sources, such as air pollution, meteorological data, and allergen data, and weather-related health data. The OGD from the project help support community air pollution health advice, heat wave forecasts, alerts, and wildfire mapping.

In New Zealand, the access aware program shows the location of mobile parking on a map (New Zealand government, n.d.-d). Users can also use the app to report real-time mobile parking abuse and violations. Some of the disabled parking data are also provided by local authorities to support the OGD initiative through this program. SaferMe uses data to warn people about the dangers and risks at work (New Zealand government, n.d.-b). The workers share important security data

across the organization that work in the same location, making them safer. LINZ data service, offering OGD such as land titles, geographic and land survey systems, topographical data, hydrographic data, and Crown property management, supports many real-time initiatives (New Zealand government, 2014a). For example, the Waka digital project developed a fisheries management tool (eFish) through the use of LINZ topographic maps, making it easier for iwi, maori tribe, to track and monitor fishing levels in coastal and inland areas. The Navman GPS technology company uses LINZ mapping data for their popular GPS application, a data application for self-navigating when camping, hiking, and hunting.

Further, GeoNet offers real-time geological hazard monitoring in New Zealand. It provides free, high-quality, and timely access to data to the public for emergency management, research, and industry (New Zealand government, 2013c, 2013a). Importantly, ThunderMaps, an app launched in 2012, presents hazard and mobile incident reports using real-time analysis of government data, and data reported by the public (New Zealand government, n.d.-c). Users are automatically notified about hazards and events, such as fire alerts, weather hazards, traffic accidents, earthquakes, and nearby police officers' contact numbers. They can view these incidents relative to their location and also review those reports. If an event or danger is near the workplace or surrounding environment, they can be prepared and kept safe. The impact of ThunderMaps with real-time reporting reduces incidents, increases immediate safety improvements, and provides rapid hazard analysis and elimination opportunities. In addition, it also saves time and money in emergency reporting as mobile devices can act instantly.

In Japan, intelligent transport system technology contains and releases map data, geospatial data, and vehicle position data, enabling a timely exchange of data among vehicles on the road (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). It reduces the risk of traffic accidents, eases traffic congestion, and contributes to road safety.

4) Better and Smarter Public Services

OGD offers insights and methods for delivering better services to the public. The government can understand how people live and work. The ability of governments to impact economic and social value from OGD and technology is

strengthened. For example, OS open data in the United Kingdom is used by many healthcare providers to better identify a patient's location and analyze him or her with evidence for more accurate decisions for recovery. Further, the open public services network (OPSN) is used to assess schools. OPSN data help parents find out which schools have the students with the best grades in the United Kingdom and which schools have been successful in improving individual students' exam results (Davies et al., 2019). Likewise, the data.police.uk project provides crime and policing open data in England, Wales, and Northern Ireland. The government agencies, businesses, and citizens can download street-level crime, arrests, 101 call handling, police activity, police performance, and a range of data collected under the police annual data in clear and simple CSV format through https://data.police.uk/. The open data will be updated monthly as each police force generates crime and outcomes in a set format. This helps to understand the current trend of the situations of crime.

In the United States, the citySDK syncs data gap among federal, state, and local governments. It enables citizens to come up with solutions that will benefit their local communities through leveraging data and creating interactions with academics, industry, entrepreneurs, and government. Developers can use the OGD available in citySDK to better understand public behavior, socioeconomic patterns about housing, employment, locations, and community development goals (Office of the Press Secretary (The White House), 2016a). Additionally, data are creating a new era of medicine that enables patients, researchers, and health providers to work together to develop personalized treatments (Office of the Press Secretary (The White House), 2016a; The White House, n.d.-b). Many health projects have utilized the health data, such as cancer moonshot, health data initiative, blue button, and Lyme innovation, to improve American’s health and wellness. Digitizing health data or records have spurred a shift in healthcare. Open and accessible health data increase health care options. Giving patients access to their health records may increase better health behaviors and improve decision-making. People now have access to nationwide data on the efficacy, costs, procedures, and patterns of hospital medicine. This gives them the essentials to make health care decisions.

In South Korea, GoodDoc is an app developed as original information on hospitals' locations nationwide as well as the operating hours is undertaken by the health insurance review and assessment service through the OGD Portal (Republic of Korea, 2016). It lets people know of the location of hospitals that meet their needs, such as checkups. Likewise, in Australia, better access to health care data can help provide more efficient and timely healthcare services for Australians, such as developing new products and services, identifying population health problems, and more targeted health research (Productivity Commission of Australian Government, 2017). DoseMe uses patient-specific data conditions (such as height, weight, and previous test results) to accurately calculate the dosage for that patient. DoseMe offers many benefits such as increased survival rates for leukemia patients, fewer drug side effects, fewer side effects for chemotherapy patients, and lower costs. This app allows consumers to manually enter and store health information such as medical records, fitness device data, etc., to provide better preventive health care and to share health information among healthcare providers quickly and easily. Health data help policymakers and researchers identify local health problems and the factors contributing to specific medical conditions and to assess the effectiveness and efficiency of health policies.

In New Zealand, the affordability in NZ project, an open-source web application created by a transportation consultant (MRCagney), uses OGD (New Zealand government, 2017a). Users enter detailed information about their income, workplace, means of transportation, and so on. By analyzing the personal data in conjunction with OGD, users can make comparisons between walking, cycling, driving, and using public transport. The mapping interface allows people to find out what form of travel will be the cheapest for them. The New Zealand fishing rules provides fishing information to assist fish farmers in complying with regulations (New Zealand government, 2014c). The free app contains information to identify fish species and legal advice. Fishers can access videos on how to properly release small fish and how to measure and determine their sex. Product recalls NZ is an information app that shows what products have been recalled from consumers (New Zealand government, 2014c). The free app allows users to see what food products have been recalled.

Japan's smart agriculture and industries have achieved success through the use of IT and data. Measures related to smart agriculture information, using various types of advanced information, including outstanding farmer knowledge, will be applied to create new models of made by Japan agriculture business (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan, 2013). Large amounts of data obtained from agricultural land measurements will be collected and analyzed for a wide range of applications, such as farmer knowledge sharing, data sharing, and use by entrepreneurs in order to gain more profits. Connecting farm data to the kitchen table will support the creation of a value chain that includes small farmers, who can earn more from the added value, and build a safe and reliable Japanese brand. As a result of these measures, Japan has stabilized and greatly increased the added value of agricultural products.

In the Netherlands, the benefits of using OGD on lifestyle are known as datafication (Ministry of the Interior and Kingdom Relations of Netherlands, 2019). This government realizes that OGD are rapidly changing the world. The datafication is closely linked to emerging technologies such as AI and the Internet of things devices. Smart use of OGD and technology can improve the quality of our life. For example, data make life easier by automatically listing pre-filled tax entries. Data help address contemporary problems, from improving healthcare and education to enhancing efficiency in critical infrastructure. Additionally, using the large OGD analysis of the department of public works and water management (Rijkswaterstaat) can make more effective predictions when asphalt needs to be maintained. These repair forecasts allow departments to plan a more efficient maintenance schedule for local roads. This forecast not only results in cost savings, but also reduces traffic jams, improves road safety, reduces carbon footprints, lowers raw materials and energy, and reduces noise pollution.

5) Public and Private (and Non-Profit) Partnerships

In the United Kingdom, the non-profit open data institute works to promote OGD within the government by meeting experts, publishing OGD case studies, and offering training courses (Cabinet Office of the United Kingdom government, 2014). The environment agency of the United Kingdom is a partnership

with volunteer Cornwall to deliver the bude cleaner seas project to upgrade Summerleaze beach's bathing quality status, which will benefit the tourism industry and the local community. Summerleaze beach visitors can get the latest data on water cleanliness from an interactive touch screen. The data are collected by the environment agency and released through their bathing water widget as part of a movement to open more government data to the public (Cabinet Office and Environment Agency of the United Kingdom, 2013). In Canada, the government encourages the use of OGD to make a more proactive impact on communities by encouraging social and nonprofit sectors to access and take advantage of it. In addition, the government encourages nonprofit organizations to increase the time, skills, and ability to make the use of OGD (Treasury Board of Canada Secretariat, 2018).

In South Korea, OGD are prepared and disseminated to citizens, businesses, and non-profit organizations. These stakeholders allow for detailed analysis and reflection on the state policies. Further, the dissemination of OGD increases the transparency and credibility of the administration, ensures efficiency in policy-making, and saves the government budget. The broad use of OGD by users has led to the development of creative services (Republic of Korea, 2016). South Korea issued the act on promotion of the provision and use of public data in 2013 as a legal mechanism that ensures the rights of citizens in accessing and using OGD.

In Australia, the opening of OGD has economic and social benefits. OGD helps to build connections and interactions among government, private and nonprofit organizations through research, motivating business activities, and developing knowledge that will benefit Australians. Having a single source of OGD reduces the time and cost of carrying out government missions (Department of the Prime Minister and Cabinet of Australia, 2013).

6) Sustainability

In the United Kingdom, OS open data is used in many ways to support sustainable development in the country (Rogawski et al., 2016). OS open data is used by the green alchemist to map business locations and local waste transport services to improve recycling and waste management. Also, OS open data is used by

IDC Consulting, an environmental and sustainable energy consulting company, to determine “the optimal location and terrain for renewable energy sources such as wind and solar farms at a wide scale.”

In New Zealand, Land, Air, Water, Aotearoa, so-called LAWA project is connected to New Zealand's environment from the local to national level. The app provides status and trend data for monitoring freshwater across New Zealand in an easy-to-understand way. This app helps communities find a balance between natural resource utilization, quality maintenance, and natural resource availability. The uniqueness of the app lies in allowing users to know about New Zealand's rivers and beaches (New Zealand government, 2015).

In Australia, OGD supports risk management. The Natural Disaster Management Report highlights the importance of OGD on the mitigation of natural disasters, such as improving land use planning and better natural disaster risk management (Productivity Commission of Australian Government, 2017). OGD also helps households to make better decisions about where to build their homes. Natural hazard data help communities understand hazards, reduce treatment duplication, and assist the government with flexible planning to combat natural disasters. For example, Landsat satellite data are used to map and analyze Australia's land and water in detail by geoscience Australia and the Australian national university (Department of the Prime Minister and Cabinet of Australia, 2013). Specific data for flood risk assessments and ecosystem management are provided with image analysis, which can be done in hours or days instead of months or years. The next step is to apply these useful data to other governments and trade issues that are based on the data for their decisions. Energy rating tools shows the energy efficiency data of more than 7 million electrical households in Australia and New Zealand every year to help households choose energy-efficient appliances. By turning on this energy data, retailers can automatically update the energy ratings of the appliances sold on their websites. This helps households lower appliance costs.

In Japan, efficient and stable energy data have been a key resource since the great east Japan earthquake. An information system was created to enable users to manage energy and electricity in their homes and communities to minimize their energy consumption, for example, allowing users to make decisions

based on their needs and the status of supplies. For example, intelligent transport system technologies provide map data, geospatial data, and vehicle positions to enable a timely exchange of information among vehicles on the road (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2013). This system reduces the risk of traffic accidents, reduces traffic jams, and encourages safer and more environmentally friendly road transport. Similarly, in the Netherlands, the energy transition vivet uses a large amount of data to know the energy change required, from individual household energy consumption to energy network data and energy generation, so as to improve the provision of data for energy transformation (Ministry of the Interior and Kingdom Relations of Netherlands, 2019).

4.1.5.3 The Taxonomy of Governance Impacts

OGD helps identify social problems, validates operational efficiencies, and recommends possible future optimization practices. Importantly, OGD helps to develop evidence-based decisions that lead to better-informed policy, research, and social outcomes. Data can be used to make effective decisions based on facts, trends, and patterns, rather than using feelings or individual opinions. It helps organizations discover new profitable opportunities, reduce risks, or uncover hidden trends. By exploring the impact of OGD on public sector operations, this research discovered 10 benefits: (i) data driven policy (or evidence-based policy), (ii) transparency, (iii) accountability, (iv) trust in government, (v) public engagement, (vi) efficiency and effectiveness, (vii) digitized government, (viii) anti-corruption, (ix) bridging the gaps between the federal, state, and local governments, and (x) global networks.

1) Data Driven Policy (or Evidence Based Policy)

OGD with the readiness of advanced technology can be used as a resource and a framework for evidence-based policymaking. The data are seen as the raw material for evidence for better policy. Leveraging the data also improves the ability of policymakers, evaluators, or researchers to generate strong evidence for policy analysis and policy options that lead to better decision-making.

For example, the city as platform project in London is an investment in infrastructure to play a role in public service decisions. OGD can be

used more systematically and effectively to manage the city's services and assets in creating new development approaches and business models. Organizations from all sectors will be able to better analyze what they are doing now and how to make it work better in the future (Suzuki & Finkelstein, 2019). In France, the OpenFisca project has used OGD to simulate how tax revenues are being used today and the impact of any budget reforms on government project funding, such as money allocation that is not appropriate for some agencies (Iniciativa Aporta, 2017). In Norway, the Brønnøysund register project is a foundation to develop a data driven public sector (Ministry of Local Government and Modernization of Norway, 2014). Open data provides broader insights into public processes. Norway is effectively digitized by using its data, and has embedded digital technology in government reform efforts to simplify administration and to provide user-friendly services (OECD, 2017).

Importantly, the United States has declared an act considering this importance. The act, the foundations for evidence-based policymaking act of 2018, was enacted in January 2019 (Foundations for Evidence – Based Policymaking Act of 2018, 2018). It addresses a new approach to how public policy should be formulated, analyzed, evaluated, and improved by systematically utilizing open data to guide government policy. This law promotes a future vision of the federal government to develop evidence-based policymaking as a routine part of its operations. The process of using rigorous evidence not only helps to point out whether policy goals are being achieved but also restores citizens' confidence in the process of policymaking and the procedures of government operations.

Likewise, Australia has realized this importance since 1982. The freedom of information act of 1982 declares that "information held by the government is a national resource to be managed for public purposes." Also, the Australian public service big data strategy (2013) noted, "the success of evidence-based policymaking depends on the quality of the evidence it constitutes" (Department of Finance and Deregulation of Australia, 2013). All Australian local governments have a comprehensive, high-quality, and long-term administrative database that increases processing, data storage, and matching technology capabilities. It means that very large databases rely on advances in analytical techniques. This

means that very large databases rely on advances in analytical techniques, enabling them to be investigated and able to differentiate policy impacts from other factors (Productivity Commission of Australian Government, 2017). Disseminating government data in a shared and easily readable format provides better support for the development of evidence-based policies (Australian government, 2019b; Department of the Prime Minister and Cabinet of Australia, 2013). Better government policies and better policy outcomes can be built by allowing stakeholders (i.e. government agencies, citizens, experts) to access and analyze multiple layers of data from different sources. For example, by disseminating government data of each public infrastructure project — such as costs, financing arrangements, and risk allocation— to the business and the public, it can motivate better decision-making of them and facilitate cost benchmarking (PricewaterhouseCoopers Australia (PwC), 2014; Productivity Commission of Australian Government, 2017).

In New Zealand, OGD generates better results for New Zealanders by improving government policies and decisions (Stats New Zealand, 2018b, 2019a). The government collects large amounts of data on behalf of New Zealanders (Stats New Zealand, 2019b). In particular, statistics organization of New Zealand has supported and empowered public agencies to leverage data more effectively. The government has declared the importance of OGD utilization in public sectors in all aspects, i.e. providing services, improving decision-making, developing evidence-informed policy, and planning for risk management (New Zealand Cabinet Office, 2011). OGD plays an increasingly important role in tackling large public problems by giving citizens and policymakers to gain benefits from data driven problem assessment. It also allows for more targeted interventions and fosters more collaboration between people that have access to OGD. For example, the school finder project developed by the ministry of education (Te Tāhuhu o te Mātauranga), aimed to be a resource for education system advising, setting the direction for education agencies and education service providers, and developing government education goals. It makes school data easily accessible to the public and education developers (New Zealand government, 2017d).

In the Netherlands, the objective of the Netherlands' open information policy is to create public values such as improved public administration

efficiency, economic growth, and improving social prosperity (Dutch government, n.d.-c; Ministry of the Interior and Kingdom Relations of Netherlands, 2015). In the policy aspect, OGD can be very helpful in policy-making, service provision, and government practice (Ministry of the Interior and Kingdom Relations of Netherlands, 2019). The government is implementing a data driven approach to many important social issues such as energy, crime, poverty, debt, infrastructure, and the environment. For example, Dutch municipalities use a data driven approach to identifying targets in order to tackle poverty. The database identifies where the poor working in the city or where children are at greater risk of living in poverty. This data are the basis for a specific intervention.

2) Transparency

The primary focus of OGD is to increase the transparency of a government. The project of open public services network (OPSN) implemented in the United Kingdom aims to indicate transparency in the public sector. The data in the project represents a multitude of truths about public service (Davies et al., 2019). Additionally, the TheyWorkForYou project uses OGD and information from the United Kingdom parliament to track and monitor congressional activity, debate comments, and legislative voting records in an easy-to-understand format (Hogge, 2016a). Further, the Canadian government has increased its transparency through publishing OGD (Government of Canada, 2014). The Canadian government has made an effort to release high-value datasets, i.e. company registry information and bankruptcy records. Additionally, the Norwegian government has developed a comprehensive network of fundamental information registrations with a clear definition of who is responsible for each of the key tasks related to OGD management (OECD, 2017). This supports the Norwegian government's goal for 2025, where the public sector must be digitized in a transparent, inclusive, and trustworthy way (Norwegian Ministry of Local Government and Modernization, 2019b).

Likewise, the White House police data initiative in the United States encourages law enforcement agencies based on the use of data and technology to reduce unnecessary use of force, and to improve efficiency, transparency, and accountability (Office of the Press Secretary (The White House), 2016a). The Congress of the United States also launched ForeignAssistance.gov to improve

transparency in foreign assistance spending. Transparency and this OGD help stakeholders and citizens to better understand the United States' overseas aid investments around the world. In Australia, OGD policies can increase government transparency leading to be more efficient and better policy outcomes (Productivity Commission of Australian Government, 2017). Dissemination of OGD can make people more involved and empowered, resulting in greater engagement and improving public debate. In New Zealand, the project of GeoNet's data informs and promotes active participation in emergencies and risk management. It helps to better assess the risks associated with current land use and plan decisions about future land use (New Zealand government, 2013a, 2013c). In Japan, providing OGD for secondary use enhances transparency in the administration and builds public confidence in the government (National Strategy Office of Information and Communications Technology (Cabinet Secretariat of Japan), 2012).

3) Accountability

In the United Kingdom, the TheyWorkForYou.com project has been transforming OGD in the country for years. The project has gathered data on the parliamentarians' actions as a window for examining the long-term impact of results based on OGD (Hogge, 2016a). TheyWorkForYou urges the members of congress to vote less for their party and more for the benefit of the people they represent. The biggest effect of TheyWorkForYou is that parliamentarians have changed the way in which they work in response to this long-term results-validation tool and public interest-oriented voting. Canada has also increased accountability by making OGD collected by the government more transparent, which allows Canadians to hold the government to account better.

In the United States, congress has improved eRegulations to make regulations more readable and easier to navigate (Office of the Press Secretary (The White House), 2016a). eRegulations also discloses regulations with relative information and a legal revision history. The project also makes it easier for people to express their views and opinions on proposed regulations before they become real laws. Another project is police data initiative (PDI) (Office of the Press Secretary (The White House), 2016a), aiming to empower law enforcement agencies through better use of OGD together with technology to boost transparency and accountability

that will lead to better-policing outcomes. Currently, more than 50 police agencies across the United States have participated in the project. They have published more than 150 open datasets on police-citizen interactions, i.e. using force, calls for service, traffic. Additionally, through multi-agency research collaboration, the project encourages innovation that is relevant to police intervention by using and analyzing OGD in the project.

4) Trust in Government

Norway's goal for 2025 is to digitize the government in a trustworthy way (Norwegian Ministry of Local Government and Modernization, 2019b). The Norwegian government has focused on improving OGD's broader insights. This strengthens the confidence of the public sector in the political system (OECD, 2017). Further, the city as platform project in London enhances public acceptance (Suzuki & Finkelstein, 2019). The police data initiative (PDI) project in the United States enhances the interaction between police and citizen, which helps to support and build trust between them (Office of the Press Secretary (The White House), 2016a). In New Zealand, the Kamo place race-town planning made lean and agile project has used OGD to improve the plan (New Zealand government, 2015a). The community was invited via Facebook, YouTube, and Twitter to talk about the issues they would like to fix and how to fix them. OGD such as demographics, maps, restrictions, and stored resources are distributed to the community for analysis. The impact of OGD in this process provides a higher level of transparency, a higher level of public trust, and increased opportunities for engagement.

5) Efficiency and Effectiveness

In the United States, the commitment of OGD proposed by The White House is data by the people, for the people (Office of the Press Secretary (The White House), 2016a). The OGD revolution holds the promise of improving the effectiveness and efficiency of services. Practically, the London city as platform project combines services from healthcare and social to optimization and behavior change. The integration enables efficient and cost-effective services (Suzuki & Finkelstein, 2019). Further, Norwegian OGD are aimed at improving efficiency through digitization, reducing the complexity of administration, and providing easy-to-use digital services (Norwegian Digitization Directorate, 2020; Norwegian

Ministry of Local Government and Modernization, 2019b). This strategy allows for better resource utilization and management through more efficient cooperation between the central and local government sectors (Ministry of Local Government and Modernization of Norway, 2014). In France, FinCom or DataPublica improves government efficiency and effectiveness by assessing the financial situation of cities and using OGD to improve local policy (Iniciativa Aporta, 2017).

Additionally, the Australian government policy developments and services benefit from the use of OGD analytics. OGD analytics have improved service delivery, generated innovation opportunities, identified new service policies, and have effectively delivered existing programs. The government uses OGD insights to help reduce costs and improve performance in providing services and locating resources to the places where they need them most. For example, eTax pre-filling (Productivity Commission of Australian Government, 2017), developed by the Australian tax office (ATO), uses relevant data from various sources to pre-fill information related to individual tax returns, i.e. income, interest income, welfare income, health insurance coverage. The data help the ATO identify individual tax returns and to reduce the cost of pre-filling checks. The taxpayer's tax-return-filing process is streamlined, saves time, and reduces the risk of manually entering incorrect data. The ATO estimated the savings incurred for an individual taxpayer at an estimated $ 535 million annually. In the Netherlands, OGD improves performance and leads to the efficiency of public services. Cross-sectoral data exchange can increase the efficiency of public service processes, such as mapping unnecessary or redundant expenditures (Dutch government, n.d.-c, n.d.-b)).

6) Digitized Government

Public sector development that is driven by OGD is the foundation of digitalized government. OGD drives higher levels of digital transformation through improving foresight capabilities to design better policies and services, to deliver public value-added, validate performance, and to increase the capacity to forecast trends or patterns that encourage more proactive initiatives. For example, the Norwegian government has carried-out considerable efforts to optimize the benefits of ICT strategic adoption and to integrate it into public sector reforms (OECD, 2017). In 2006, the government enacted the freedom of information act in the

country to be digitized government through OGD as an essential agenda for Norway (Act Relating to the Right of Access to Documents Held by Public Authorities and Public Undertakings (Freedom of Information Act), 2006; Norwegian Ministry of Local Government and Modernization, 2019b). The digitization strategy is a follow-up to Storting's digital agenda (2015-2016). Then they launched the digital strategy for the public sector 2019-2020, which defines goals and focuses on digitization work until 2025. Data driven government development in Norway is an opportunity to advance a high level of public sector digitalization (Norwegian Ministry of Local Government and Modernization, 2019b).

In Canada, the two main tasks of digital governments and services are the new digital policy and the OGD strategy (Treasury Board of Canada Secretariat, 2018). The role of OGD and digital governments has benefited Canadians by helping them set a path forward to using OGD and by connecting them with digital solutions. In France, the digital republic act, passed in 2016, includes OGD as one of the cornerstones of government reform in digitalization (Radu, 2020). The Australian government's digital transformation policy was developed in July 2011 with a focus on digital OGD records and management (National Archives of Australia, 2011). Government agencies store and manage OGD digitally, or, if possible, scanned papers are included. In the Netherlands, the Dutch government published the Dutch Digitalization Strategy 2018, focusing primarily on OGD development. In this regard, the federal and local governments share the responsibility of implementing the OGD agenda (Ministry of the Interior and Kingdom Relations of Netherlands, 2019).

7) Public Engagement

Data are an important primary resource for the ability to make decisions on issues, participate in debates, and influence social development. Access to OGD allows people to control how civil servants and politicians manage their positions and allocate social resources; people thus benefit from more informed and valuable decisions. In the United States, The White House's proposed government open data commitment is the pledge of better-informed citizens. eRegulations makes it easier for citizens to express their opinions on the proposed rules and regulations before they become the “law of the land” (Office of the Press Secretary (The White House), 2016a). In Norway, people can more easily access government decision bases

and public service priorities through accessing OGD (Norwegian Digitization Directorate, 2020). Norway's open-minded culture increases the involvement of citizens in the political process, promoting participation in democracy (Ministry of Local Government and Modernization of Norway, 2014).

In the United Kingdom, debating on the quality of public services has been encouraged by the open public services network (OPSN) project through empowering public service users. The OPSN often holds expert panel meetings representing units, such as school governors, students, teachers, and others to seek a set of attributes representing what they think about the quality of school education, facilities, the learning atmosphere, and curriculum outcomes (Davies et al., 2019). OPSN then interprets the available data to see how appropriate they are in order to present policy alternatives. Data obtained from consultation meetings together with statistical data lead to new measures (Transparency and Accountability Initiative, 2015). The program aims to open a broader public dialogue using digital tools. OPSN has been successful in engaging with a target audience of both the public, the press, and policymakers. Additionally, the FixMyStreet project provides citizens with a convenient way to find data or information to contact and communicate with their councils about problems in UK public areas via https://www.fixmystreet.com/. Likewise, the French government works with civil society organizations to prioritize government data for dissemination, provide public discussion on datasets, identify high-value datasets, and inform the country's efforts to publish OGD and technical methods of OGD in multiple languages (Vrushi & Hodess, 2017). The government always seeks new alliances and stakeholders to engage in anti-corruption through utilizing OGD.

In South Korea, the government promotes online policy discussions for public-private cooperation, which are carried out in the central and local governments in order to reflect public opinion on government policy (Republic of Korea, 2016). The e-People website (epeople.go.kr), a portal to provide public data and organize online discussions, has hosted special online discussions on social issues. The number of online discussions increases five times each year. For example, in 2012 there were approximately 50 online discussions, while in 2013 there were 280 online discussions. Further, in New Zealand, OGD helps citizens take control of their

lives by enabling more informed decisions. Citizens can call for change and mobilize new forms of a social movement through accessing and utilizing OGD. At an organizational level, the New Zealand government has collaborated with Iwi, Māori, and NGOs. By working together, the New Zealand government has researched, developed skills, recommended new resources, shared code sharing for reuse, capacity building, application design collaboration, and the provision of training and guidance (New Zealand Cabinet Office, 2011).

8) Anti-Corruption

An anti-corruption data ecosystem can be built by launching OGD since the public can access the data and use it to monitor their government. As governments encourage civil society to join them in improving OGD, the public will recognize what government data should be disclosed and how OGD will be used to monitor and control governments. OGD have extended to other sectors, not only the public sector. Disclosure obligations apply to companies in some sectors. For example, France has made great efforts to work with civil society organizations to prioritize OGD for dissemination. The French government is engaged in an alliance with anti-corruption stakeholders (Vrushi & Hodess, 2017). The anti-corruption agenda in France is driven by the OGD process. Further, the anti-corruption action plan is linked to open data (Savy, 2017). Additionally, utility companies must publish their information in an open data format. For example, public transport information must be made available, free of charge, and in an OGD format, such as the data of stations, signboards, bus schedules, prices, accident statistics, etc., to promote OGD utilization to develop new public service guidelines and new applications.

Likewise, in New Zealand, OGD improves government at all levels with primary goals, such as solving corruption, enhancing transparency, and improving better public services and resource allocation (New Zealand Cabinet Office, 2011). In Australia, information exposes government corruption (Productivity Commission of Australian Government, 2017). Greater government spending checks lead to important social benefits, such as the prevention of wasted spending. Specific OGD, including datasets about government budgets, auctions, donations to political parties, lobbyist registrations, and companies blacklisted from public contracts, provides greater financial and political transparency. Information about government

procurement can also help reveal fraud. These data will be used by journalists and activists to expose corruption.

9) Bridging Gaps among the Federal, State, and Local Governments

In Norway, the development of OGD is part of a strategy to drive digitalization and to create multi-level government agency collaboration. The physical infrastructure of OGD will make it easier to assess the possibility of OGD sharing at all levels. The task of OGD is too complex for an agency to perform alone. This is one of the development requirements for digital governments that municipalities need to implement in order to digitize their operational processes (Norwegian Ministry of Local Government and Modernization, 2019b, 2019a). Likewise, the Canadian government supports local authorities' efforts to leverage OGD to benefit their communities by supporting research, the use of technology, and the development of social innovation (Treasury Board of Canada Secretariat, 2018). In the United States, the gap among federal, state, and local government data has been bridged through the CitySDK project (Software development kit) (Office of the Press Secretary (The White House), 2016a). Cities and states across the country use this OGD platform to deliver innovative solutions for society. The OGD system allows citizens to deliver technical solutions that benefit communities through the interaction between stakeholders at all levels.

10) Enhancing Global Networks

OGD can network with other governments or international organizations to seek cooperation in the development and knowledge sharing systems of OGD in both the management and utilization of OGD. Specifically, international networking organizations have encouraged their members to make commitments to perform OGD, assist in OGD development initiatives, and build academic cooperation. Nine of the top ten countries are members of the Open Government Partnership (OGP), an international organization that includes people from the public sector, civil society, the private sector, non-profit organizations, and others at the national and local levels as reformers. Their partnership works to transform the way in which governments serve the people and works to share expertise in open government

issues and values so as to promote a transparent, inclusive, and responsible governance as well as to improve the relationship between the governments and their citizens (Open Government Partnership, n.d.-a). One of the OGP commitments is to commit to an open data action plan, such as providing open data conferences to support the international exchange of knowledge and experience on this issue (Open Government Partnership, 2020). Since the inception of OGP, open data policies and practices have been at the heart of the OGP culture. The open data concept is that data should be freely available to everyone to access, use, and redistribute as needed. In a democratic society, what the governments are doing should be known by the citizens. They must be able to freely access government data, and analyze and share it with other citizens. This collaboration of OGP ensures that government will not be data monopolies. The OGP mission addresses the pursuit of policies, technologies, and processes that enable everyone to freely reuse and distribute government data (Open Government Partnership, n.d.-b)).

Table 4.15 Year of Being a Member of the Open Government Partnership

Open Government Partnership	**Year of being a member**
United Kingdom	2011
Canada	2011
France	2014
United States of America	2011
South Korea	2011
Australia	2015
New Zealand	2013
The Netherlands	2011
Norway	2011

Source: Open Government Partnership. (2020). Members. https://www.opengovpartnership.org/our-members/

France, for example, is eager to share its OGD experience with other governments and international organizations to support the digital efforts of developing countries in order to achieve the 17 Sustainable Development Goals. The

uData project, developed by Etalab, shares the code of data.gouv.fr platform for OGD and has engaged in technical cooperation with Luxembourg, Serbia, and Togo (https://github.com/etalab/udata-gouvfr). Further, the Korean government constantly monitors world trends in the promotion of the acquisition and use of OGD. Membership in international organization promotes international cooperation to support the international exchange of OGD technology and human resources related to OGD. Further, the government also learns and follows the international standards of OGD. In particular, research and development cooperation among the governments of each country can be effectively established. Moreover, the public sector can also build partnerships with the private sector on OGD.

4.1.6 Political Instability in the Context of OGD

When considering the political contexts of the ten countries, the politics of the countries are relatively stable. The political structure and political dynamics are not linked to violence that affects the fundamental rights of humanity or destroys the governance structure. Although many countries have changed their government leaders since each country launched an OGD development initiative, changing governments was a normal process based on democracy. These countries remain committed to the ongoing implementation of OGD with their people. For example, implementing OGD in the United States took place seriously during the Obama administration. Obama declared a strong commitment to open and release government data to the public, especially in federal government agencies. He also launched policies, establishing operational guidelines and strengthening the disclosure of OGD in state governments. Later, the U.S. government was led by Trump. While OGD was not Trump's main policy, Trump saw the importance and value of its use. He supported legislation on disclosure and the use of OGD. The foundations for evidence-based policymaking act of 2018 was officially enacted during his government.

Likewise, assessing the perception of the possibility of political instability or politically motivated violence, including terrorism, performed by Kaufmann et al. (2018) in the report of Worldwide Governance Indicators from 1996 until 2016 (score value between - 2.5 (politically stable) to 2.5 (politically stable)), all ten countries had

scores that reflected considerable political stability. When compared with Thailand, political instability was different, as shown in the Figure below.

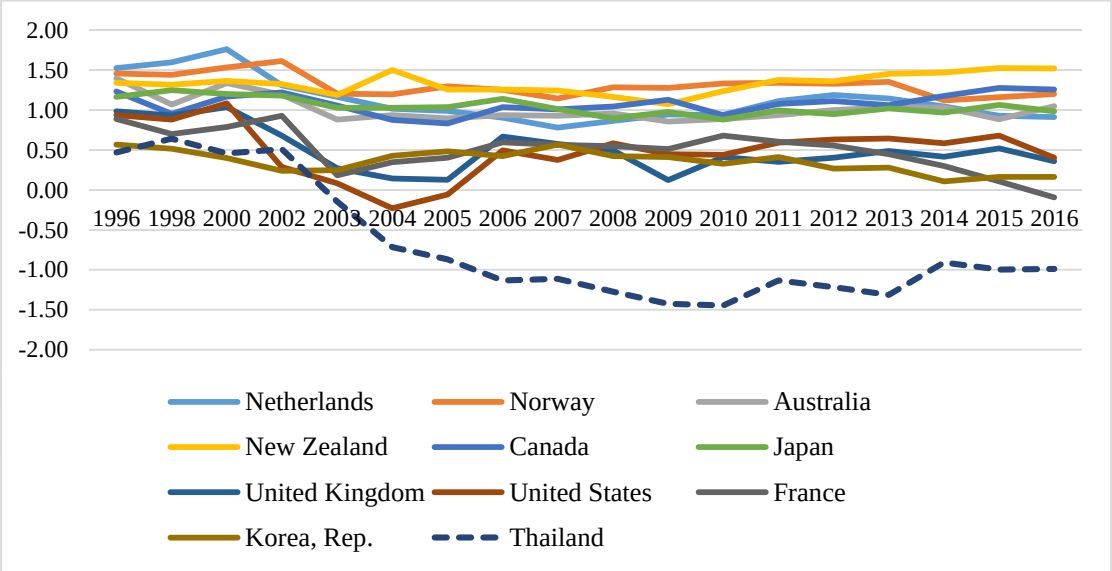


Figure 4.1 The Perception of the Possibility of Political Instability or Politically Motivated Violence from 1996 to 2016 Performed by Kaufmann et al. (2018)

However, this analysis may not reflect much on the relevance of OGD development or its utilization. When considering the analysis in conjunction with OGD policy, it can be reflected in how the political contexts of the ten countries favor OGD policies and practices. However, the political context issues related to the development of OGD and their use of OGD need to be further studied. Analysis of the case of Thailand may provide some knowledge.

4.1.7 A Special Case: Thailand

4.1.7.1 Preconditions for Developing OGD in Thailand

1) Technology Investment and Development

Thailand has invested in a web portal of OGD, the so-called data.go.th, as the center of OGD and as the center of government application (Digital Government Development Agency (Public Organization) (DGA), n.d.-a) in B.E. 2558. It is in charge of the digital government development agency as the main

agency in responding to OGD policy in Thailand (Digital Government Development Agency (Public Organization) (DGA), 2020c). The center of OGD refers to the center of open data disclosure organized by the agency so that other government agencies can disclose their government data digitally to the public.

Further, Thailand is quite technologically ready but still needs time to make use of it as an expert interviewed, key informant A, former director of the digital government development agency (Public Organization), stated the following.

> Thailand is ready for software, hardware, or tools. But it still takes time to adjust the Information technology system of OGD to support the development of OGD in government agencies. Also, the data center website has just been operating for 3-4 years. The development still takes a lot of time.

Thailand's information technology infrastructure is quite good and ready, such as the smart card identification technology system. Key informant B, former permanent secretary, ministry of information and communication technology and Thailand smart card designer and producer, stated the following.

> Thailand has the good basics of the Smart Card identification system that has an internationally recognized standard … Thailand should develop information technology based on existing good data systems.

However, although the technology is available to some extent, its use is not as expected. This could be due to reasons that Thai government agencies do not want to use, cannot use, or do not give importance to it. C, former research director of good governance policy, Thailand development research institute, in an interview with 101 One-on-One.World as creative knowledge media (ChandraPhichit, 2019) pointed out the following.

> Technology already exists, but in the case of Thailand, the Thai government does not want to use it, cannot use it, and I have to say that the Thai state does

> not give priority. Thai organizations seem to be trying, but not capable. I used to look at Seoul's e-license in South Korea, all licenses related to Seoul are online. We look at the things of Bangkok. It has a smile license but when you look at the website, it doesn't work. Thailand has every idea, but in practice, it doesn't work. We always have beautiful marketing ideas but put them into practice, don't work, don't care, and abandon them.

Additionally, although some technologies are available, much more advanced technology is still needed as technology will affect the quality of OGD and its utilization. The technology that Thailand should further invest in and develop is related to technology to generate, collect, and record data, and technology for the dissemination of OGD for utilization. For example, technologies that automatically generate data should be invested in and developed: “The data should not be filled by people. We should use technology that can automatically generate data” (key informant A). Even if the data needs to be collected by hand, they should have supportive technology tools that can easily collect data and get it into the system quickly: “The collection of spatial data should be performed by local people, as they know the area and its people well. But they should have tools to support the data collection” (key informant B).

Furthermore, technology systems for various aspects of government data should be developed: “other data systems need to be developed, such as data on budgets and expenditures of various departments, data on development indicators in various dimensions and at the all levels. The technology systems should be able to create the linkage and integration between them” (key informant B). Especially, technologies that can support large amounts of data integration and linkage should be invested in, such as cloud, a technology that can facilitate easy access to data and build engagement, as key informant B indicated in the following.

> The government sector should be promoted to have a government cloud. There may be an independent agency responsible for integrating or linking large amounts of data. Civil registration data, basic necessity information, should be integrated with other dimensions and areas such as geographic information

system (GIS) to be the basis for planning, solving problems, or meeting the needs of the people precisely. It will help us to budget appropriately and measure its achievement ... The distributed data are impossible to expand the usefulness.

2) Data Security

OGD in the web portal are an open license. The copyright owner can exercise his or her rights and allow others to use them (Digital Government Development Agency (Public Organization) (DGA), n.d.-b). However, there are intellectual property rights to information that prevent third parties from reusing and distributing information without explicit permission. Therefore, in order to make the organization's data available for use by others, a license must be added to the data in order to prevent misuse of the data set. The Thai government enacted the personal data protection act, B.E. 2562 (2019) to support and develop the data security issue. The law requires organizations or agencies that collect the personal data of citizens, whether private companies or government agencies, to not use personal data in any activity that is not consented to.

In this matter, personal data means the data that directly or indirectly makes it possible to identify that living person, covering name, address, ID card number, phone number, location, e-mail, IP addresses, cookies, ID bank account, photos, work history, and age (if they are a minor, parents must be identified and have parental consent). The indirect meaning is the data that can be used to distinguish who we are and to be used to track people. It can link with other data and tell who it is. Further, sensitive personal data are the data that have to be used with special care under Article 26, collecting or processing them with more stringent controls, including ethnicity, ethnic race, political opinions, belief, creed, religion or philosophy, sexual behavior, criminal history, information on health and disability, union information, genetic information, and biometrics. The law protects sensitive data more stringently than general personal data. The collection, use, disclosure, and transfer of personal data requires consent, unless otherwise permitted by law. That consent must be given independently, specifically, and expressly. The data owner can withdraw his/her consent. Whenever there is an incident of a personal data breach, the

incident must be reported to the relevant authorities within 72 hours, and the owner of the data must be notified. Additionally, undisclosed data that may cause damage to the monarchy and government agencies or government officials may be ordered for disclosure based on the laws of government agencies, the public interest, and related private interests. Personal data, which government agencies will disclose, must have the consent of the owner of the data provided in advance (Digital Government Development Agency (Public Organization) (DGA), n.d.-b). This is similar to what is done in other countries: “In other counties, the public information act clearly writes that even though it is personal data, issues relating to the public interest, public interest must precede personal interests” (key informant C).

Personal data are extremely valuable. The public sector has to assure the public that even if the data are used, it will not have any negative consequences: “The most important data are personal data which is useful. The government has to find a strategy to ensure people's data must be protected while taking advantage of personal data. How do we balance between protecting personal data and enabling innovations in data use?” (key informant A.) In this regard, experts agree that privacy laws are quite good. However, in practice, data security development should also be linked to the development of technology to be able to support data utilization as well.

> Privacy law is already around and pretty good ... but increasing data security should use technology as a support. For example, if citizens use ID smart cards for public services, they should have an identification system. People should have their safety identification. If a data security system can be built with technology, then it is possible to link data and integrate more data. With the development of National ID, authentication systems can extend the foundation of the ID smart cards. If we can, it will be able to expand to all areas such as banking services, financial operations, private services, e-commerce trading, public service, online voting (key informant B).

3) Trust in the Government

Although it is not documented that the Thai government is concerned with building trust in the public sector for OGD development, an expert has pointed out that confidence in the public sector is a key player in doing so. If the public is not convinced or is suspicious of the state, the data provided by the public may be incomplete or false.

> In my opinion, people have little confidence in the public sector because they are paranoid that the government will use the state power to interfere with their safety, for example: Interfering with online comments, etc. People are not yet dared to comment, fearing prosecution by computer laws. However, if society is open, the exchange of data from the public will take place. Any correct or incorrect data will be automatically verified by the public. But now it is in a very powerful state and people cannot complain or give any opinions or data (key informant B).

4.1.7.2 Implementation of the Principles of OGD in Thailand

According to the regulation of DGA open government license (draft)(2020), "data" mean things that convey information about a story, fact, or any other matter whether it has been made in the form of documents, files, reports, books, diagrams, maps, drawings, photos, satellite images, films, video or audio recording, computer recording, measurement equipment, remote sensing, or any other means that enable the recording to appear (Digital Government Development Agency (Public Organization) (DGA), n.d.-c). Importantly, “OGD” means data that government agencies must disclose to the public under the law on government information that the public can access and freely use free of charge and without any limitation to disseminate and reproduce for any objective. The data released in the web portal (data.go.th), in an open format and with an open license, are not strict on any platform, are non-proprietary, and re machine-readable such as CSV, KLS, XLSX, PDF, DOC, XML, RDF, JSON, TIFF, JPEG, and so on (Digital Government Development Agency (Public Organization) (DGA), n.d.-b).

The digital government development agency clarifies the difference between the OGD indicated in the official information act B.E. 2540. Data or information in the official information act B.E. 2540 refer to disclosed data or information under the section 7 and 9 as a means of disseminating information to inform the public in any format, while data in the notion of OGD refer to non-specific disclosed data in machine-readable formats such as XLS, CSV, or ODS. The data under such the Act must be able to be used to create various benefits such as improving the quality of life and developing new business models, products, and services.

The digital government development agency as the center of opening government data has proposed three main keys for such data, including the following: (i) availability and access, (ii) reuse and redistribution, and (iii) universal participation. However, it must be for the owner of the data; for example, if commercial use is not allowed, it cannot be used for commercial purposes (only for non-commercial use). Further, the digital government development agency set the level of disclosure so that users can consider it more convenient to use (Digital Government Development Agency (Public Organization) (DGA), n.d.-b), ordered from 1 to 5 stars: (i) data are published in all formats on the web portal and are subject to the terms of the open license (PDF, DOC, TXT, TIFF, JPEG); (ii) data are published in a structured format that is machine-readable such as excel format; (iii) data are published in a non-proprietary format such ah CSV; (iv) data can be used the URI (Uniform Resource Identifier) in the identification of data and its location; and (v) data can be linked to other relevant datasets.

It seems that the Thai government's OGD concept is quite comprehensive and is tied to international standards. However, in practice, experts agree that the development of Thai OGD systems still needs to be done in terms of the amount of disclosure and the quality of the OGD. In terms of quantity, experts agree that the amount of OGD disclosed is not yet large.

> Currently on the website that has been disclosed about 1,800 data, the data are not much. If you compare the world's leading countries such as England with more than 20,000, and America with more than a hundred thousand data. The

> OGD nowadays must be equivalent to big data. Thai OGD are not as big data as it should be, there is not enough amount. It means that data should be more diverse, both structured and unstructured. But the Thai government usually only has a table or few databases (key informant A).

An expert also pointed out that low data volumes and slow development of OGD systems may be the result of public sector traditional practices that are not favored for data collection and utilization. C stated the following in this regard.

> It could be because there was no data at all. I must say that Thailand is not a country of data collection. Unlike Japan, Japan keeps everything. Most Thai government agencies do not see the value of the data. But to blame them is not right because Thai government policy formulation rarely uses data, but often uses more feelings. So they may think why do government agencies collect data? Policies don't apply, better follow the policy, what they ordered. So, government agencies do not have to find a lot of data… Government agencies do not want to be held accountable, for example, if they are opened, personal data are unintentionally released. A person who opens such data must be illegal.

In addition to the amount of data on other dimensions, it should be published in large enough and comprehensive volumes, as well as in various dimensions.

> There is some level of data related to the civil registry, but the data of government performance and budget for a project, plans, and spending is very small and is not comprehensive in terms of dimensions and areas… for example, the gross product data should be stored at the village, community, sub-district, district, province level, where it can be a national overview. The government will see where areas need to accelerate and which areas need to be developed, which areas must maintain sustainable growth (key informant B).

In terms of quality, Thailand's disclosed OGD still needs to be more developed; some of it cannot be further used. This is still considered a lack of quality data. “The quality of data is not just the accuracy of the fault. But the key point is whether the data can be further used or not. Is it the data that meets the needs for further use or not? If OGD are released, but still cannot be used, it may show that there is no quality” (key informant A). Likewise, C stated regarding this issue: “Bad quality data. It is possible that the data collected is inaccurate or there is a very frequent problem. If the agency is not sure about the accuracy of the data, they are afraid that the user will be criticized for the poor quality. So it doesn't open better.”

In particular, the integration of OGD or the linking of OGD is one of the qualities of OGD that should be greatly improved. Scattered data are difficult to continue to use: “The data are not yet integrated enough” (key informant A). The fact that the data are not integrated or coherent leads the government to create new systems over and over, and creating many systems results in monitoring difficulties. One of the informants interestingly explained this point.

> Civil registration, smart card identification technology system, data has not been further utilized, such as receiving government services or verifying rights for the government help. The data are yet to be integrated into one. So governments often create new systems or create new data for new projects, such as issuing a poor card instead of an ID card that can be multipurpose. So, it turned out that government policies were not transparent, and had to do a separate system so that it was difficult to monitor. Instead of people being able to check whether the government has distributed money based on the data, is distributed thoroughly, or who has benefited from the budget (key informant B).

Key informant B also assessed the quality of Thai OGD; the overall assessment was not good enough. The quality in each component is still low and should be further developed.

The overall assessment is not good enough. In terms of completeness, it is good in certain types of data such as civil registry or demographic data quite complete. However, the data about government spending, national development indicators, such as GDP, depth inequality, quality of life, etc., is not clear. The data should be extended to the level of households, and communities. Machine-readable is still at a low level. Data cannot be easily downloaded for research or development analysis. Open standards are not very standard yet but can be developed. Open licensing is still narrow because it is not open or allowed to be used. Free of charge is available depending on the case as it may incur a cost. With the fact that the data has not yet been publicly opened, the discrimination is huge because the data are not entirely public. Therefore, people who have a network or know someone within will tend to get the data, while those who do not know will be more difficult to obtain the data. Open by default hasn't happened yet. If you want to get the data, you have to ask for it, but still, you can't because it is related to a culture that doesn't want to disclose.

4.1.7.3 The Key Mechanisms to Unleash the Power of OGD

1) Administrative Culture Transformation

Open government looks like a new story for Thailand. According to the government's documented research, this has not been formally identified. However, this movement is “taking off" in practice. In this matter, experts agreed that the Thai government's work culture remains an obstacle to the development and progress of OGD. In particular, the Thai government does not have a culture of data collection or retention, the use of it in management, or utilizing it in development: “Changing the public sector culture to be open is very important. The open government is the key and at the heart of everything in today's development” (informant B). From the past to the present, the Thai government has not taken this seriously.

Open government is a government that is responsible for its performance. In the past I have not seen any Thai government trying to be held accountable for

> its performance, no matter what it is doing, there is little evaluation. Think about which public service in the public sector allows people to assess whether they are satisfied or not, it is not available in Thailand. To say that open government has to be accountable has to be evaluated, and that the service of the people is improved to be of quality, and to be satisfied by the people (informant C).

The problems of the Thai state are like those of the developing countries. Lack of transparency, accountability, and public participation represents the lack of open government. These three “lacks” make the administration of the country inefficient and ineffective. This lack of the fundamental elements of open government has resulted in a closed culture and the lack of OGD exploitation.

> Non-disclosure of data to the public leads to a lack of transparency. The public did not receive the data. When the data are not received, the public is also not involved in the state, making it impossible to give feedback to the government on whether this policy is good or not. Even if the public had the information, they couldn't provide it because they didn't know in the first place whether there was a project or a draft law. It turned out that the administration of the country was in the hands of a few people (informant C).

In particular, a deep-rooted understanding of the Thai government is the understanding that the government owns data, or having a confidentiality agreement between the public and businesses prevents the data from being disclosed to the public. This is unlike foreign countries, where they consider government data as public data and the public are the owners. Any agency funded by the public tax is required to disclose its data to the public by taking the public interest primarily over business or personal interests.

> The Thai state thinks the data are owned by the state. But not, it is the data owned by people. Even the legal name, Thai people still call it the official information act. It is data owned by “official”. However, in many countries,

> they use the term public information act or public data act. Citizens own data, only in the custody of government agencies. Therefore, government agencies should disclose the data because it belongs to the people, not the government … (for example) a British court ruled that the BBC must disclose the data because it uses government subsidies that come from the people. Therefore, although the BBC is a business in the stock market, public interests precede business interests. The BBC eventually had to disclose all the data. But in Thailand, it can be seen that Thai enterprises do not have to open (informant C).

The problem of driving OGD that has not yet occurred is related to the law; that is, if the law is not yet clear or seriously enforced, the disclosure would not take place: "open government is about engagement, transparency, and accountability. All three of these things depend on what the law is written. If the law says that government agencies must disclose data, they must do so. If not disclosed, it means breaking the law" (informant C). This may indicate that open government culture is not yet developed through the awareness of the importance and potential of open government. Although the law can boost and drive the development of open government and OGD, it still needs to be driven by other mechanisms and stakeholders.

2) The Policy of OGD

The right to access government data and information was mentioned in official information act B.E. 2540. It requires the disclosure of government information so that people have a broad opportunity to receive information about various government operations. However, there are exceptions: to not disclose information that will cause damage to the nation or important private benefits.

Digital government administration and services act B.E. 2562 was established to support the constitution. It states that the constitution aims to reform the public administration to "become digital" by using suitable technology to be used in the administration and provision of public services. This requires the

integration of all government agencies' databases into a system of data. This law will lead to being a digital government that is safe, efficient, fast, open, and transparent. It should be convenient for the public to receive the services and to check and monitor the operations of the government agencies (Digital Government Development Agency (Public Organization) (DGA), 2020c). According to digital government administration and services act (B.E. 2562) in section 17, government agencies shall open digital data available to the public, which shall be freely accessible, free of charge, distributed, and utilized to develop services and innovations in any form. One of the purposes of digitizing the government is to disclose government data: "disclosure of public data or announcement produced and possessed by state agencies through a digital means to create easy access to the public, promoting their involvement in and inspection on governmental operations, and enabling them to further use the data to develop innovations and services which would be beneficial to the country in certain aspects," embedded in digital government administration and services act (B.E. 2562).

According to an interview, an expert pointed out that the Thai government's OGD policy had begun and was a good start. Disclosure OGD efforts have been going on for years, but they have recently driven OGD in a digital format.

> Thailand had a digital government law of 2019 which states that the government must provide open information services in digital form with digital governance. What kind of data can and cannot be disclosed is based on the Official Information Act. The new law highlights how the data can be digitized and there is an agency that will be responsible for it. The new law will help accelerate OGD disclosure and improve data quality (informant A).

However, the informants agreed that disclosing OGD for utilization still needs time in practice: "clear policy, the only action left," stated A. The disclosure of OGD has not been widely seen in the Thai government sector. Difficulties in doing this may also be related to the political environment.

> OGD disclosure in Thailand is seldom occurring because it involves other important factors, such as a non-democratic government that is overused its power. I estimated the OGD disclosure of less than 50% because even if there is a law for OGD disclosure, just the public request for some data, it is still difficult. It starts with a democratic culture (informant B).

3) The Management of OGD

In order to manage OGD, the digital government administration and services act (B.E. 2562) in section 18 stated that the OGD center should be established to coordinate the government agencies to send or link to data under section 17 to publish the data to the public. Further, a digital government development committee is appointed according to the act. The board can specify the type, format, and standard of data disclosed to the public by the OGD centers. It must use the same guidelines and standards as well as comply with international data disclosure principles. The OGD center is operated by the digital government development agency (Public Organization) to facilitate the provision of services to the public and the operation of government agencies through digital systems. The office is responsible for establishing guidelines for the disclosure of data and coordinating with government agencies to deliver or link data that must be disclosed to the public (Digital Government Development Agency (Public Organization) (DGA), 2020a). The guidelines consist of defining procedures, forms, and mechanisms such as a selection of disclosure data sets, data quality control, methods of disclosure, those involved in disclosing the data, and use the data to create benefits (Digital Government Development Agency (Public Organization) (DGA), n.d.-c).

Practically, for government agencies, an agency appoints a committee or a work group of the department for OGD. The committee will select the data set to be published, which should consider high-value datasets or be needed by all sectors to promote widespread use and maximize benefits. The committee must consider the data sets chosen for publication, which must not violate laws, regulations, regulations, privacy, or security. Then, the agency provides data in a standardized format. Further, agencies must create a description of that data set so that users can understand the context of the data, such as the purpose, scope, date of

release, frequency of improvement and dissemination, data source, etc. After that, the agency can bring the data set to be distributed to the public in two ways, through the website of the agency and Data.go.th.

However, the organization structure of OGD disclosure remains fragmented. The departments responsible for this matter are under different higher departments, resulting in an unintegrated operation. Achieving common goals is difficult.

> The responsible agencies are scattered. There is a ministry of digital economy and Society that acts as a policy, while the digital government development agency is under the prime minister's office. Also, the unit performs as the core engine is under the ministry of interior with the largest population database; every province, every district, every sub-district, and village. Work on this OGD issue may go in different directions, and it requires integration. However, even the operating units have no integration occurred (informant B).

However, the existing OGD management concept, data governance, is quite good as it connects stakeholders to OGD development. One key informant believes that OGD managed with the data governance concept will be of good quality and readily available to be utilized. However, this concept still needs time to install in the Thai public sector.

> Data governance aims at government agencies to develop data that is quality, and suitable for use, security, and accountability. OGD that has not been made to DG is often not readily available. Data governance looks at OGD management within the organization to have good governance. One of the components of Data governance is the utilization of OGD. The government must involve stakeholders with OGD development. The public sector must make OGD in line with the needs of the people (informant C).

4) Data Cooperation

Although each agency, both the public agencies and local government, has a website to release data or information, there is no local government publishing its data based on the idea of OGD in the web portal. Since 2556 when Data.go.th was initiated, there was a promotion and push for all government agencies to standardize the government website standards to apply and improve their website (Digital Government Development Agency (Public Organization) (DGA), n.d.-a). After the digital government administration and services act, B.E. 2562 was signed, government agencies had to make their data open due to the act. However, it is in the early stage; there are only 351 public organizations (Digital Government Development Agency (Public Organization) (DGA), n.d.-d) under the central government that have opened some data in the central web portal.

> Many organizations have begun to disclose OGD, but many have yet to begin (emphasized). Some agencies do half the job. As for local governments of Thailand, since they are under a central agency, the central agencies will disclose OGD for them. In the future, local governments should be more involved because the concept of decentralization itself encourages local governments to disclose OGD so that local people can use the data in their area (informant A).

In addition, the cooperation between the central and local governments in disclosing OGD should be integrated: “the OGD cooperation between federal, local governments and government agencies is essential to be coordinated and integrated, for example, creating a cloud system to reduce costs and to integrate a database that can communicate with each other” (informant B).

5) Government Support

The Thai government has supported the use of data for innovation by establishing the Thailand data innovation awards (Digital Government Development Agency (Public Organization) (DGA), 2019). The project aims to drive innovation development with open data and to encourage the development of a variety

of applications. It is a project that encourages Thai developers to have the opportunity to extend their ideas to work that is ready and displayed on a national stage. Further, qualified applicants will be allowed to submit their work in an international forum called Asia open data partnership (cross countries Hackathon). The government also promotes the use of data by organizing an event called Datathon-organizing data for anti-corruption. The activity is intended to examine conflicts of interest, and to allow people to participate in expressing their opinions through the application.

At present, the Thai government sector is focused on supporting the development of personnel skills related to OGD disclosure in various dimensions, such as data collection, data maintenance, and utilization of OGD. However, time is still needed for building skills.

> Government promotion offers courses to develop knowledge and skills of the official, but government agencies are abundant and OGD are very new. It is, therefore, necessary to give the government some time to develop and build up the knowledge and skills. However, there are now quite a few opportunities to develop them since technology, access to knowledge, and coordination are more convenient and conducive to promoting knowledge and skills (informant A).

The public sector must have strategies to stimulate OGD utilization in terms of knowledge, skills, and ideas of OGD-driven innovation. Also, an environment of access related to technology should be promoted.

> Government support for investing in human resources, knowledge, training in technology and OGD use, promoting competition, and providing rewards are essential. It needs to be stimulated. In particular, the basis of our existing data systems should be developed further…the cost of using the Internet for the elderly, farmers, and college students should be affordable because access to technology communication tools is a basic need (informant B).

6) Research and Development

Thailand invests in research and development at approximately 0.5% of the GDP. In 2018, the government spent $ 5,154.3M. There are 963 researchers per million inhabitants (United Nations Educational Scientific and Cultural Organization, n.d.). However, a search for policy documents found that it had not yet identified research support for the use of OGD. It is not yet a policy to state the importance of research for the release of the value of OGD. However, the results of the interviews revealed that promoting research using OGD was essential. Educational institutions should play a role in utilizing OGD through research processes and building students' skills related to the use of OGD skills.

> Encouraging research using OGD is essential. Research topics must be consistent with social problems and needs. Students must be involved in making use of the OGD. OGD data-based research should be a function or part of the teaching and learning process for the outcome of the study to be of benefit to society. OGD are important, if the government does not share it, it can't be researched. The research that has been done must also be disclosed to be a repository of knowledge baes that can access (informant B).

The research topics should be based on issues that are close to the public to show how OGD can transform society: “it has to start with a problem that is close to them (the public). To say it is a principle, they wouldn't care. If we select a group of people and ask what they are interested in, then we say how if the government discloses OGD or if the public is involved in it, how will it make your life better? ... We have to find the subject that they are particularly interested in, and then start showing them how it affects their life” (informant C).

7) Citizen Engagement

According to the data portal website, everyone can freely use all of the data on the website (data.go.th) without any restrictions, such as use, reuse, or distribution. According to the terms and conditions for using data from the OGD centers (Digital Government Development Agency (Public Organization) (DGA),

n.d.-c), "data users" means individuals, faculties, individuals, legal entities, agencies, or organizations, both government and private, both domestically and internationally. "Use of data" means the use of the data, whether in whole or in part, for use in any form or method or any legitimate purpose and under the acceptance of compliance.

Ideally, data users have the rights and responsibilities to use the data in OGD centers as mentioned in the data portal website: (1) to reproduce, distribute, or use in any form for the development of various services and innovations or other benefits in the country's economic and social development; (2) to apply data by various methods or forms, which does not alter the content of the information or misrepresent it; (3) to use the data by combining it with other data or using the data as part of the study, analysis, research, development, service, and innovation or any other action aimed at the general public's economic and social development; and (4) to comply with the standards, requirements, and criteria relevant to the use of OGD (Digital Government Development Agency (Public Organization) (DGA), n.d.-c). Users of the data can be considered as participants in the process of improving the quality of the data that the agency has disseminated through the means of commenting and requesting the requested data. Disclosing data quality that meets consumer needs will help to create innovation and enhance the quality of life for people, including helping to create new jobs as well.

However, the reality is that people are far from driving the development of OGD and exploiting it. Most people do not pay attention to the disclosure and use of data while the success of any development must arise from the people.

> The general public was not interested in the data. The media only reports that this person said this, but little empirical data to support it. Readers do not often question what the true data are… It is part of a non-data-based way of thinking … all reform must come from the people. Don't expect a top-down. Don’t expect there is a good state that will establish legislation to reveal everything. It's difficult in the environments we see (informant C).

The initiation of the development, driving the development, and the use of OGD need to begin with the public as well. The public sector also has to respond to those contributions.

> People must recognize the importance of OGD. When people are interested, when OGD are released, society will change the way it works because OGD brings to the power of the people. Citizen participation should take place at every stage, such as defining a highly valuable and necessary set of data, giving opinions, utilizing it, etc. In particular, a public hearing is very necessary. If the government listens to the public, they are more interested in participating in actions. On the other hand, if people make their views but are threatened or unresponsive, they will become fearful and not interested in engaging with the government (informant B).

An expert offered guidance on how to drive OGD and make the most of it. An OGD development and utilization initiative could be initiated at the local government level, where people can pressure their local government to disclose OGD for utilization.

> So it must come from the public pressure on the government ... I think we have to start small with the local government. Like India, there is an amazing project in which a municipality discloses all its budget to residents, such as what the organization is spending money on, when does each local development project begin and when does it end? Local people helped to investigate and it appeared to be very effective. Corruption disappeared. This is an example of how good projects are not necessarily expected at the federal level. Don't forget that we have 8,000 small governments (informant C).

4.1.7.4 The Influence of Political Context on the Government Capability to Unleash the Power of OGD

Changing or reforming the bureaucracy would be difficult without understanding the traditional political culture of the bureaucracy. The political culture

that has been deeply rooted in Thai bureaucracy for a long time is an authoritarianism culture (Tanapornpan, 1992). Such a culture is, for example, evident in the promotion or reward of civil servant positions, depending on the patronizing relationship of a civil servant with a political authority at that time. This behavior reflects that both the regular civil servants and politicians “play politics.” The influence of this authoritarian culture greatly undermines the effectiveness of the bureaucracy. Accepting change, accepting new ideas, public hearings, open information, and communication both within and outside an agency that has a sparse authoritarian culture will be more than an agency with full and intense patronizing authoritarianism (Tanapornpan, 1992). On the other hand, the full and intense patronizing authoritarianism organization tends to conceal its data. This political culture does not support government agencies to take responsibility or accountability to citizens. The authoritarianism culture has cultivated government agencies to think the government data are owned by the state. Likewise, it influences people by keeping them far away from accessing or using the government data.

Moreover, frequent coups in Thailand have reinforced the authoritarian culture of politics and bureaucracy. The abrupt changes of government have undermined the capacity of public administration and continually undermined national development. Currently, Thailand is ruled by a semi-military government led by Prayut Chan-o-cha, a former military officer who headed the coup in 2014, and his influential former soldiers. Although his current government established a policy of Thailand 4.0 focusing on driving the country’s economy and society with technological advancements, it only seems that the semi-military government follows the world trend, whose importance cannot be denied. Before he was appointed as the Prime Minister for a second time, the military government announced control and regulation of the accessibility and flow of information on the Internet by establishing a computer crime act that had drawn widespread criticism (Charoen, 2018). The semi-military government does not seem to understand or recognize the advanced technology's true value and potential in developing the country, which is evident in the absence of the utilization of available data in the administration and public services. For example, under the lean economic conditions, severe social inequality, and COVID-19 effects, the semi-military government has run many projects to

stimulate the economy and alleviate suffering, but the projects seemed fragmented and redundantly processed.

Rao cha-na (เราชนะ: we win) project (Prime Minister's Delivery Unit, 2021), for example, aimed to provide financial assistance to citizens for two months (January - to February 2021) due to the epidemic situation of COVID19 at a limit of 3,500 baht per person per month. Access to the right to be granted this required that citizens fill in the information through a smartphone application. For those that cannot afford a smartphone, they can register at any Krungthai Bank branch nationwide. Once eligible, they are entitled to receive the right to the weekly financial support of 675 - to 700 baht for the group holding a government welfare card (a card with financial support for 200 to 300 baht per month that was given to low-income citizens (approximately 11.67 million people nationwide), and 1,000 baht for other groups using the application. They can spend their financial support at participating stores via a card reader machine or smartphone application, not using cash. Such financial support cannot be exchanged for cash. The implementation of the project seems to fit in the technology era but on the other hand it has caused a lot of criticism and problems.

There are many people, especially the elderly and the disabled, who are not able to afford an updated smartphone to support the government-required application. According to the latest statistics from Hootsuite (2020), a leader in social media management institutions, only 64.83 percent of the total population was able to afford devices and services for mobile connectivity. Importantly, only 6.1 percent of people aged 16 to 64 years old use a non-smartphone mobile phone as well. The statistics show that a large number of people have faced difficulties in registering for the right to the outbreak's financial support. The gap in access to this technology immediately increases technological inequality. There have been questions from the public as to why it was not given in cash by transferring to the citizens' bank accounts or not given in check form. The government, Supatanapong Punmeechaow, the deputy prime minister, the minister of energy, and one of Prayut Chan-o-cha's economic team members argued that "no giving cash or transferring to bank account is because cash can spread the virus. The government does not want people to touch cash. We also think about reducing congestion for many people who have to queue to

withdraw cash from ATMs. This is to support the epidemic control measures of the ministry of public health" (Posttoday, 2021a)."

Not everything is as expected by the government. Citizens that are non-smartphone users (i.e. the elderly, the disabled, unemployed) had to gather for hours to wait for the bank's services since the project set a limited time to register for the financial support. This government project put people at risk of infection and transmission during the epidemic. Menacingly, it happened. A COVID-infected patient, an 83-year-old grandmother, came to the bank with her granddaughter to register for financial support on February 18, 2021, from 10.00 a.m. to 01.00 p.m. The bank then announced a temporary closure. The governor informed the people traveling to the bank on that date and that time to hurry to inform the authorities for COVID19 screening at all hospitals near their home (Thairath, 2021a). This reflects the ineffectiveness of the semi-military government, which is not thoughtful. The government action posed a greater burden on the people, and created further risks and crises.

The questions were why the semi-military government, which already has citizens' information, required people to repeatedly enter the same information through an application system. Why was the semi-military government not taking the available information on the elderly (11,627,130 people as of December 31, 2020) (The Department of elderly affairs, 2020) and the disabled (2,076,313 people as of December 31, 2020) (Empowerment of Persons with Disabilities Department, 2020), who have already been financially supported by the government (i.e. age range 60-69 years receiving 600 baht per month, age 70-79 years receiving 700 baht per month, age range 80-89 years receiving 800 baht per month, age 90 years and over receiving 1000 baht per month, and people with disabilities receiving 1,000 baht per month) (The Standard, 2020), into this project? Moreover, why did the semi-military government not conduct this project in coordination with 7,850 local governments (Department of Local Administration, 2020) (or 293,237 village health volunteers (Department of Health Service Support, n.d.)) to have access to people at the household level? After facing many criticisms, the government afterward informed that the bank for agriculture and agricultural cooperatives, mobile units of Krung Thai bank, and some volunteers would provide registering services for the elderly who

could not travel and the disabled in local areas. However, those affected by the epidemic and that did not have smartphones still had to travel to the bank. Imprudent solutions formulated and implemented by the semi-military government led to more crises and even more burdens. This precisely reflected the centralized administration of the semi-military government, which does not favor other entities or cooperative ideas.

Insidiously, once financially supported, the semi-military government also defined the spending framework for eligible citizens to use it at the participating stores, i.e. Thong Fah Pracharat stores, service providers (i.e. taxis, public vans, motorcycle taxis) through its application or government welfare cardholders. The period of use of rights was set at 31 May 2021. The semi-military government clarified the reasons for not providing cash assistance but instead giving the right to use the money and setting a framework for spending. It was because the government did not want people to spend money on alcohol and cigarettes, to make purchases in general convenience stores, or to buy gold, jewelry, silver, or gemstones which were not the objective of the project. These reasons seemed logical mistakes. For example, the amount of only 7,000 baht would not be able to be used to buy gold, jewelry, silver, or gemstones. Further, was it wrong to consider the drinking behavior of the minority to judge the majority of the larger population? Although some Thai people drink alcohol, they are very few.

Figure 4.2 Photos of People without Smartphones Queuing up to Register for Financial Assistance

Source: Khaosod (2021); Matichon (2021); Posttoday (2021b); Thairath (2021b); Thebangkokinsight (2021)

Using this issue to frame what can be purchased, undermined the freedom of spending of the large population in the entire country, as people have different spending needs. The semi-military government pointed out that this project would allow 200 billion baht to enter the economy without disappearing within two

months as specified. This financial aid during the pandemic did not focus on humanitarian aid but rather focused on the economic benefits in the market system for a specified time.

The methods of this project reflected the problems of government data utilization that did not use the available citizens' data and did not integrate the data for providing public services. It somehow discriminated against the people by using technology and data that undermined their citizenship and some freedom as well. The ethics in the use of technology and data for this semi-military government were questioned; why did the government not take into account the limitations of people, such as the affordability of smartphone mobile connectivity, or the ability to use a smartphone? Why did the government not use the available data to run the project to help people? Importantly, in a diverse society with social inequality, why did the government not create service choices to provide the public service to cover all groups of people so that they could access it conveniently based on their conditions? Providing public services by the government should not increase the burden on the citizens.

In addition to the example above, many citizens were judged and arrested during the political movement when the semi-military government had always been criticized for its lack of democracy. This critical democratic environment was a barrier to the government's capability and the freedom of the people. The lack of democracy resulted in the people's lack of freedom in demanding data disclosure. At the same time, the government itself, which had a semi-absolute power system, did not disclose data.

> If when it is not democratic, the people cannot have the power to monitor or check the government, or force the government to disclose the data. Here it is completely blocked. Non-democratic culture means the government has a culture to be closed. If the state is the semi-empowered state, the state will not disclose data, which will result in the lack of data that can be exploited (informant B).

Similarly, expert C indicated that freedom of political expression was needed to support the government's capability, especially for an open government and for citizen engagement.

> Freedom of political expression is essential for open government. We talk about open government as transparency and responsibility for what the government does. So, without freedom, how can we criticize that this is not good? But there is no need to look at criticism to find fault with the government, don't look at it negatively. We look at open government positively that if the government's work wants to do well, there must have feedback from the people on what is good and bad. If no feedback comes out, how can the government be sure that what it does is good? So I think that being an open government has to have freedom (informant C).

It can be seen that the authoritarian culture and the political context of Thailand have greatly affected the government's potential and OGD utilization.

4.1.7.5 The Impacts of OGD in Thailand

The responsible agency perceives the importance of OGD as one of the methods that will help promote and lead to a strong and progressive country by relying on the ability of access to knowledge sources or data that are useful to the public (Digital Government Development Agency (Public Organization) (DGA), 2020c). The push to use the OGD to create boundless possibilities can create opportunities and can be the starting point for effective information technology innovations. The OGD provided by the government is a huge resource for individuals and organizations. However, the use of OGD is still rare in Thailand. An example is the use of OGD to support anti-corruption. OGD for the public and civil society can help them monitor their government operations by their announced policies to the public (Digital Government Development Agency (Public Organization) (DGA), n.d.-b).

Thailand has disclosed data from various agencies to prevent corruption, such as company and board names, government procurement information,

corporate registration information, and so on through the activity so-called "Datathon." This activity is for the public, government officials, and data specialists to use OGD to analyze relationships between datasets such as those that are not responsible for work, supreme court decisions, the office of the securities and exchange commission, and securities (SEC), the office of the national counter corruption commission (NACC), and news about corruption. The benefits of the events are that the datasets are linked to checking politicians' relations for having been convicted of corruption, and investigating corruption in government procurement programs to analyze opportunities for a compromise in the bidding (Digital Government Development Agency (Public Organization) (DGA), 2020b). One of the experts, C, stated how to take advantage of OGD related to the prevention of corruption as follows.

> Government procurement data available on the website "gprocurement.go.th" is the data of millions of procurement projects. If asked, if it was opened, has someone used it? TDRI took it. When we look at it, we understood where the problem of government procurement was. When we looked at this data, we found that every project had a similar pattern, such as a construction project, the auction price would be 0.3 percent lower than the median price. Medical drug procurement project, the auction price is about 10 percent lower than the middle price.

In another example from the interviews, A pointed out that OGD was used to monitor how the government has spent taxes and was used for businesses in their decision-making.

> One of the public sectors that make use of OGD is the website called "where does the tax go?" (https://govspending.data.go.th/). It shows how the Thailand government spends its budget. What the government sector has done. Also, the ministry of commerce has opened shareholder data. The private sector can use this data in business planning. Startups can also use the data to further develop new businesses.

From the analysis of documents and interviews, it was found that the use of OGD focuses on preventing corruption, building an understanding of public sector operations and performances for the people, and expecting the private sector to use the data. However, there is still relatively little use of OGD in Thailand, which has resulted in fewer impacts of OGD as well. One of these reasons arose from the fact that government agencies themselves were not serious about using OGD themselves.

> OGD are important to people and the country's development through a planning and policy process. Thailand has internationally recognized and standardized electronic population data but has not yet developed further. The public sector should expand the existing data to cover all development and area dimensions so that the data can be processed for use in planning or policy-making. But as of now, the government does not take the OGD very seriously (informant B).

However, there is a hope that OGD will help the public sector work more efficiently if there are enough data; we will know what we can do to make the most of it, and how it will meet the resolution of public problems. One of the experts expected that open public disclosures and the use of them would further improve the country in many ways.

> In the future, if we can make the public sector first disclose information about what projects they have in mind, then the public express their opinions on the project so that the project can be developed to meet the real needs of the people. If we have enough OGD and can make it a good governance system, then our policy will no longer be a budget division. Policy formulation is based on the data of population and area. The transparent of the government will be a consequence. Citizens will come to work with the government or they can come to help work for the government, such as informing or examining the government sector about the problems instead of the

government being the sole operator. Disclosure of OGD thus improves relations between the government and the people as well (informant A).

4.2 The Results of the Tested Model

Secondary data from 115 countries were employed for analysis. Table 4.16 summarizes the regional proportions of the countries. Table 4.16 presents the proportion of countries by region.

Table 4.16 Countries Categorized by Regions

Regions	Frequency (Percent)
East Asia and Pacific	12 (10.4)
Europe and Central Asia	40 (34.8)
Latin America and the Caribbean	20 (17.4)
The Middle East and North Africa	12 (10.4)
North America	2 (1.7)
South Asia	4 (3.5)
Sub-Saharan Africa	25 (21.7)
Total	115 (100.0)

4.2.1 The Assessment of the Measurement Model

The results of the measurement model, which is the second-order constructs, are presented in two parts: (i) the result of first-order constructs and (ii) the result of second-order constructs. The assessment of the measurement model, which confirmed the construct validity, including convergent validity, discriminant validity, and no multicollinearity, is presented as follows.

4.2.1.1 The Assessment of First-Order Constructs

The measurement model of the formative first-order constructs was validated by applying the factor analysis. Table 4.17 displays the factor analysis results.

First, convergent validity or indicator validity was examined by considering the values of outer weights between items within a variable that ought to be significant. If not, the values of outer loadings ought to be greater than 0.5 (Hair et al., 2019; Lee et al., 2016). However, although the value of outer loading were less than 0.5, the item could be retained if there was empirical research or theoretical considerations support its significance. Importantly, if it was deleted, content validity would reduce (Hair et al., 2019). According to the analysis, the values of the outer weights of many items were significant (*p*-value < 0.05), except for the items of OGDC, OGDE, MOGD1, and MOGD2. However, since the outer loading of OGDE was greater than 0.5 (outer loading of OGDE = 0.785), OGDE had to be kept in order to measure OGD. Further, although the outer loadings of the other items were below 0.50 (outer loading of OGDC = 0.334, outer loading of MOGD1 = 0.449, and outer loading of MOGD2 = 0.453), the measurements of these items were direct questions that represented their constructs. Additionally, there were literature reviews that supported each item, i.e. OGDC measured the level of data existence (the relevant literature, e.g. Kalampokis et al. (2011), Kassen (2013), and Reiche and Höfig (2013), MOGD1 measured the extent of a clear implementation plan of a government in utilizing information to improve the competitiveness of a country (the relevant literature, e.g. Dawes et al. (2016) and Marr (2017), and MOGD2 measured the success level of the promotion of the use of information technology in a country (the relevant literature, e.g. Kassen (2013), Wang and Lo (2016), Zhao and Fan (2018), and Zuiderwijk and Janssen (2014). Content validity would be reduced if deleting these items. Thus, the items would remain for this research in order to sustain the contribution of indicators and content validity (Hair et al., 2019).

Second, discriminant validity was examined by considering the difference of cross-loadings among a variable and the other variables (Henseler et al., 2009; Lee et al., 2016; Sarstedt et al., 2014). The cross-loadings within a construct should be greater than the other constructs. The results showed that most of cross-

loadings of the items within a variable were greater than those of the other variables, except the items of MOGD1 and MOGD2. That is, the cross-loadings of MOGD1 and MOGD2 were 0.449 and 0.453 for the MOGD construct, which were less than the cross-loadings for POGD (0.502, 0.499), SI (0.617, 0.618), and DS (0.509, 0.541), respectively. However, the measurements of these items were direct questions (MOGD1 measured the extent of a clear implementation plan of a government in utilizing information to improve the competitiveness of a country, and MOGD2 measured the success level of the promotion of the use of information technology in a country) that represented their constructs and they did not have meanings or contributions to POGD, SI, or DS. Further, they were supported by the relevant literature. Thus, the items were retained for their latent constructs (MOGD) in order to sustain content validity (Hair et al., 2019).

Last, no multicollinearity was ensured by using the variance inflation factor (VIF), which should not exceed 10, which is the accepted value (Gujarati, 2003; Henseler et al., 2009; Sarstedt et al., 2014; Urbach & Ahlemann, 2010). The results presented that the VIF values of all measurement items were less than 10, which shows that there is no multicollinearity for the first-order constructs.

4.2.1.2 The Assessment of Second-Order Constructs

Table 4.18 shows that the model of the second-order constructs was assessed using factor analysis. The latent variable scores from the first-order constructs were used for the second-order constructs. The quality of the measurement model in the second-order constructs was tested in two steps. First, convergent validity was found to be acceptable. The results showed that most of the outer weights values were statically significant at p-value < 0.05, except for DC and TA. However, the outer loadings of DC and TA (outer loadings of DC = 0.837 and outer loadings of TA = 0.730) were greater than 0.50, which demonstrated convergent validity. To maintain convergent and content validity, DC and TA were kept (Hair et al., 2019). Second, discriminant validity was verified because the cross-loadings of the items and their targeted variables were greater than the cross-loading on the other variables in comparison. It represented that each items shared greater variance with its variables rather than other variables. Last, multicollinearity criteria was examined by

considering the values of VIF that should be below 10. The results showed that there was no multicollinearity in the model. In sum, the results from the three criteria confirmed that the measurement model of the second-order constructs was consistent with the data. Therefore, the model was suitable for further analysis.

Table 4.17 Results of Factor Analysis of Formative First-Order Constructs

Latent variables in formative first-order constructs	**Items**	**Outer weights *(Outer loadings)***	**t-value**	**VIF**	**Cross loadings**														
					1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.Open government data (OGD)	OGDC	0.044 *(0.334)*	0.867	1.187	0.334	0.195	0.317	0.266	0.246	0.265	0.146	0.274	0.245	0.218	0.211	0.249	0.297	-0.030	0.091
	OGDT	0.106**	2.579	4.200	0.926	0.712	0.770	0.771	0.709	0.732	0.621	0.650	0.660	0.685	0.608	0.677	0.787	-0.118	0.541
	OGDM	0.238***	3.364	5.911	0.969	0.706	0.813	0.815	0.748	0.761	0.550	0.731	0.712	0.754	0.654	0.704	0.800	-0.203	0.491
	OGDE	0.446 *(0.785)*	1.548	2.455	0.785	0.481	0.687	0.661	0.570	0.653	0.386	0.668	0.560	0.613	0.518	0.571	0.670	-0.081	0.390
	OGDL	0.288**	3.054	2.445	0.854	0.667	0.688	0.684	0.703	0.732	0.586	0.627	0.763	0.744	0.644	0.567	0.657	-0.067	0.365
2. Administrative cultural transformation (ACT)	ACT	1.000	-	1.000	0.738	1.000	0.699	0.689	0.685	0.627	0.570	0.517	0.668	0.657	0.486	0.616	0.696	-0.187	0.570
3.The policy of OGD (POGD)	POGD1	0.723***	15.326	1.293	0.772	0.591	0.926	0.853	0.778	0.770	0.506	0.727	0.722	0.684	0.642	0.595	0.694	-0.124	0.378
	POGD2	0.428***	8.128	1.293	0.647	0.637	0.772	0.608	0.525	0.600	0.671	0.424	0.590	0.763	0.348	0.721	0.709	-0.034	0.569
4. The management of OGD (MOGD)	MOGD1	0.022 *(0.449)*	0.198	8.131	0.342	0.310	0.502	*0.449*	0.226	0.357	0.371	0.178	0.325	0.617	0.060	0.406	0.509	0.261	0.435
	MOGD2	0.142 *(0.453)*	0.225	8.106	0.352	0.326	0.499	*0.453*	0.216	0.342	0.413	0.159	0.319	0.618	0.061	0.417	0.541	0.241	0.366
	MOGD3	0.937***	36.494	1.112	0.824	0.678	0.848	0.988	0.806	0.805	0.541	0.748	0.796	0.725	0.669	0.613	0.738	-0.058	0.454

Latent variables in formative first-order constructs	Items	Outer weights *(Outer loadings)*	t-value	VIF	Cross loadings														
					1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
5. Data cooperation (DC)	DC	1.000	-	1.000	0.776	0.685	0.787	0.791	1.000	0.820	0.618	0.770	0.809	0.690	0.625	0.622	0.730	-0.200	0.366
6. Government support (GS)	GS1	0.599***	8.903	2.088	0.762	0.571	0.785	0.748	0.780	0.944	0.566	0.783	0.796	0.719	0.609	0.606	0.655	-0.091	0.339
	GS2	0.478***	6.928	2.088	0.730	0.597	0.718	0.759	0.738	0.910	0.565	0.734	0.717	0.705	0.591	0.534	0.642	0.011	0.374
7. Research and development (RD)	RD1	0.640***	3.737	4.281	0.614	0.586	0.647	0.568	0.584	0.596	0.982	0.436	0.665	0.606	0.396	0.703	0.620	-0.028	0.479
	RD2	0.390**	2.219	4.281	0.557	0.499	0.612	0.540	0.627	0.583	0.951	0.481	0.654	0.580	0.420	0.577	0.597	-0.052	0.362
8. Citizen engagement (GE)	CE	1.000	-	1.000	0.745	0.517	0.707	0.727	0.770	0.820	0.467	1.000	0.687	0.647	0.696	0.513	0.681	-0.161	0.292
9. Economic impact (EI)	EI1	0.330**	2.094	3.170	0.714	0.599	0.704	0.738	0.699	0.743	0.605	0.588	0.917	0.702	0.609	0.536	0.611	-0.060	0.321
	EI2	0.709***	4.877	3.170	0.738	0.663	0.764	0.782	0.815	0.809	0.678	0.694	0.983	0.757	0.639	0.584	0.704	0.004	0.347
10. Social impact (SI)	SI1	0.532***	6.081	1.779	0.699	0.526	0.669	0.698	0.629	0.711	0.416	0.634	0.693	0.872	0.666	0.426	0.581	-0.046	0.272
	SI2	0.205**	2.308	1.571	0.459	0.353	0.471	0.500	0.527	0.568	0.322	0.513	0.600	0.663	0.532	0.237	0.395	0.018	0.160
	SI3	0.507***	6.657	1.223	0.630	0.601	0.728	0.605	0.488	0.538	0.646	0.405	0.546	0.790	0.287	0.725	0.714	0.015	0.548
11. Transparency and accountability (TA)	TAA	1.000	-	1.000	0.684	0.486	0.613	0.637	0.625	0.647	0.418	0.696	0.655	0.609	1.000	0.381	0.582	-0.136	0.224
12. ICT infrastructure (ICTI)	ICTI	1.000	-	1.000	0.716	0.616	0.739	0.643	0.622	0.618	0.675	0.513	0.591	0.643	0.381	1.000	0.744	-0.282	0.587

Latent variables in formative first-order constructs	Items	Outer weights *(Outer loadings)*	t-value	VIF	Cross loadings														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13. Data security (DS)	DS1	0.505***	5.913	1.503	0.708	0.642	0.679	0.667	0.657	0.590	0.522	0.628	0.580	0.536	0.548	0.644	0.860	-0.196	0.522
	DS2	0.224**	2.819	1.760	0.633	0.583	0.734	0.652	0.498	0.550	0.569	0.402	0.540	0.767	0.283	0.705	0.768	0.037	0.559
	DS3	0.459***	6.005	1.763	0.708	0.526	0.650	0.648	0.626	0.606	0.522	0.598	0.628	0.674	0.529	0.570	0.859	-0.062	0.366
14. Trust in national government (TG)	TG	1.000	-	1.000	-0.150	-0.187	-0.104	-0.014	-0.200	-0.049	-0.038	-0.161	-0.017	-0.013	-0.136	-0.282	-0.119	1.000	0.025
15. Political instability (PI)	PI	1.000	-	1.000	0.507	0.570	0.517	0.487	0.366	0.382	0.448	0.292	0.352	0.455	0.224	0.587	0.557	0.025	1.000

Note * p < 0.1, ** p < 0.05, *** p < 0.01

Table 4.18 Results of Factor Analysis of Formative Second-Order Constructs

Latent variables in formative second-order constructs	**Items (Latent variables) from formative first-order constructs**	**Outer weights *(Outer loading)***	**t-value**	**VIF**	**Cross loadings**						
					1	**2**	**3**	**4**	**5**	**6**	**7**
1. Open government data (OGD)		1.000	-	1.000	1.000	0.893	0.835	0.716	0.824	-0.150	0.507
2. Government capability (GC)	2.1 Administrative cultural transformation (ACT)	0.187**	3.167	2.299	0.738	0.800	0.702	0.616	0.696	-0.187	0.570
	2.2 The policy of OGD (POGD)	0.239**	2.649	5.691	0.835	0.937	0.853	0.739	0.805	-0.104	0.517
	2.3 The management of OGD (MOGD)	0.237**	2.463	5.363	0.830	0.929	0.843	0.643	0.780	-0.014	0.487
	2.4 Data cooperation (DC)	0.014 *(0.837)*	0.166	4.346	0.776	0.873	0.795	0.622	0.730	-0.200	0.366
	2.5 Government support (GS)	0.228**	2.820	5.269	0.805	0.917	0.845	0.618	0.699	-0.049	0.382
	2.6 Research and development (RD)	0.106**	2.038	1.959	0.611	0.715	0.675	0.675	0.630	-0.038	0.448
	2.7 Citizen engagement (CE)	0.133**	2.000	3.525	0.745	0.818	0.729	0.513	0.681	-0.161	0.292
3. Data impacts (DI)	3.1 Economic impact (EI)	0.415***	3.934	2.826	0.759	0.861	0.922	0.591	0.702	-0.017	0.352
	3.2 Social impact (SI)	0.559***	5.738	2.567	0.785	0.840	0.950	0.643	0.752	-0.013	0.455
	3.3 Transparency and accountability (TA)	0.118* *(0.730)*	1.655	1.837	0.684	0.682	0.730	0.381	0.582	-0.136	0.224
4. ICT infrastructure (ICTI)		1.000	-	1.000	0.716	0.734	0.650	1.000	0.744	-0.282	0.587

Latent variables in formative second-order constructs	Items (Latent variables) from formative first-order constructs	Outer weights *(Outer loading)*	t-value	VIF	Cross loadings						
					1	2	3	4	5	6	7
5. Data security (DS)		1.000	-	1.000	0.824	0.835	0.780	0.744	1.000	-0.119	0.557
6. Trust in national government (TG)		1.000	-	1.000	-0.150	-0.103	-0.031	-0.282	-0.119	1.000	0.025
7. Political instability (PI)		1.000	-	1.000	0.507	0.524	0.427	0.587	0.557	0.025	1.000

Note * p < 0.1, ** p < 0.05, *** p < 0.01

4.2.2 The Assessment of the Structural Model

As illustrated in Table 4.19 and Figure 4.3, the structural model was tested by four main criteria: nomological validity, coefficient of determination (R^2), blindfolding (Q^2), and overall model fit as follows.

Table 4.19 Structural Model Path Coefficients and Significance Testing

Hypotheses	Structural relationship	Path coefficient	T statistics	P values	Results
H1	ICTI → OGD	0.226	3.302	0.001	Supported
H2	DS → OGD	0.655	9.206	0.001	Supported
H3	TG → OGD	-0.008	0.189	0.850	Not supported
H4	OGD → DI	0.125	1.426	0.154	Not supported
H6	OGD → GC	0.893	40.559	0.001	Supported
H7	GC → DI	0.831	9.642	0.001	Supported

First, nomological validity was examined by considering the significance of path coefficients between variables (Hair et al., 2019; Henseler et al., 2009b; Urbach & Ahlemann, 2010). Table 4.19 shows that the path coefficients of ICTI and DS on OGD were significant; H1 was supported. The path coefficient of DS on OGD was also significant; H2 was supported. However, the path coefficient of TG on OGD was not significant; H3 was not supported. Further, the path coefficient of OGD on DI was not significant; H4 was not supported. The path coefficient of OGD on GC was significant; H6 was supported. The path coefficient of GC on DI was significant; H7 was supported. The nomological validity of each relationship were shown in Figure 4.3.

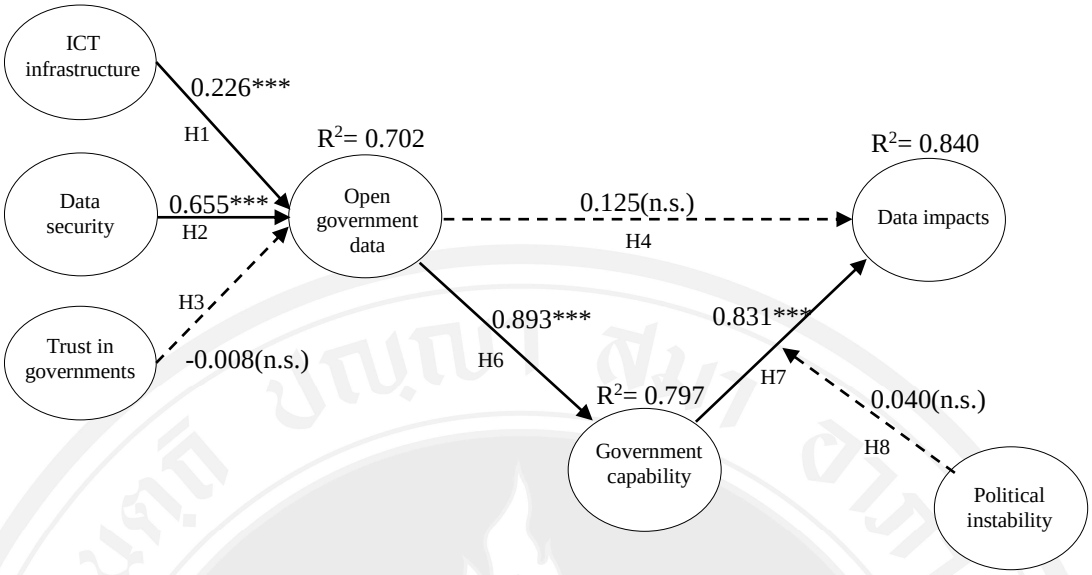


Figure 4.3 The Results of PLS-SEM

Significant paths: * p < 0.1, ** p < 0.05, *** p < 0.01, n.s. = non-significance

In terms of mediating analysis as shown in Table 4.20, the coefficient of OGD and GC on DI was 0.741, which was statistically significant (p-value < .05); H5 was supported. As the direct effect was not significant while the indirect effect and total effect were significant, this represented the role of the mediating variable as full mediation for this model as recommended by Hair et al. (2017) and Zhao et al. (2010). It represented that releasing the power of OGD requires government capability as a mediator to make valuable impacts.

Table 4.20 The Mediating Effect

Hypothesis	**Structural relationship**	**Direct effect**	**Indirect effect**	**Total effect**	**Result**
H5	OGD → GC→ DI	0.125	0.741***	0.867***	Supported

Note * p < 0.1, ** p < 0.05, *** p < 0.01

T statistics for indirect effect = 9.522, *p* value for indirect effect = 0.001

T statistics for total effect = 19.060, *p* value for total effect = 0.001

In the moderated analysis, the coefficient of PI was 0.040, which was not statistically significant; H8 was therefore not supported as shown in Table 4.21.

Table 4.21 The Moderating Effect

Hypothesis	Structural relationship	Original sample	Standard deviation	T-statistics	P values	Result
H8	GC → DI	0.831***	0.086	9.642	0.001	
	PI → DI	-0.089*	0.049	1.816	0.070	
	(PI*GC) → DI	0.040	0.044	0.921	0.358	Not supported

Note * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Second, the coefficient of determination (R^2) was assessed to indicate the predictive fit. According to Hair et al. (2019), and Urbach and Ahlemann (2010), values of R^2 over 0.75 were considered substantial, values of R^2 around 0.50 were considered moderate, and values of R^2 lower than 0.25 were considered weak. The results showed that the preconditions explained 70.2 % of the variance in OGD, which represented a moderate level of explanatory power. OGD explained 79.7 % of the variance in GC, which indicated a substantial level of explanatory power. OGD and GC together explained 84 % of the variance in DI, which showed a substantial level of explanatory power. All the values of R^2 had sufficiently high level of explanatory power, as shown in Figure 4.3.

Third, construct cross-validated redundancy was examined by using the blindfolding (Q^2) showing the predictive power of the research model (Hair et al., 2019). As Hair et al. (2019) suggested, the values of Q^2 were greater than zero reflecting that the path model's predictive accuracy was acceptable for an endogenous construct. The larger Q^2, the higher was the predictive accuracy. As presented in Table 4.22, all three variables had values over 0. Further, the average redundancy for the model was 0.607. These results indicated that the predictive power of the model was high accurate.

Last, the model fit was assessed by following the calculation steps proposed by Lee et al. (2016) and Park, Lee, and Chae (2017). The first step was to find the

average of R^2 of all variables and the average of communalities of all variables. The following step was to multiply between the two averages (average of R^2 and average of communalities). The final step was to calculate the square root of the result of the second step. Following these steps, the results of the first step included the average of R^2 was 0.780 and the average of communality was 0.854. The result of the second step was 0.666. The result of the final step was 0.816. In this regard, the value of the model fit at 0.36 or higher was considered high, the value between 0.25 and 0.36 was considered moderate, and value lower than 0.25 was considered low (Lee et al., 2016; Park, Lee, & Chae, 2017). Thus, the overall model fit was high (0.816) as presented in Table 4.22.

Table 4.22 Research Model Fit

Latent variables	**R^2**	**Redundancy**	**Communality**
ICT infrastructure (ICTI)	-	-	1
Data security (DS)	-	-	1
Trust in governments (TG)	-	-	1
Open government data (OGD)	0.702	0.680	1
Government capability (GC)	0.797	0.543	0.612
Data impacts (DI)	0.840	0.597	0.513
Average	0.780	0.607	0.854
Overall model fit	0.816		

CHAPTER 5

CONCLUSION, DISCUSSION, AND RECOMMENDATIONS

Although open government data (OGD) have become a trend topic in public administration, little is known about how to unlock the power of OGD. This study is an early attempt to explore the systematic mechanisms that explain how OGD is developed and how OGD is transformed to make its impacts. The objectives of this study were thus (i) to perceive the essential preconditions influencing the development of OGD; (ii) to investigate how a government implements the OGD principles; (iii) to explore how a government unleashes the power of OGD; (iv) to investigate how OGD effects on country development in terms of economic, social, and governance impacts; and (v) to provide policy recommendations based on the results of this research for improving OGD and unleashing its power.

Since the OGD concept is a recent phenomenon and is still in the early stage of development, mixed research methods were employed to understand this phenomenon and to be able to develop an OGD model that explains how to develop and utilize OGD. The research started with the case study method as it is often used for early-stages and developing concepts and it offers a holistic understanding. The selection of the case studies was done according to the top-ranking countries in the Open Data Barometer (2017) (World Wide Web Foundation, 2017) including the United Kingdom, Canada, France, the United States, South Korea, Australia, New Zealand, Japan, the Netherlands, and Norway. Additionally, Thailand as a special case was also studied. In this regard, in order to analyze available and relevant documents (i.e. laws and regulations, government policies and plans, government reports, and previous research), document analysis together with the content analysis method were employed. For the Thailand case, key informants were supplementarily interviewed for discussion with the document analysis.

After the ten case studies were analyzed, an OGD model describing how to develop and utilize OGD was developed and tested using the quantitative method. Secondary data from 1 1 5 countries were analyzed employing partial least squares-structural equation modeling. This chapter is divided into three main sections: conclusion, discussion, and research recommendations. The conclusion section explains what this research found. The discussion part comparatively analyzes the results from both methods and the relevant literature. Last, research recommendations including policy implications and recommendations for future research are presented.

5.1 Conclusion

The results were consistent between the qualitative and quantitative methods. They showed that the systematic mechanisms of data driven government were found in the four-linked aspects: (i) pre-conditions influencing the OGD development; (ii) OGD development; (iii) government capabilities (GC); and (iv) OGD impacts (DI). The mixed-methods affirmed the research's argument: although OGD as a strategic asset could not directly impact a country's development, OGD can present valuable impacts when its pre-conditions and government capability are sufficiently supported. To develop OGD, it requires proper conditions. Additionally, in order to unlock the value of OGD, GC is needed. The systematic model explained 84 % of the variance in DI. It was also considered a substantial level of explanatory power. The results showed that the value of R^2 was sufficiently high for the model to have explanatory power with a high model fit (0.816). The linking process of data driven government is presented in Figure 5.1, which explains how OGD is developed and how OGD's value is unlocked.

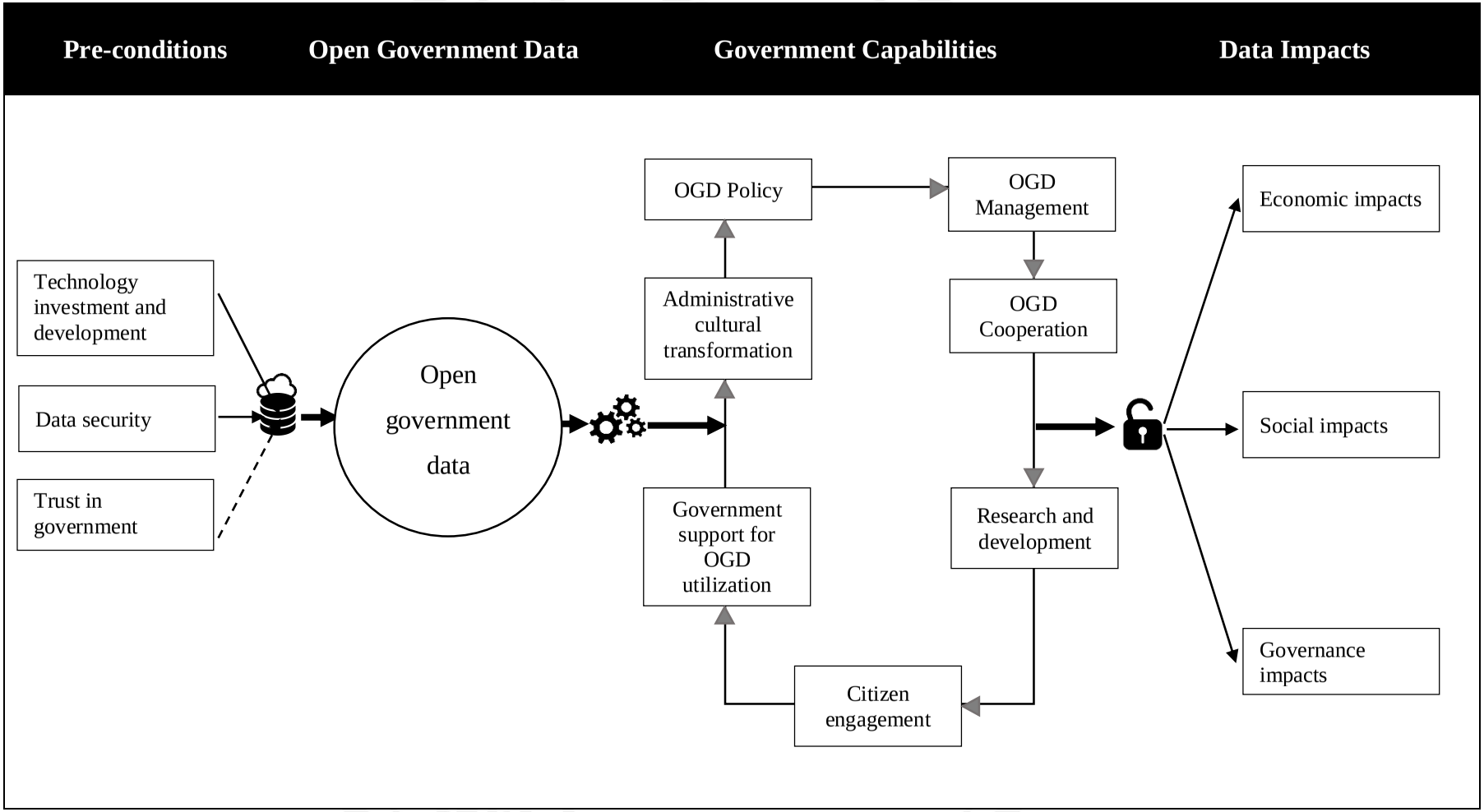


Figure 5.1 The Entire Process of Data Driven Government

Driving governments with data begins with the right and proper preconditions for the development of OGD. Based on the case study analysis, the ten leading countries have made great progress in opening their data and increasing access for people through supporting these preconditions. To accomplish OGD development, there are three major preconditions for governments: investment in the infrastructure of information and communication technology (ICTI); data security (DS); and citizen trust in their national government (TG). Figure 5.2 presents the main idea of each precondition.

ICTI is the fundamental need for building government data since it is relevant for accessing, reusing, and applying data. The ICTI policy should indicate (i) how advanced technology, such as Cloud technology, the Internet of Things, and application programming interfaces, will be invested; (ii) clear guidelines/standards to improve technology for OGD development; and (iii) the technology environment of OGD. Advanced technology can harvest data from other repositories, presenting the data itself, making it easier for the public to find and access government data and services online. Additionally, the principles to improve technology for OGD development should be described in order to ensure coherent use and development of advanced technologies, such as a user-centric focus, better access, seamless service delivery, and connected government. The ten governments have not only developed advanced technology but have focused on improving the technology environment of OGD. The governments have served and drawn up a strategy for expanding electronic communication infrastructure and networks, as well as high-speed Internet broadband. Government agencies have set ongoing strategies to make websites and software applications accessible. Unprofitable areas, such as remote areas or islands, are also provided with high-speed broadband. These efforts have aimed to achieve a society where anyone can benefit from advanced technology anytime and anywhere.

Importantly, DS is also a fundamental prerequisite for developing and implementing OGD. Fundamentally, citizens' rights, privacy, and personal information are protected by law. Government agencies must carefully scrutinize that personal information will not be made public; personal information should be disseminated to only those that are authorized to know the information. In order to secure OGD, the ten leading countries have established specialized organizations to

be responsible for this issue and to build the cybersecurity context, provide knowledge, and indicate vulnerabilities. Further, the governments have pursued their action to build relationships among specialists at the international level, including NATO, the EU, and the UN. Additionally, privacy impact assessment (PIA) has been implemented by many countries to (i) describe how personal data flows in the data cycle; (ii) analyze the individual's privacy impacts; and (iii) identify the possible options to manage and minimize the impacts. PIA ensures that the data or information stored is leveraged for the intended purpose with data security according to relevant laws and regulations.

Moreover, TG is vital for the implementation of any reforms in a country. Lack of trust in data lifecycle management can result in underused data and potential loss of benefits. According to the content analysis, some countries (including the United States, France, Australia, New Zealand, and Norway) have paid attention to this topic, but some have not. In order to increase trust in OGD development, setting out frameworks or requirements of OGD that are relevant to the issues of citizens' rights, privacy, and personal information is needed, such as citizens' rights guarantees, and effective management of risk. Further, maintaining an understanding of the OGD process is required. Governments have continually set out and released their frameworks or requirements of OGD to guarantee the whole process of open data, budget investment, how OGD is used, and oversight performance evaluation.

Consistently with the qualitative results, the quantitative results fairly confirmed that ICT infrastructure should be well designed and developed and secure, and strict data security must already be in place. The two preconditions explained 70.2 % of the variance in OGD, which represented a predictive fit for the model to have a moderate level of explanatory power, while trust in government did not significantly influence OGD improvement. In this matter, trust in government will be further described in the next section.

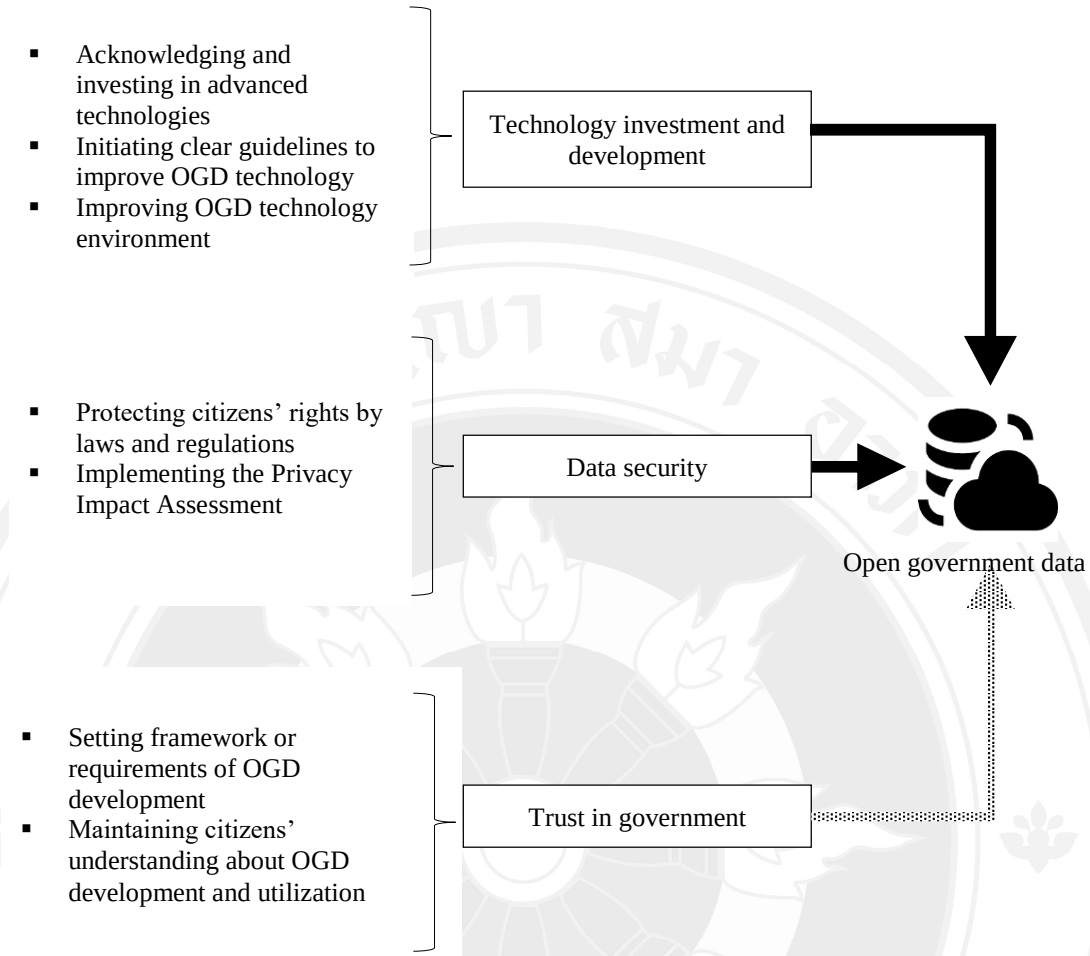


Figure 5.2 Preconditions for Developing OGD in the Ten Leading Countries

After the prerequisites are ready, the government should take action to disclose OGD to the public. The term "open government data" differs according to the country. It is also known as "open public data" in Norway, "open data" in the United Kingdom, Canada, France, the United States, New Zealand, Japan, and the Netherlands, "public data" in South Korea, and "big data" in Australia. These keywords are often used interchangeably to refer to OGD in their policy. After thoroughly analyzing available documents (i.e. laws and regulations, government policies and plans, government reports, and previous research), the ten governments have declared their policies of OGD principles to ensure that the data are made available and assessable in an appropriate manner. The implemented common principles of OGD included eight principles as presented in Figure 5.3: completeness,

timeliness, machine readability, open standards /open formats, openly licensing, free of charge, non-discrimination, and open by default.

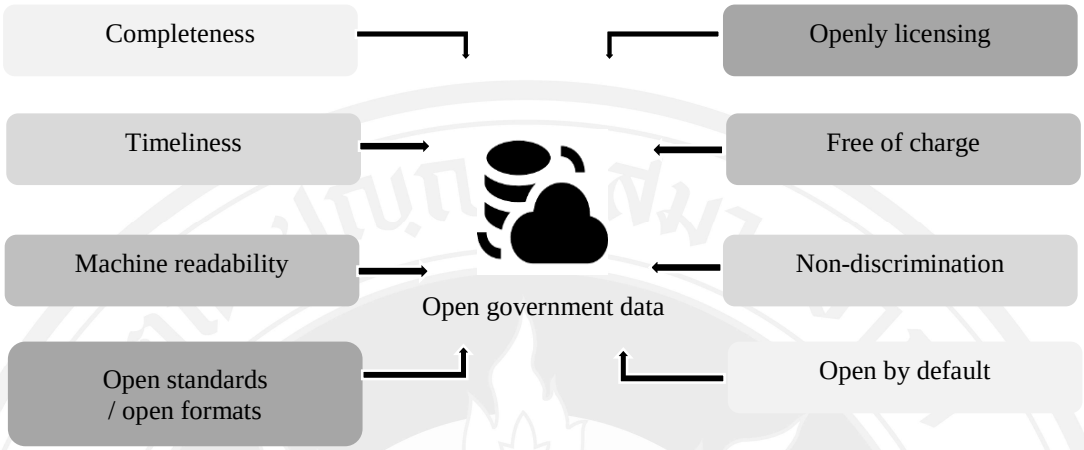


Figure 5.3 Principles of OGD Implementation in the Ten Leading Countries

Completeness refers to data that are completed, available, and accessible. Timeliness refers to data that are frequently and continuously kept up to date automatically as quickly as possible in order to ensure that the latest data are available. Machine readability refers to data that will be freely released in machine-readable form so that the public can easily and automatically read and processed it by a computer, software, or a machine for searching, indexing, modifying, and downloading it without human intervention. Open standards or open formats refer to data that will be published in standard formats that are reusable and readable by a computer or software, such as MS Word, HTML, XLS, CSV, Zip, Atom, RDF(Turtle), RDF(XML), RSS feed or XML, JSON, Shapefile, etc. Open licensing refers to data that are freely used without restrictions, and are not subject to any copyrights, regulations, or patents. Free of charge refers to data that are freely accessed and used by the public at no charge. Non-discrimination refers to data that are proactively available for everyone without mandatory registration, restrictions, requiring the information of a user, or applying for any permission. It can be used by anyone, from anywhere, and for any purpose. Open by default refers to data that are

proactively released, are provided with easy accessibility, and meaningfully respond to citizens' requests, for both government data and their own data.

Interestingly, the United Kingdom and the Netherlands have adopted the framework of data openness levels developed by Berners-Lee (2006) to improve their OGD open formats. The levels of data openness that are relevant to open data formants are presented in Figure 5.4.

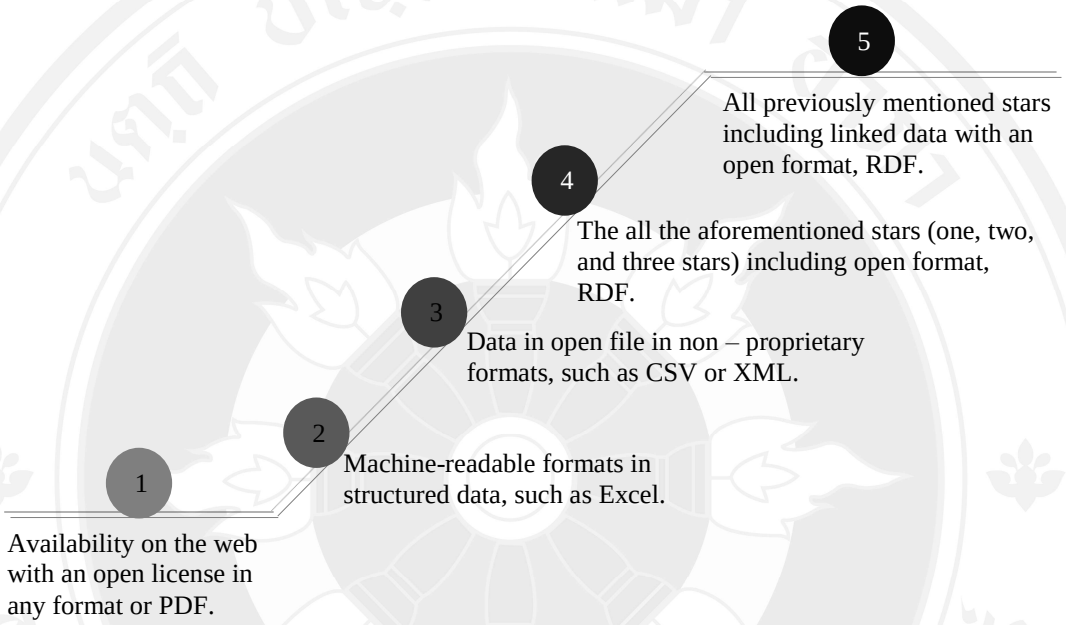


Figure 5.4 Levels of Government Data Openness
Source: Berners-Lee (2006) and Minister for the Cabinet Office and Paymaster General of England (2012)

However, although OGD have been made public, OGD itself cannot create huge value. The results of both research methods showed consistently that government capabilities are critical to unlocking the value of OGD. Based on the ten case study analyses, this research identified seven key activation capabilities: administrative cultural transformation, OGD policy, OGD management, data cooperation, government support, research and development, and citizen engagement, each of which helps us identify how data unlock their power. The statistical analysis confirmed that these government capabilities (GC) fully mediated the relationship

between OGD development and its impacts. GC as the mediator can significantly explain 84% of the relationship between OGD and DI. The key mechanisms for unleashing the power of OGD in the ten leading countries are presented in Figure 5.5.

First, the administrative culture needs to be transformed to be more open. Traditional cultural organizations seem to be unable to unleash the power of OGD. The ten leading countries saw this challenge and implemented the idea of open government to transform the traditional culture and to obtain the benefits from new advanced technology. The open government supports governments to be more transparent, more accessible, and more collaborative with the public. Document analysis shows that open government is necessary to be able to release the power of open data. The more open the government is, the more people will be able to participate in the use of data and unlock its value. Driving open government help to ensure and enhance the OGD improvement by (i) getting more understanding of citizens' needs and taking steps to address OGD issues; (ii) getting citizens' ideas, expertise, feedback, and assessment from the public in utilizing OGD; (iii) encouraging public agencies to open up their data; (iv) ensuring that citizens will receive and access accurate and clear data; (v) realizing the potentiality of OGD from the public as data users; and (vi) supporting public engagement in OGD policy. Through employing the open government and OGD, it will (i) offer various economic opportunities by reusing OGD; (ii) contribute to finding solutions to social issues by collaborating between the public and the governments; (iii) enhance and empower citizen participation in policymaking and service design; (iv) create more informed and active citizenship; (v) strengthen the positive relationship between the government and citizens; and (vi) support the public to be involved in the decision-making process by stating their opinions and controlling their government on an OGD basis.

Second, the ten leading countries have a long history of opening government data. Opening up government data was relatively a result of the "freedom of information act" or "right to information act" in these countries. Although the right to access the government data or information is proposed, providing access to the original data does not automatically grant reuse rights. The ten countries need to establish a law to declare and guarantee the right to use or reuse the government data.

The policies support OGD development in all of the government agencies and at all government levels. The policies supported the OGD utilization. OGD utilization is guaranteed and promoted by law without registering or making any requests. Allowing data users to use the open data in new contexts was indicated. Improving clear and digitalization-friendly regulations was acknowledged to facilitate increased data sharing, to support data utilization, and to protect privacy. The positive impacts of OGD are acknowledged in OGD policy, such as OGD being one of the cornerstones of digitizing the governments, OGD as a strategic asset for evidence-based policy, OGD as an asset for citizen participation.

Third, ten countries have executed the OGD policies by giving their political will and by prioritizing their missions focusing on the OGD development and utilization. OGD management are founded in three main aspects. First, the governments established responsible organizations, such as establishing a specialized organization to be responsible for promoting and assisting OGD among all government agencies and at all government levels. Within government agencies or other government levels, the national governments support each public agency to appoint a chief data officer and a statistical expert. For example, the United States established the "foundations for evidence-based policymaking act (2018)" on January 14th, 2019 for its public agencies to follow. The act defined an organizational structure for the development and utilization of OGD including a chief data officer, a chief information officer, a chief privacy officer, a chief performance officer, and evaluation officer, a statistical expert, and stakeholders as data users. Further, it defined cooperation with other organizations as its network, including a council of chief data officers and an advisory committee on data utilization. Second, all government agencies (i.e. departments, ministries) are committed to initiating their own OGD strategy and plan. The contents of such strategies and plans included the announcement of OGD commitments and standards, how the OGD management and advanced technology will be integrated, how OGD connects with other development policies, what activities should support OGD improvement, what measures are necessary to ensure quality control at a reasonable level, how to expand public participation as co-creation for OGD development and utilization, how annual assessment should be conducted, how time-bound activities will be implemented, and

how action plans will be delivered. In this matter, the strategies and plans of OGD management are clear, consistent, and updated frequently. Last, the governments have proactively published and opened up their OGD by launching a centralized OGD portal that serves as a data catalog site available for the use of data.

Fourth, OGD cooperation among public agencies and government levels is required. The countries have committed to implementing OGD with the principle of open by default. This supports government agencies at all levels to proceed with the OGD system. OGD commitments have been embedded in many government agencies (such as government departments and ministries) of the national governments since they are a co-design with their government to implement and use OGD. All government agencies are required by law to automatically publish and release public data. The United States requires its public agencies under the federal government to open OGD by default. The United Kingdom and Canada do not apply OGD policy at local government levels either in state and local governments but they are encouraged by their national government to develop and implement the OGD approach with open standards, principles of OGD, and a national OGD portal. In some countries, such as France and Japan, local governments are mandated by law to automatically publish and release public data. Local governments in such countries are required to establish basic plans and implement measures for promoting the use of OGD. In this matter, nearly all government agencies (departments and ministries) are jointly responsible for implementing the data agenda and for taking a data driven approach. They have developed their open data strategy and have released it on their websites. Government agencies cooperate in creating and operating OGD portals. They keep OGD in a machine-readable format to ensure efficient use, and to devise a means to provide data utilization.

Fifth, the governments have strengthened their citizens and officers with digital competence by growing their skills, inclusion, and culture to use or reuse OGD in effective ways. In order to unlock the power of OGD, they acknowledge that digital skills and inclusion are enabling factors for the implementation of OGD utilization. For public agencies, the governments have invested and developed their government officials in various ways, such as (i) setting up a specialized organization to support OGD development and utilization; (ii) appointing experts, such as chief data officers

and chief information officer; (iii) encouraging state and local governments to open their data in a national open data portal; (iv) offering funding, technical, and consultant services; (v) providing computer-based and data science training; and (vi) supporting the sorting of software and enhancing data culture. For citizens, the governments (i) design user-centric systems for OGD development and utilization; (ii) support two-way connections between data providers and data users; (iii) encourage data users to share their experiences, tools, and codes to leverage OGD utilization; and (iv) organize conferences or competitions.

Sixth, OGD enables researchers to further social issues. It also provides and drives more opportunities to do research. In turn, researchers have played essential roles in OGD utilization, such as conducting research with strong evidence, obtaining more insights into social issues, leading to the improvement of society and economy on how to put OGD into practice, and driving research for value creation, increased efficiency, and innovative public services. It is increasingly clear that evidence-based research and policies respond effectively to social and economic issues. OGD can reduce deficits because policymakers will be able to set budget limits based on clarity on what works, which will drive better service outcomes and lower costs. Research can inform decision-making, develop policy, improve service design and delivery, and better understand what is working and what needs improvement. Additionally, OGD holds major promise for science. OGD-based research can lead to new insights and knowledge. The movement of the OGD concept also encourages researchers to open up their scientific research and data to support further knowledge for society, so-called “open science.” Society will recognize the social and economic benefits of knowledge and data sharing to support the scientific community. In Canada, the United Kingdom, and the United States, all federally-funded science research has committed to being open by default.

Last, citizen engagement is the key contributor to OGD development and utilization. The United Kingdom, Canada, France, the United States, South Korea, New Zealand, Japan, the Netherlands, and Norway have perceived the roles of citizens as their third parties, co-chairs, and co-creation. Citizens or the public can be non-government organizations, individual developers, small and medium enterprises, occupational classes, experts, business/companies/entrepreneurs, universities and

colleges, data/service consumers, civil society organizations, anti-corruption organizations, and civic tech communities, such as civic hackers, volunteer developers, and data scientists. Since OGD can decrease knowledge asymmetries between citizens and governments, providing government data lays the fundamental ground and opportunity for citizen engagement in public policymaking, and innovative ways to use and unleash the power of data. Citizens can help to improve OGD implementation through (i) providing information about the demand for OGD or identifying what data should be prioritized to be released; (ii) providing information about any mistakes, feedback, comments, or suggestions in OGD provided by the government; (iii) being involved in OGD quality assessment and development; (iv) using the OGD to support public discussion; (v) creating value-added services; (vi) monitoring and fighting against corruption; (vii) meaningfully participating in the decision-making process; and (viii) better accessing their government performance, for examples.

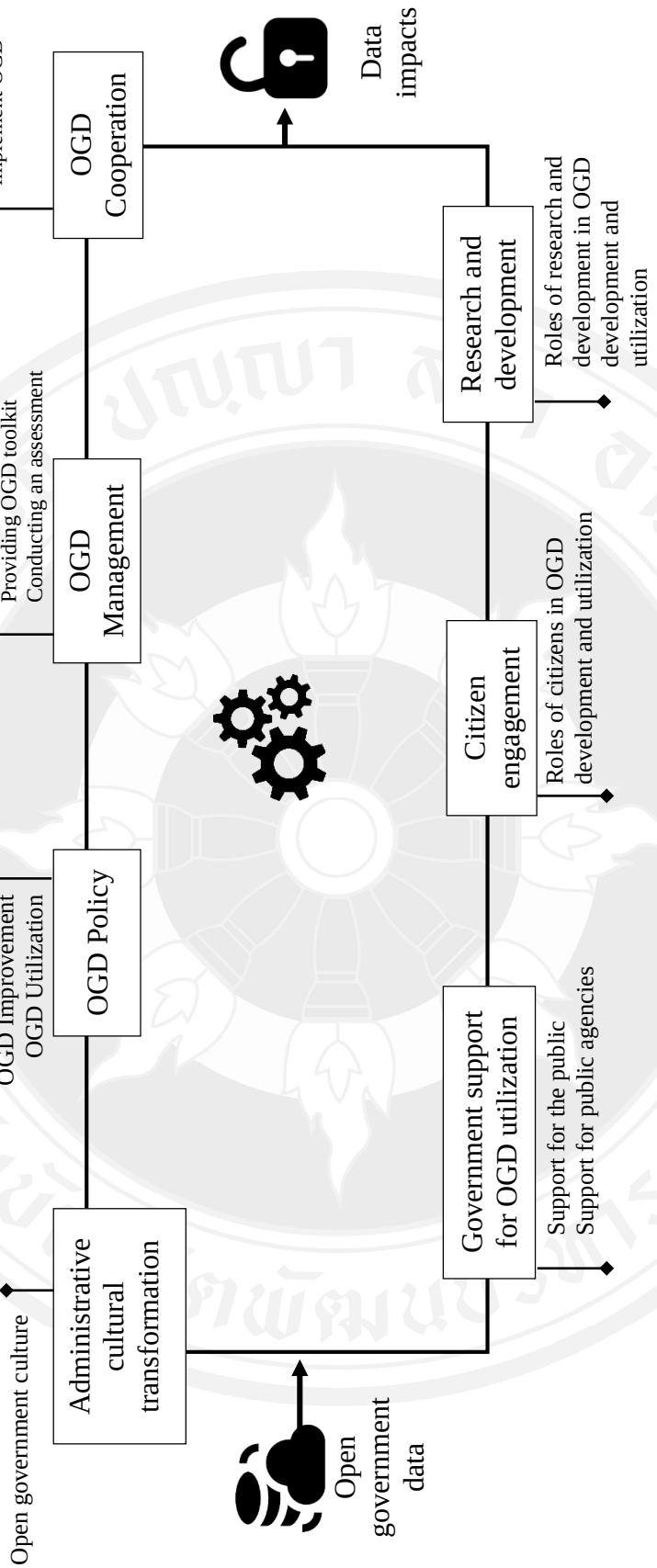


Figure 5.5 The Key Mechanisms to Unleash the Power of OGD in the Ten Leading Countries

Once the OGD's preconditions are met, and OGD implementation and government capabilities are prepared, the effects of OGD on a country's development will appear. The use of OGD is beneficial if the conditions are favorable. Taking advantage of OGD can cover many sectors, users, and interests. Based on analyzing the 79 OGD projects from the private sector, civil society, and government, there exist three main ways in which OGD are having an impact on a country's development, but the impacts are limited to these: economic impacts, social impacts, and governance impacts. A taxonomy of the impacts of OGD is presented in Figure 5.6.

OGD makes the economic development in a country flourish in various ways since OGD are critical to building a base of evidence to encourage governments and businesses to deliver more customized, coordinated, or timely products and services. According to the research results, there are eight dimensions of economic impacts. First, economic growth is created by OGD through increasing economic value, investment, new jobs, and new opportunities. Second, innovation is driven by OGD through creating new services and entrepreneurial activities. Gaining insights through data helps innovators and providers understand the needs of buyers and customers. Third, OGD drives business development, such as start-ups, new markets, and new business models. Through utilizing OGD, start-ups and small businesses are agile and can pilot and experiment with new products. It makes it easier for them to change or alter their products and services. Fourth, OGD boosts operation improvement. Using OGD helps to benchmark key performance indicators and to drive internal change. Fifth, OGD drives smarter decision-making. It will also help to build new businesses, create innovative tools, and inspire new analytics. It helps investors to make better planning decisions regarding investment. Sixth, OGD drives better marketing. It offers the ability to visualize customers on a map, identify new customers, categorize customer segments, and predict the trend of crowded areas. Seventh, OGD boosts public-private partnerships. Collaborating between data users in data collection, data analysis, and data improvement can help increase the understanding of how data can be maximized. Last, OGD supports corporate transparency. Participating in OGD requires private units (individuals or business units) to commit to transparency. To connect with the public sector and the private itself, the private sector tends to share its data in order to facilitate greater connection.

Moreover, OGD improves public services. The social impacts of the use of OGD by the government, the private sector, or civil society are diverse, such as the delivery of appropriate welfare services, health services, infrastructure management, personal service delivery, reducing fraudulent activities, and reducing errors in both public and private sectors. First, using OGD supports citizen-centric services. OGD puts people at the center of public service. Creating a citizen-driven service means using the OGD necessary to understand what kind of standard services they expect. The feedback of citizens is the primary mechanism to develop public services. Second, OGD drives social innovation (application development, and innovative and creative service delivery). Making OGD available can help achieve several goals of social interests. It can develop new services or innovative products on the part of the public and private sectors. Third, real-time or up-to-date services can be provided through the OGD system. OGD also supports better monitoring and use of resources, and better monitoring of public services in the current time. Fourth, public services are better and more smartly developed. OGD offers insights into understanding how people live or behave. This supports the administration in deliver bettering public services to their citizens. Fifth, public and private (and non-profit) partnerships are developed through working together for promoting OGD development and utilization. Last, OGD supports environmental sustainability. The OGD system will support users to actively participate in energy management, such as demand responses that allow users to choose their needs based on their supply status.

Furthermore, OGD improves government performance in terms of public process, efficiency and effectiveness, and good governance. There are ten dimensions of the governance impacts driven by OGD. First, OGD are a strategic resource and demonstrates evidence in policymaking. Data are seen as the raw ingredient for evidence to improve better policy. Data utilization helps to improve the ability of policymakers, evaluators, and researchers to build up rigorous evidence for policy analysis and policy options that will lead to better informed decision-making. Second, transparency is increased by OGD as it is often implicitly enhanced and correlated with the disclosure of OGD. Third, accountability is supported through driving transparency by OGD as it can support a richer and more multi-dimensional approach to accountability. Fourth, trust in government is increased since OGD provides

broader insights into public inputs, processes, and outputs. This can help strengthen public sector confidence and the political system. Fifth, efficiency and effectiveness are increased by assessing the financial situation of cities, using open information to improve local policies, reducing complexity, and delivering user-friendly digital services. Sixth, a digitized government is supported by OGD development. The development of OGD is the foundation of the development of digitalization in the public sector. It pushes digitalization to a higher level by improving foresight capacities. Seventh, public engagement/public participation is enhanced. Data are an important prerequisite for being able to decide on issues, participate in society's debates, and influence society's development. Access to data, cases, and processes provides an opportunity to control how bureaucrats and politicians manage their positions and society's resources. Communities can benefit from making decisions based on more relevant and valuable data. Relationships are strengthened by working together on OGD development and utilization, leading to building trust and confidence. Eighth, opening up OGD creates an anti-corruption ecosystem. Since the governments have encouraged public and private stakeholders to participate in opening up their data, they will recognize what data should be released and how significant the data are for monitoring and controlling their government. Ninth, OGD supports bridging the gaps among the federal, state, and local governments for data sharing. Last, OGD enhances global networks for governments to be able to share technical cooperation, the experience of OGD, exchange human resources, and research and development projects with international cooperation.

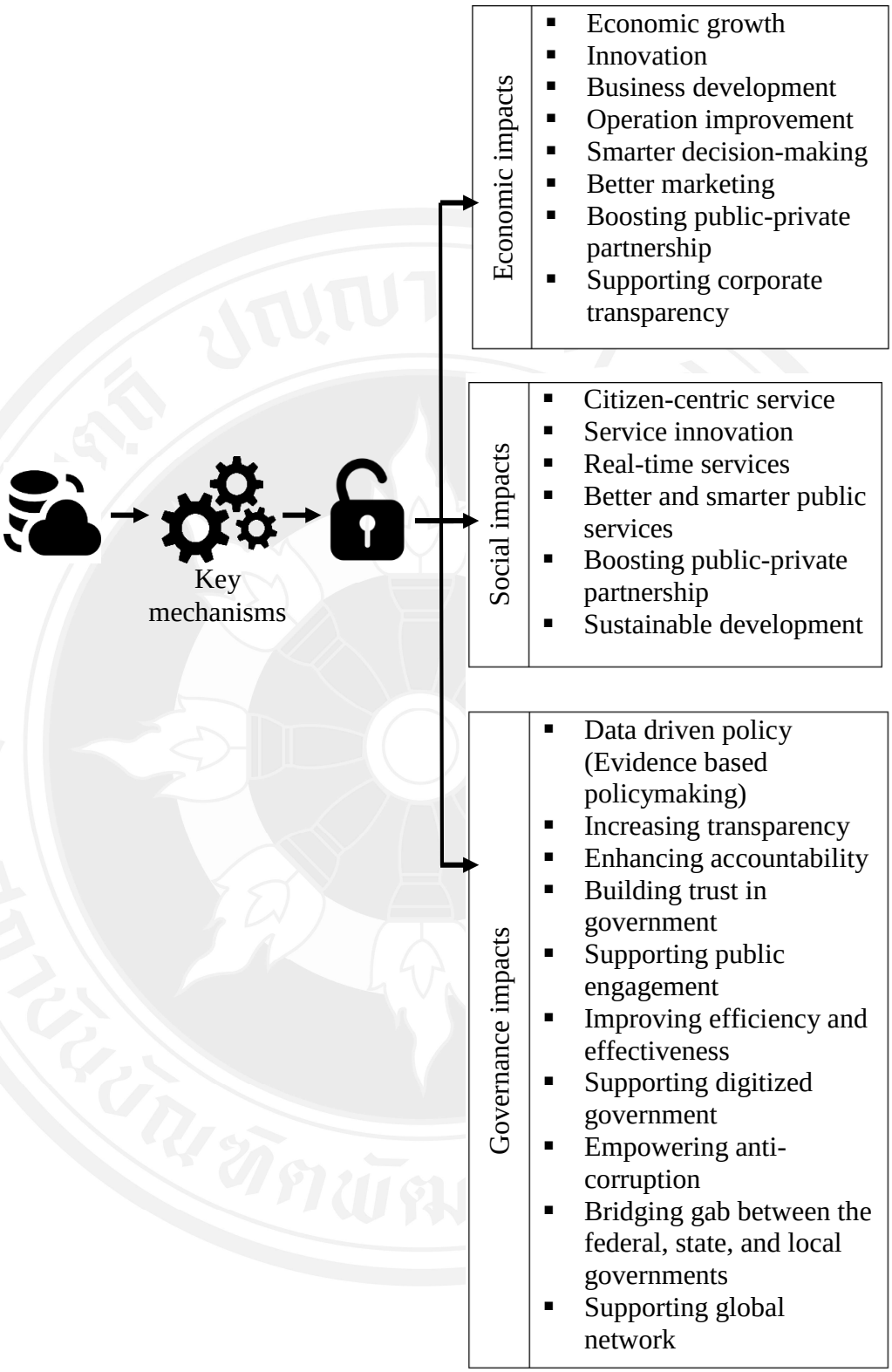
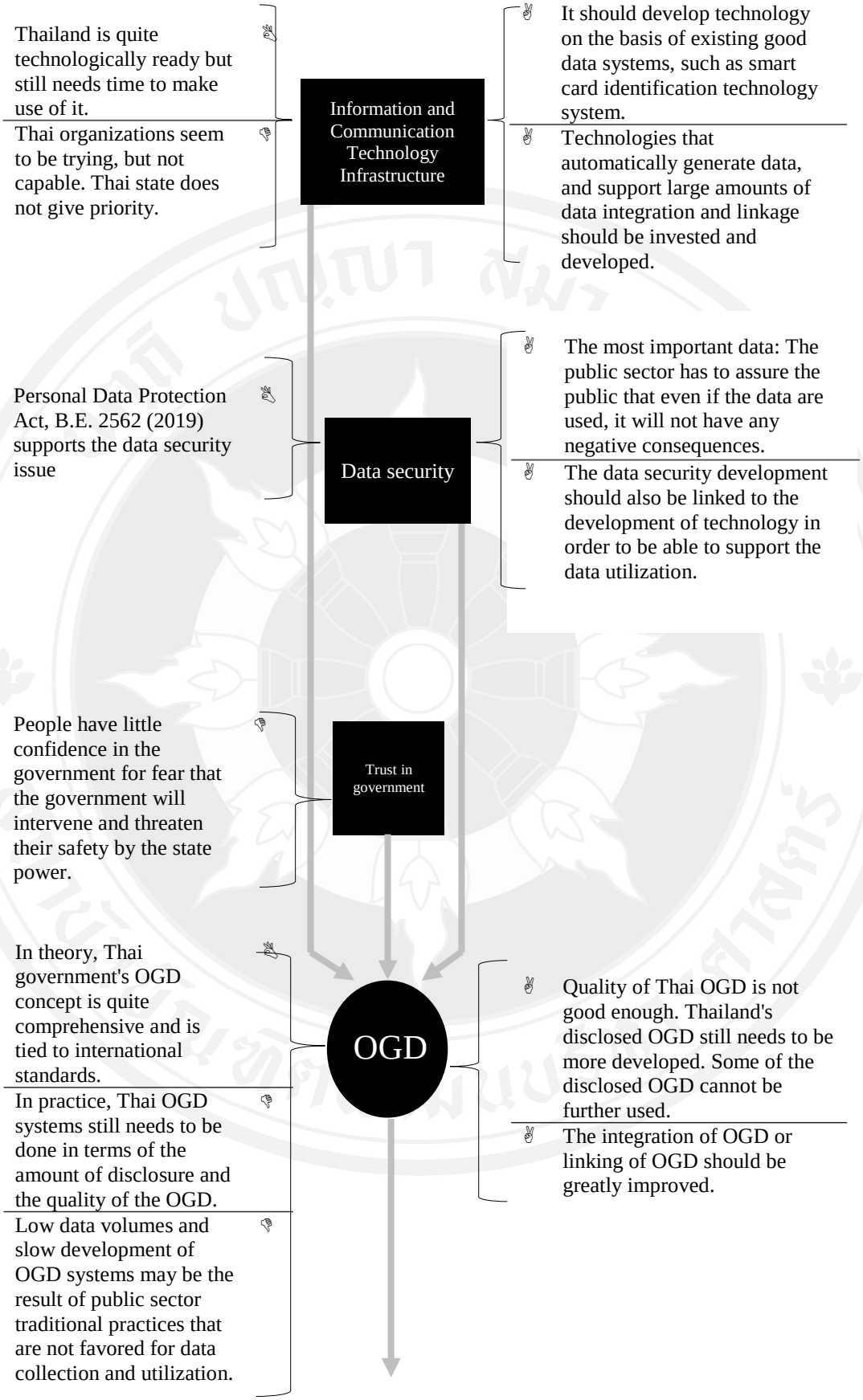
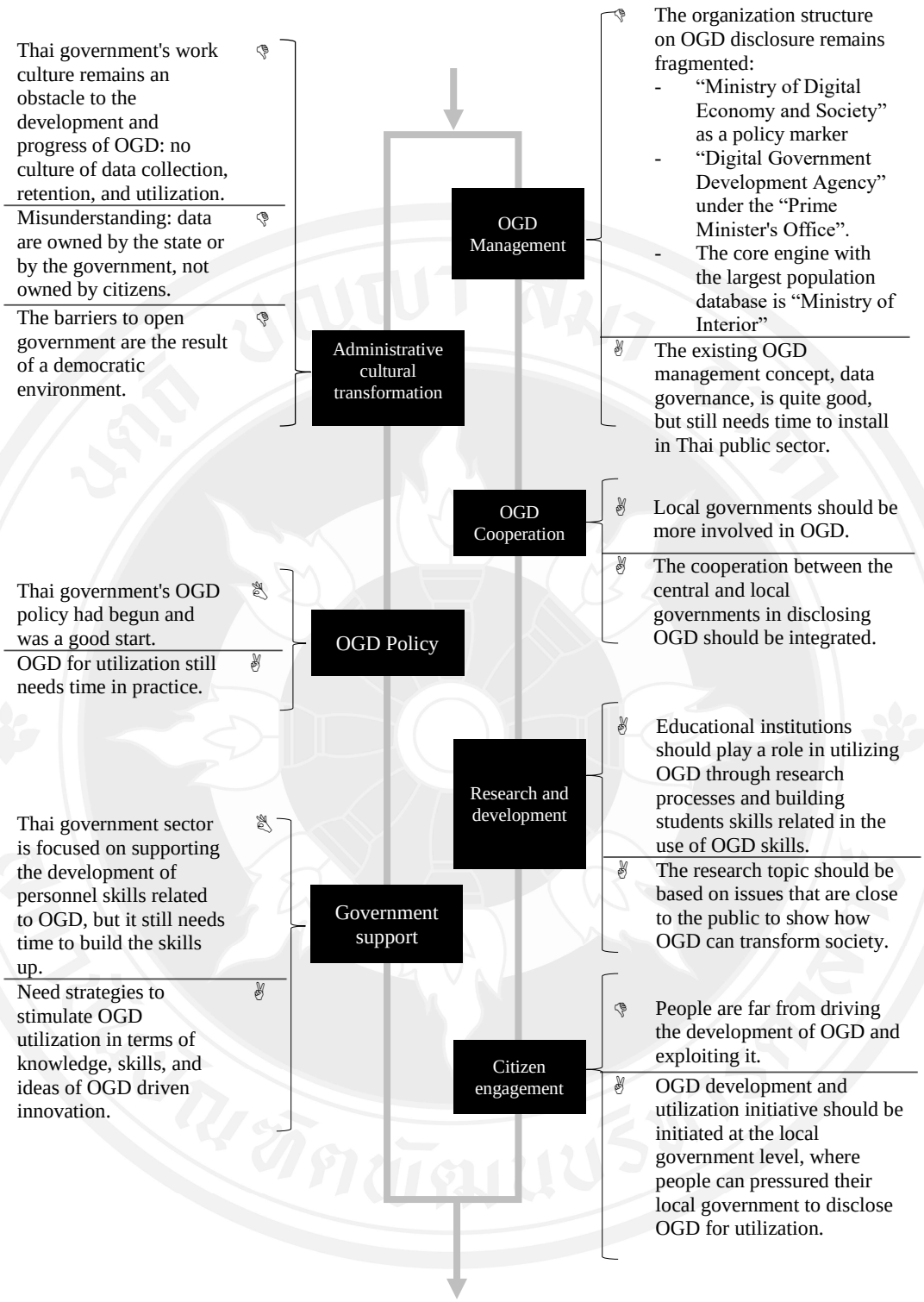


Figure 5.6 The Taxonomy of the Impacts of OGD

For Thailand, the idea of OGD was initiated under the cabinet resolution of B.E. 2556 to raising the levels of public service through electronic services. Thailand invested in a web portal of open data, so-called data.go.th as the center of OGD and as the center of government application since B.E. 2558. The current constitution of the Kingdom of Thailand (B.E. 2560) in section 59 also stated that the state must disclose data or public information in the possession of government agencies that are not security data or information as well as not confidential. Although OGD in the web portal has an open license, a license from the copyright owner must be added to the data in order to prevent misuse of the dataset. Importantly, according to personal data protection act B.E. 2560, the use or disclosure of personal information requires protection in order not to be violated.

To implement the OGD policy in Thailand, the "digital government administration and services act B.E. 2562" was established to reform the public administration to become digital by using suitable technology to be used in the administration and provision of public services. This requires the integration of all government agencies' databases into a system of data. However, it is in the early stage. In order to release the government dataset, a government agency will appoint a committee or a working group to select the government data set to be published. The data released in the web portal (data.go.th) are in an open format, with an open license, and are non-proprietary, and machine-readable. In order to utilize the OGD, the Thai government has supported the use of data for innovation by establishing such the campaigns as Thailand data innovation awards to drive innovation development and to encourage the development of a variety of applications, and Datathon project, which refers to data for anti-corruption. However, the use of data is still rare in Thailand.


Thailand is quite technologically ready but still needs time to make use of it.
Thai organizations seem to be trying, but not capable. Thai state does not give priority.
Information and Communication Technology Infrastructure
It should develop technology on the basis of existing good data systems, such as smart card identification technology system.
Technologies that automatically generate data, and support large amounts of data integration and linkage should be invested and developed.
Personal Data Protection Act, B.E. 2562 (2019) supports the data security issue
Data security
The most important data: The public sector has to assure the public that even if the data are used, it will not have any negative consequences.
The data security development should also be linked to the development of technology in order to be able to support the data utilization.
People have little confidence in the government for fear that the government will intervene and threaten their safety by the state power.
Trust in government
In theory, Thai government's OGD concept is quite comprehensive and is tied to international standards.
In practice, Thai OGD systems still needs to be done in terms of the amount of disclosure and the quality of the OGD.
Low data volumes and slow development of OGD systems may be the result of public sector traditional practices that are not favored for data collection and utilization.
OGD
Quality of Thai OGD is not good enough. Thailand's disclosed OGD still needs to be more developed. Some of the disclosed OGD cannot be further used.
The integration of OGD or linking of OGD should be greatly improved.


Thai government's work culture remains an obstacle to the development and progress of OGD: no culture of data collection, retention, and utilization.
Misunderstanding: data are owned by the state or by the government, not owned by citizens.
The barriers to open government are the result of a democratic environment.
Administrative cultural transformation
The organization structure on OGD disclosure remains fragmented:
- "Ministry of Digital Economy and Society" as a policy marker
- "Digital Government Development Agency" under the "Prime Minister's Office".
- The core engine with the largest population database is "Ministry of Interior"
OGD Management
The existing OGD management concept, data governance, is quite good, but still needs time to install in Thai public sector.
Local governments should be more involved in OGD.
OGD Cooperation
The cooperation between the central and local governments in disclosing OGD should be integrated.
Thai government's OGD policy had begun and was a good start.
OGD for utilization still needs time in practice.
OGD Policy
Educational institutions should play a role in utilizing OGD through research processes and building students skills related in the use of OGD skills.
Research and development
The research topic should be based on issues that are close to the public to show how OGD can transform society.
Thai government sector is focused on supporting the development of personnel skills related to OGD, but it still needs time to build the skills up.
Need strategies to stimulate OGD utilization in terms of knowledge, skills, and ideas of OGD driven innovation.
Government support
People are far from driving the development of OGD and exploiting it.
Citizen engagement
OGD development and utilization initiative should be initiated at the local government level, where people can pressured their local government to disclose OGD for utilization.

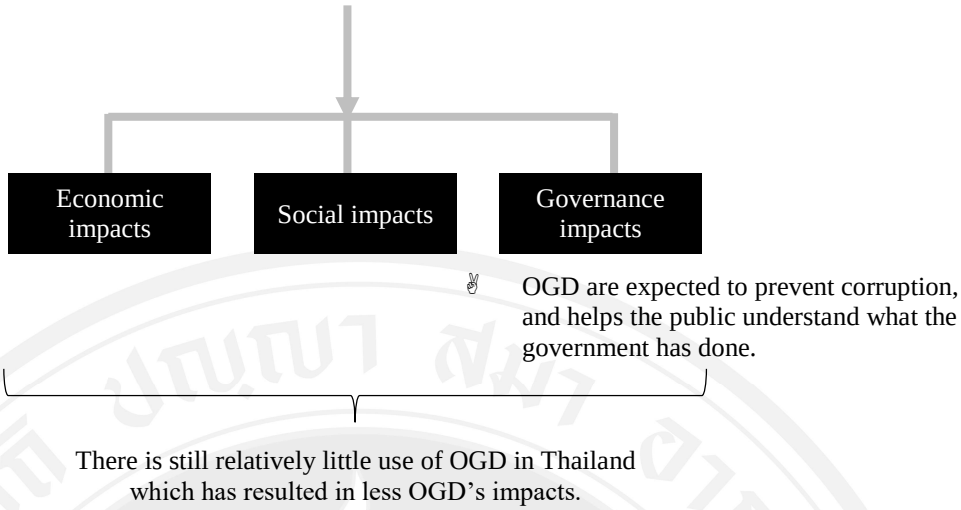


Figure 5.7 The Situation of OGD in Thailand

5.2 Discussion

The results from the ten case studies and the quantitative method affirmed the main argument of this study - that although OGD had its values as an asset, it might not make an impact on society immediately. This result is compatible with previous studies and the suggestions of Cotton (2015), Esty and Rushing (2007), IBM (2015), KPMG (2017), Marr (2015, 2017), and Mayer-Schonberger and Cukier (2013). They stated that OGD could be perceived as an asset of a country, but OGD itself might not make impacts. Gathering or releasing data is not the end. Data itself might be like a white elephant that is expensive and useless (Marr, 2017). If a government does not prepare for data utilization, the cost of investment will be wasted, and the data will not release its true value. In this regard, OGD requires government capabilities, which are also known as government capabilities, to unleash the value of the data.

In order to drive OGD development, the ten case studies supported the three preconditions: investment of information and communication technology (ICTI), data security (DS), and trust in government (TG). The results from the statistically tested model revealed that the two preconditions-ICTI (H1) and DS (H2)-were significant while TG was not significant (H3). The three perspectives can be interpreted as follows.

Table 5.1 Comparison between the Literature and Research Results for the OGD Preconditions

Preconditions	Theoretical framework	The results from ten case studies	The results from the tested model
Technology investment and development (ICTI)	ICTI positively influences the development of OGD (i.e. Lane (2018); Meyer et al. (2015); O'Flaherty & Maloney (2017))	Supported	Supported
Data security (DS)	The stronger the DS, the better the development of OGD (i.e. Blauer (2017); IBM (2015); O'Flaherty & Maloney (2017); Spavin & Fegan (2017))	Supported	Supported
Trust in government (TG)	TG positively influences the development of OGD (i.e. Blauer (2017); IBM (2015); O'Flaherty & Maloney (2017); Spavin & Fegan (2017))	Supported (Few cases)	Not supported

First, the results from case study analysis and the statistical-model testing showed that ICTI was significantly required as the precondition of OGD development. These results are consistent with the previous studies. ICTI is the fundamental structure of OGD. By designing and developing ICTI, people have greater access to and promote the quality of using or reusing data.

Second, DS was confirmed by analyzing the ten case studies and statistical model testing as the significant precondition for OGD development. These results are compatible with the previous studies and experts' suggestions. They stated that DS is the ongoing biggest challenge for governments to address since citizens are always concerned about the issue that their data should be strictly protected and operated. DS was seen as the necessary prerequisite for building and improving OGD.

Last, TG may be supported by case study analysis, but TG was not seen to statistically, significantly influence OGD improvement, which was not supported by

H3. This finding might contradict the claims of scholars, such as Chawda (2017b), Gravestock (2017), Henderson and Applewhite (2017), and Spavin and Fegan (2017), who proposed that citizens' trust was necessary for a government to have the ability to collect, access, release, and use or reuse government data. However, one should keep in mind that trust is a complex concept (Chawda, 2017a). Also, the causes of distrust in government vary. It is common for people to not fully trust their governments regarding their data implementation (Gravestock, 2017). However, scholars (Binsted, 2015; Chawda, 2017b; Smithe, 2017; Spavin & Fegan, 2017) have stated that although TG remains low, people still want their government to do continuously on improving government data and using it to develop the country. In this regard, it can be interpreted that OGD continues to be expected to improve no matter whether TG increases or decreases. However, as this study employed secondary data, further research using primary data may explain this hypothesis.

For implementing OGD principles, making open data available is more than releasing data on a website; it must be made available in appropriate ways to help the public utilize and unleash its power. OGD must be well described and improved. Previous studies have proposed the general principles of data openness with seven principles: completeness, timeliness, machine-readability, open standards/open formats, open licensing, being free of charge, and non-discriminatory. In analyzing the ten cases, those proposed principles were seen to be implemented by the ten countries. The most common principles are completeness, machine-readability, open standards/open formats, non-discrimination, timeliness, being free of charge, and open licensing. Some of the principles are related to each other. For example, machine-readability is relative to open formats. Further, an open license or free license is commonly related to being free of charge.

Table 5.2 Comparison between the Literature and Research Results for the OGD Principles

Principles of open government data	Theoretical framework	The results from ten case studies
Completeness	Berners-Lee (2006), Liu et al. (2011), Maurino et al. (2014), Solar, Concha, & Meijueiro (2012), and World Wide Web Foundation (2017)	Supported (The principles are implemented by the ten countries.)
Timeliness		
Machine readability		
Open standards / open formats		
Openly licensing		
Free of charge		
Non-discrimination		
Open by default	* New finding	It has been implemented by nine countries.

Moreover, being open by default is the new finding discovered principle from this research. From the ten cases, nine leading countries (the United Kingdom. Canada, France, the United States, South Korea, Australia, New Zealand, Japan, and the Netherlands) have implemented it as a fundamental and practical principle. Being open by default refers to "proactively publish open data and provide easy access to the data as well as meaningfully respond to citizens' requests for both government data and their personal data." It allows citizens to easily access information through a single web portal. This principle guarantees that a government is committed to proceeding with and implementing open data. Being open by default is a new finding in this research.

For OGD utilization, the theoretical framework showed that government capability included administrative culture transformation, OGD policy, OGD management, data cooperation, government support, research and development, and citizen engagement. These constructed capabilities were supported by the case study analysis from the ten leading countries. These results were also confirmed by the statistical analysis. The government's capabilities are needed to be able to unlock the value of OGD. Government capability fully mediated the relationship between OGD and its impacts. This result is consistent with previous research and experts' suggestions that proposed that although data are perceived as an asset, on their own, they may not make an impact; it still requires the government's capabilities to unleash

its full value. Government capability (GC) is essential to apply their OGD to achieve their goals.

When we consider the benefits of OGD in improving GC, the results showed that OGD had a significant direct effect on GC (H6). This result was consistent with the previous studies of Esty and Rushing (2007), Höchtl et al. (2016), IBM (2015), Janssen (2012), Marr (2015, 2017), Mayer-Schonberger and Cukier (2013), Parkes and Costello (2018), Rutter (2014), and Zuiderwijk and Janssen (2013). They posited that data could provide better government performance in many aspects such as policy-making, decision-making, modernizing real-time public services. This result confirmed the prior findings and their suggestions and it could be interpreted that OGD can help governments boost their capability.

Table 5.3 Comparison between the Literature and the Research Results on the Government Capabilities (GC) Required for OGD Utilization

Government capability	**Theoretical framework**	**The results from the case study analysis**	**The results from the tested model**
GC includes (i) administrative cultural transformation (ACT), (ii) the policy of OGD (POGD), (iii) the management of OGD (MOGD), (iv) data cooperation (DC), (v) government support (GS), (vi) research and development (RD), and (vii) citizen engagement (CE)	Government capability (GC) (mediator) significantly mediates the relationship between OGD (independent variable) and DI (dependent variable). (i.e. Blauer (2017), Cohen (2010), Cotton (2015), Esty and Rushing (2007), Höchtl et al. (2016), IBM (2015), Janssen and Zuiderwijk (2014), Jung and Park (2015), KPMG (2017), Marr (2015), Mayer-Schonberger and Cukier (2013), and Sayogo and Yuli (2018))	Supported	Supported

When the necessary abilities are ready, OGD impacts can be released. Theoretically, the extensive values of open government data can be divided into three aspects: economic impacts, social impacts, and governance impacts. These results from the case study analysis are consistent with the previous studies mentioned in the table. Through analyzing the 79 OGD projects in the ten countries, this research has made more findings on the taxonomy of the data impacts. Case-by-case analyses of OGD projects have shown the wide range of benefits of OGD. One OGD project can create its values in many ways, which helps to more clearly see the value chains of OGD.

In sum, OGD and DI were significantly mediated by GC. It ensured the main argument of this study-that GC is a critical mechanism for explaining how OGD can be transformed and unlocked completely to OGD's impacts. Furthermore, as the direct effect of OGD on its impacts was not significant (H4), while the direct effects of OGD on GC (H6), the direct effect of GC on DI (H7), and the indirect effect of OGD and GC on DI (H5) were statistically significant (H2), this indicated the role of GC in the relationship between OGD and DI as one of full mediation (Hair et al., 2017; Zhao et al., 2010). In this regard, OGD and GC together explained 84% of the variance in DI, which was also considered a substantial level of explanatory power. It can be interpreted that OGD and its impacts might no longer exist without GC. The results of H5, H6, and H7 contributed to a clear understanding of how and why OGD can be implemented to unlock its values, including social and economic development as well as government performance.

In terms of political instability, the relationship between political contexts and a bureaucratic system is essential for the administration of a country to operate in an orderly manner and to benefit people. When considering political instability as a moderating variable, it did not show a significant relationship with government capability or data impacts. It can be interpreted that government capability with OGD as the administrative resource will be strengthened since the resources and necessary capabilities are fully mobilized into the bureaucratic system. Government agencies with sufficient data and with the seven capabilities will have the ability to present and reflect the public's needs or problems, to present solutions, to compare the pros and cons of solution alternatives, to forecast results by using the data, and to present them

all to the public or a decision-maker. The government's potential driven by the data as evidence-based practice allows government agencies to continue to function consistently without political instability influence.

However, although political issues may intervene or influence public administration in terms of policy and practices, having OGD and the seven capabilities may mitigate the political influences since data-based administration, i.e. polity implementation and policy evaluation, will help strengthen bureaucratic practices from "shaking" or failing due to political changes or issues. This may be the reasons why the political instability did not affect the link between GC to take advantage of OGD in providing public services to the people. OGD was therefore expected to bring about sustainable development. This result supports the 2030 sustainable development agenda regarding the importance of OGD (United Nations, 2016, 2018) as it presumably particularized that the use of OGD was fundamental to the use of public resources, which might be positively potential consequences for sustainable development.

When looking at the results of the case study analysis, it may not reflect deeper details since the top ten countries as the developed countries have a stable political context. That is, despite the government having transition leaders, the commitment to OGD and the use of OGD have continued to be driven. For example, OGD took place with strong commitment during the Obama administration. Later, the Trump administration also recognized the importance of OGD by enacting important legislation: the Foundations for Evidence-Based Policymaking Act of 2018, as stated earlier. However, the case of Thailand seemed to be able to explain some of the influence of the political context on OGD and DI. The governmental agencies of Thailand have been covered with an authoritarian culture. If an agency has an overwhelming authoritarianism culture, it is difficult for such an agency to be willing to release or share its data since the data are a currency of power, as described by Davenport, Eccles, and Prusak (1992) as "information politics". Although the argument of Davenport et al. (1992) mentioned the term information, it can be interpreted as OGD since information and OGD as raw data are intricately interconnected; given the meaning and context for OGD, it would become

information. The resistance of this kind of government agency is an obstacle to driving OGD (Anneke Zuiderwijk et al., 2012).

Further, the structure of the Thai bureaucratic system has centralized decision-making power, especially when ruled by a semi-military government that strongly demands control of information and criticism. The semi-military government does not use the available data, does not cooperate with other local governments, does not listen to the people's voice, and does not take into account the restrictions of the people, as mentioned in the Rao cha-na (เราชนะ) project as an example. Even worse, such a project led to a greater burden, risks, and even more crises for citizens. However, since Thailand has just begun developing OGD, it is difficult to say that Thailand has not been successful in OGD development or utilization. One thing to say is that the political context, especially for the semi-military politics, was extremely incapable of taking advantage of government data in designing policies and in providing public services. This supports the claims of Aisen and Veiga (2013), and Hollyer, Rosendorff, and Vreeland (2014), who stated that political issues had negatively affected social and economic development and influenced the government process.

The relationship between the political context and government capability or the bureaucratic system is related to the administrative culture, values, the system structure, and bureaucrat behaviors. The pursuit of centralized power is an obstacle to a country's development. Changing political contexts leads to changes in government policies and instability. Political interference will be more or less dependent on the political and administrative conditions at the time. It inevitably affects the performance of agencies that have to adjust their administrative practices in line with the political context. Especially, developing countries are veiled with a traditional authoritarian culture. Government agencies with non-political neutrality may benefit from concealment, misuse of data, use of office roles, tools, and equipment for their political side in order to gain personal interest.

In order reach the point where government agencies are data driven and automated, as a result of quantitative research, it remains necessary to take into account these political contexts, especially in developing countries. The relationship between politics and bureaucracy in policy formulation, policy implementation, and

policy evaluation varies according to each country; we may need to consider the nature of the relationship in each case. The various aspects of political contexts in the OGD formation, OGD development, and OGD utilization should be further studied.

5.3 Recommendations

5.3.1 Theoretical Implications

This dissertation contributed to the literature on (i) data driven government in terms of how to develop OGD and how to utilize OGD to drive a government; and (ii) the key focal point transition of public administration in the current time and in the future as follows.

5.3.1.1 The Linkage of OGD Supply Side and Demand Side

Previous studies often studied separate sections between how to develop OGD on the supply side and the benefits of OGD on the demand side. Additionally, how to leverage the power of the OGD remains unanswered. Since OGD are at the early stage of development, this research contributes to the closure of this research gap. It contributes to the linkage between the supply and demand sides, and the investigation of the systematic mechanisms to unlock the power of the OGD. In more detail, empirical evidence suggested the interrelations among preconditions, OGD development, government capabilities as the systematic mechanisms to unleash the value of OGD, and OGD impacts. Further, this research created the government capabilities, including administrative cultural transformation, OGD policy, OGD management, data cooperation, government support, research and development, and citizen engagement. These capabilities demonstrated a positive relationship between OGD development and OGD impacts. These findings added to those of other scholars and experts who proposed that OGD itself might not make impacts. Yet, to the best of the knowledge of the present researcher, this study is the first to show the “open by default” aspect as one of the practical OGD principles; it was not mentioned in previous literature. Being open by default is a new finding based on empirical evidence from the ten countries. Another best was that this research uncovered the taxonomy of OGD impacts. One OGD project leads to a chain of positive impacts in the economic, social, and governance aspects.

5.3.1.2 OGD as the Key Focal Point Transition of Public Administration in this Current Time and for the Future

This dissertation contributed to explaining the focal point transition of public administration, as presented in Figure 5.8. This research showed that OGD have taken a role in the administration of public services. Data are at the core of driving public administration and services in present and future government.

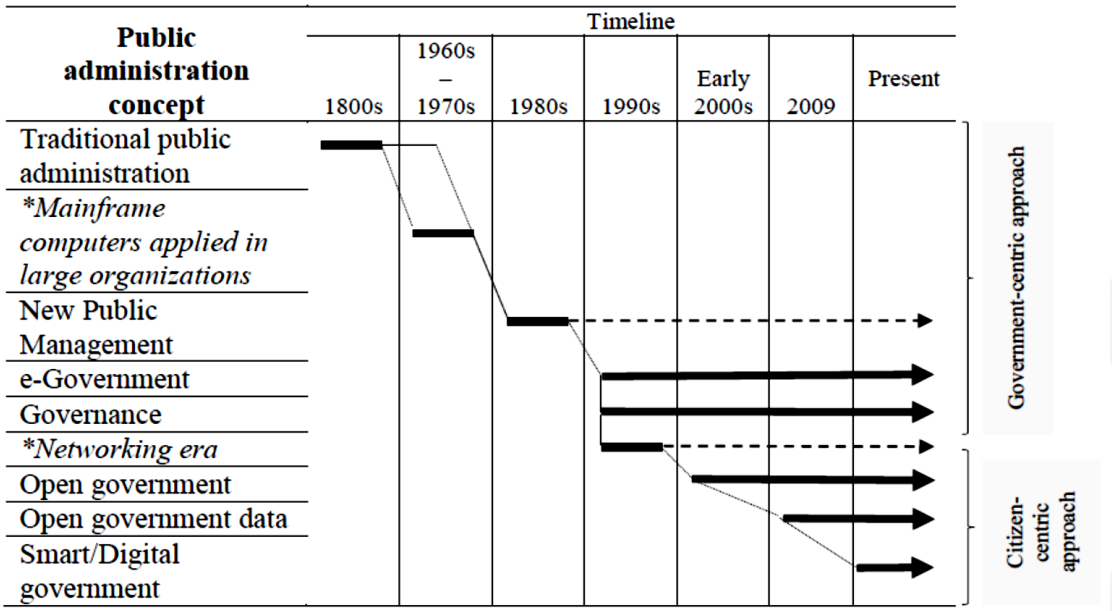


Figure 5.8 The Transition to the Public Administration Approach

In the past, the paradigms of public administration focused on government as the center: external factors influencing public administration, human development, organizational development, the efficient use of resources, public-private cooperation, and so on. However, despite efforts to explore the best or proper ways to support public administration, it has always faced chronic problems, such as inertia, being poorly organized, irrational decision-making, poor delivery, weak accountability, corruption, and so on. Public administration has attempted to fix these problems by applying information and communication technology to government operations since the end of the 1970s to provide better public services and better

performance. Since then, even though the e-government system has been well developed, public administration has still faced problems.

Currently, advances in technology have revolutionized and brought tremendous change to humanity; public administration is one of the affected sectors. Technology encourages governments to be more open and effective by releasing government data to the public. In terms of OGD, technological advancements have enabled us to access vast and diverse amounts of data that are modernizing the governments themselves. They can store large data in a variety of formats. Governments are also able to link and analyze data in a timely and efficient way. Data have led to the development of public administration in many dimensions. Many leading countries have now realized the importance of data as a strategic asset in driving their countries. OGD will drive a government to be digitized and smarter by improving foresight capacity in formulating, implementing, and evaluating public policies and public services, and by increasing the ability to forecast trends that support more proactive initiatives. With data, a government has opportunities to gain better insights into the needs, opinions, behaviors, and experiences of citizens, and the situations of its country. Data as a strategic asset and foundation for public policy create opportunities for policy-making, policy implementation, policy evaluation, and policy improvement with greater reference to citizens. Data can lead to more sound, rational, and scientific evidence used to make decisions and to take action. This importance of OGD will offer a citizen-centric approach in public policy and public services.

However, this does not mean that the previous knowledge of public administration will be reduced. The previous knowledge has still laid important administrative key concepts and methods which have been used until now. The emergence of OGD will support and drive more quality practices of public administration. As revealed in the taxonomy of the data impacts in terms of governance impacts, OGD will help resolve or alleviate government problems and will make public administration more efficient and effective. For example, OGD will boost transparency and lead to accountability by allowing the public to hold their government accountable better. Further, OGD will enhance efficiency and effectiveness by reducing the duplication of work, creating real-time government

operations, real-time public services, and increasing the ability to most cost-effectively allocate resources, for example. In addition to this, OGD will reduce corruption or fraud opportunities as the public can access the data to monitor and control their government activities. OGD will reduce information/data asymmetry between a government and the public, which will enhance active and meaningful public participation in the public sector. In this sense, the transition from a government-centric to a citizen-centric approach will be driven by OGD under the changing advanced technology. Importantly, OGD will also offer opportunities to link the government-centric and citizen-centric approaches to be developed together as well.

5.3.2 Policy Implications

This section describes how data driven government should be designed, formulated, and implemented in order to more effectively reach its desired outcomes. For the following policy implications, a government, a professionally responsible organization, government agencies, and data users (i.e. citizens, business units, researchers, and civil organizations) should collaborate on OGD improvement in order to identify flawed practices and how to initiate other actions. This study suggests practical implications for governments in five aspects as follows.

5.3.2.1 Focusing on the Most Importance Preconditions of OGD

Initiating and developing OGD should mostly concern ICTI and DS as the important prerequisites. A government should acknowledge the potential of advanced technology for OGD development, should provide guidelines for government agencies to follow, and should improve the environment for OGD development and utilization by increasing the public's technology accessibility. Importantly, DS policy needs to declare and protect the citizens' right to access and use OGD. Enhancing DS for OGD should also be implemented by continually proceeding with privacy impact assessment. The more secure the OGD are, the more long-term development and utilization are possible. Moreover, although this research revealed that trust in governments was not statistically significant, some case studies still provided its importance. A government should still enhance trust in OGD by establishing a framework of OGD implementation and maintaining the public's

understanding of the OGD process. Increasing trust in governments will facilitate the development and utilization of OGD.

5.3.2.2 Enhancing the Implementation of OGD Principles

In order to initiate and improve OGD policy, a government should follow and benchmark the eight principles revealed in this research: being machine readable or machine readability, having open standards, being non-discriminatory, being free of charge, having open licensing, and being open by default. Applying the common principles of OGD from the ten leading countries will be useful for other countries to improve and implement their policy to stimulate data provision and utilization.

5.3.2.3 Improving the Seven Government Capabilities

A government should develop its essential seven capabilities to facilitate OGD utilization. The following activities enable agencies to create effective coalitions for changes resulting from a data driven government approach. Policy implication checklists are presented as follows.

Table 5.4 Policy Implications Regarding the Seven Government Capabilities

Administrative cultural transformation	☑ Formulating a policy, laws, or regulations regarding open government and OGD ☑ Implementing "open by default" for open government ☑ Identifying a clear cornerstone for open government, i.e. transparency, accountability, accessibility, open decision, participation, collaboration, and network enhancement ☑ Promoting open culture by supporting all public agencies and local governments to initiate and develop an open government action plan ☑ Enhancing open culture by supporting open data sharing and using between public and private sectors ☑ Launching an avenue, conference, working group, or events for public engagement to support the OGD utilization ☑ Opening for public feedbacks in accessing and leveraging OGD

OGD Policy	☑ Ensuring the OGD disclosure by the policy or laws ☑ Ensuring and specifying the right of the public to use OGD ☑ Protecting the right and privacy of citizens ☑ Ensuring the principles of OGD and how OGD is stored, released, online, freely usable, accessible, and machine-readable ☑ Acknowledging and mentioning the expected impacts of OGD in the policy or laws. ☑ Setting requirements and recommending practices for government agencies or local governments to implement OGD ☑ Supporting and encouraging government agencies and local governments to initiate their OGD strategies
OGD Management	☑ Embedding OGD in a national action plan ☑ Supporting government agencies and local governments to formulate OGD management system, strategy, and action plans ☑ Establishing a responsible organization to support OGD improvement activities ☑ OGD's action plan should specify OGD step-by-step guidelines, standards, and activities to encourage OGD development and utilization. It should be updated, clear, coherent, and connect with other development policies. ☑ Providing tools and expert consultants ☑ Initiating OGD indicators of development and utilization ☑ Implementing OGD activities, i.e. managing OGD platforms, fostering OGD standards, organizing regular training, conferences, and events for government workers, business units, and the public ☑ Monitoring and evaluating the readiness and completeness of OGD

Data Cooperation	☑ Supporting and encouraging government agencies and local governments to commit to making their data in the public ☑ (or) Enforcing government agencies and local governments to comply with the relevant OGD laws or policies ☑ Publishing guidelines, and supporting tools, technical needs, and financial needs for OGD development and utilization ☑ Supporting government agencies and local governments to initiate their OGD strategies and action plan to leverage their OGD in public services and area development ☑ Providing OGD portal template so that other agencies can host their OGD ☑ Collaborating with public agencies and local governments as data providers to identify a set of high - value data and to improve their data quality ☑ Establishing a responsible organization to promote and support OGD improvement ☑ Boosting the accessibility to technology ☑ Initiating and launching an OGD utilization project between a federal or central government and local governments ☑ Coordinating a joint data user or stakeholder to unleash the power of OGD ☑ Providing additional supports as required by other agencies
Government Support	☑ Providing consultancy and assistance for government agencies, local governments, and citizens ☑ Appointing a national chief data officer to be responsible for OGD support and coordination for a whole country ☑ Empowering digital and analytic skills and data culture for government agencies, local governments, and citizens to support effectively use OGD ☑ Initiating and implementing measures to cultivate and develop human resources ☑ Providing OGD development and utilization training and knowledge ☑ Developing online resources, i.e. software, training, case studies, tools, assistances, and user experiences ☑ Annually organizing and hosting conferences, forums, seminars, workshops, hackathon, and events to support knowledge exchange, sharing, and network ☑ Supporting competition and funding to enhance OGD utilization ☑ Building and supporting OGD usage community among data experts, program developers, researchers, innovators, data users, community members, businessmen, and so on. ☑ Annually promoting OGD impact showcases to raise public awareness about OGD's potentiality ☑ Actively participating in the international OGD community and projects

Research and Development	☑ Increasing young program developers and students' digital literacy ☑ Encouraging undergraduate and graduate students to leverage OGD in their studying ☑ Providing and supporting public – fund for research ☑ Requiring publicly – funded research (as public goods) to open by default to the public in order to support open sciences and contribute to the research community, business sectors, and citizens ☑ Requiring government agencies to release their research data ☑ Responding to researchers' OGD requests for dataset and assistance ☑ Supporting research networks and collaborations to utilize OGD
Citizen Engagement	☑ Developing a clear strategy for public engagement in OGD development and utilization ☑ Providing and educating digital competence to citizens ☑ Supporting the public to identify what data should be prioritized to release ☑ Regularly conducting OGD demand survey to gain feedback and opinions of the public about OGD quality and data needs ☑ Establishing channels to directly communicate with stakeholders and the public, i.e. online communication, roundtables, conferences, workshops, or events, to get the public's feedback, comments, ideas, suggestions, and needs, as well as to encourage them to share and exchange their skills and knowledge ☑ Responding to the public's requests or needs on OGD disclosure ☑ Funding and giving awards to competition events of OGD utilization ☑ Promoting public and private collaboration to use OGD

5.3.2.4 Enhancing the OGD Impacts

As the emergence of OGD in many countries has just recently occurred, the clarity and tangibility of pieces of evidence from OGD utilization are necessary. Enhancing the value of OGD utilization may begin with a specific purpose to produce empirical results. Further, such results should be disseminated, publicized, and promoted so that wider society can be aware of and realize the value of OGD. Additionally, the value or the results of OGD utilization should be organized in the showcases in the OGD web portal.

5.3.2.5 Strategies to Develop and Utilize OGD in Practice

Although the above seven capabilities should be implemented, the disclosure and utilization of OGD are costly and time-consuming. The

implementation should therefore take into account the limitations and challenges in practice so that practical strategies can be designed wisely. In practice, there are still many flaws in understanding and implementing OGD provision and utilization (Marr, 2016, 2017). For example, there is a misunderstanding that data driven government is only a matter of technology. An organization has limited resources, such as financial investments, professionals, data infrastructure, and so on, and an organization also has cultural restrictions. An organization may have some data available, but not enough to be useful. An organization only focuses on its need to open the data that it wants, without considering the people's need for which data should be disclosed. An organization strives to collect as much data as possible, regardless of cost or utilization. An organization suffers from overwhelming data, but it is unable to use it; so the data turns out to be a costly but useless white elephant. The data lacks quality, which causes errors when going into the analysis (garbage in, garbage out). Data are not used to solve any problems of society. Despite efforts to utilize the data, the results obtained from the data may not be desirable. Accessing data is difficult for the public since data are scattered on websites and are not kept according to the same standards. These problems make it impossible to put the data into practice. Driving a government through OGD is not just a matter of the creation of advanced technology or the acquisition of enormous data; but it is the use of data and unlocking its values to achieve development goals. Leveraging and unlocking the value of data need to be done strategically so that the data can be a key fuel in driving a country towards its goals. By applying the research results, this research suggests seven strategic phases to improve OGD provision and utilization as shown in Figure 5.9.

Phase I: Launching vision (OGD policy, OGD management, and administrative culture transformation)

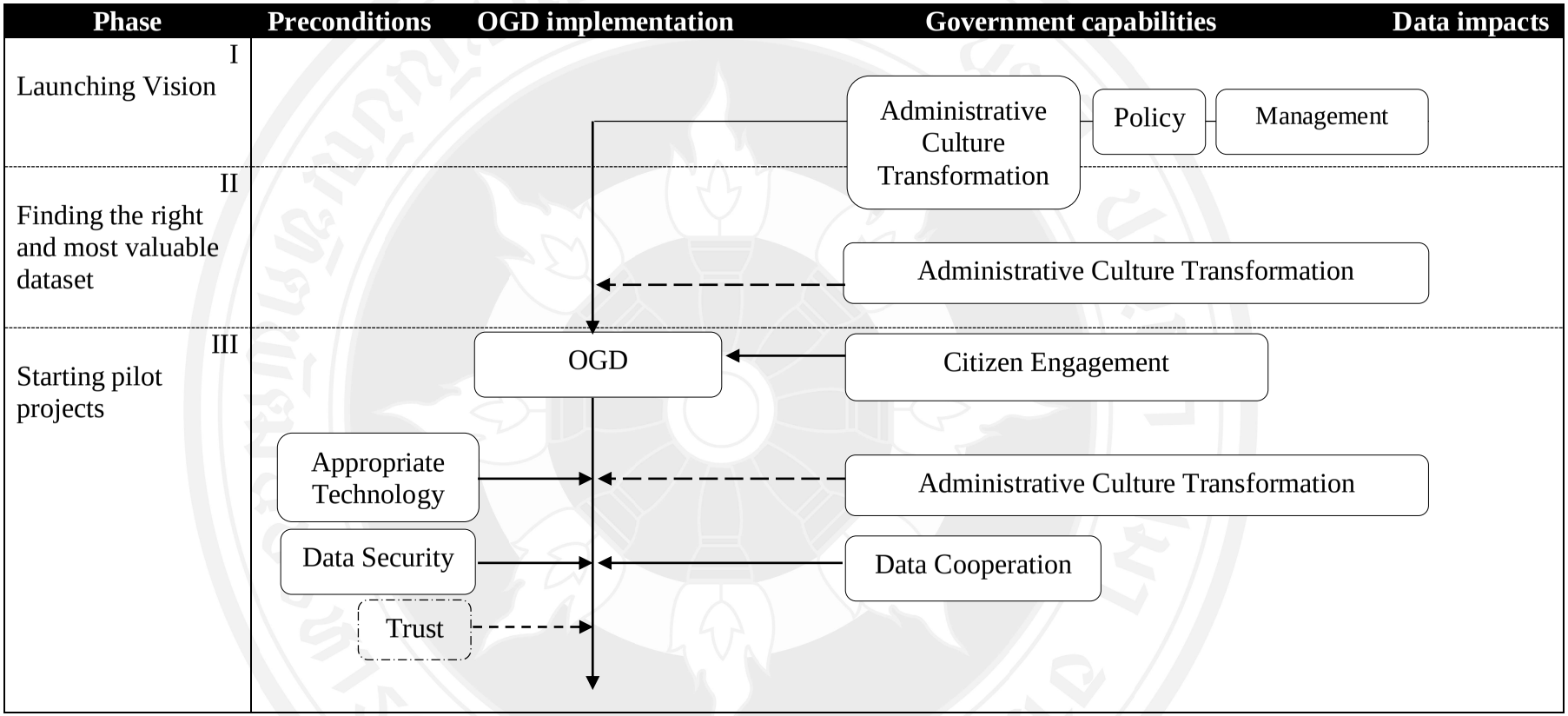
The barriers to government data development and utilization are not just cost or resource constraints, such as appropriate technology or staff shortages, but also governmental culture. Driving an organization with data is essential to creating the overall organizational change. In particular, more than 71.7 % of organizations trying to drive their organization with data have failed because they have not yet established a suitable organizational culture to support the data. 95 % of data driven

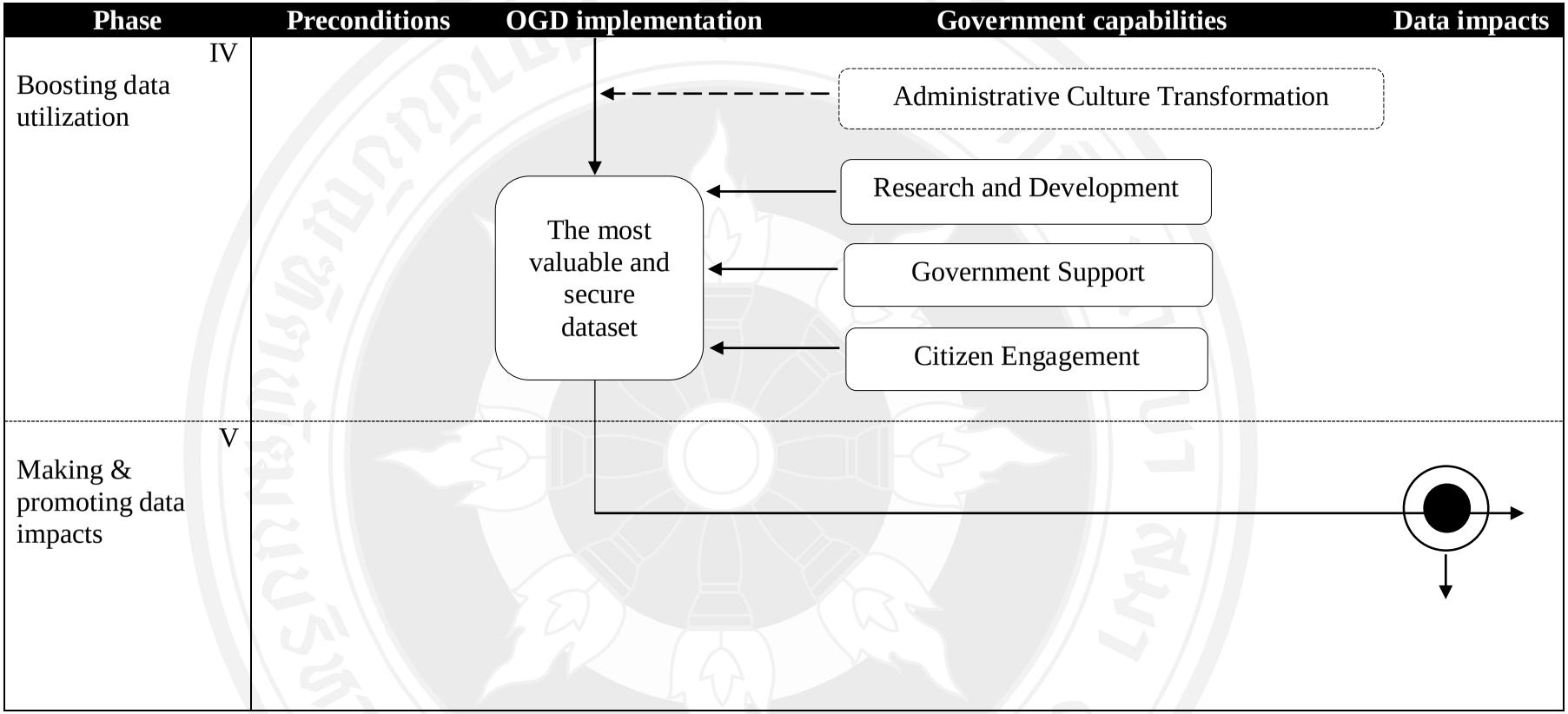
organizational challenges are cultural challenges, while 5.0 % are a technological challenge (NewVantage Partners, 2019). The management level must have a need, clarity, and commitment to make change happen.

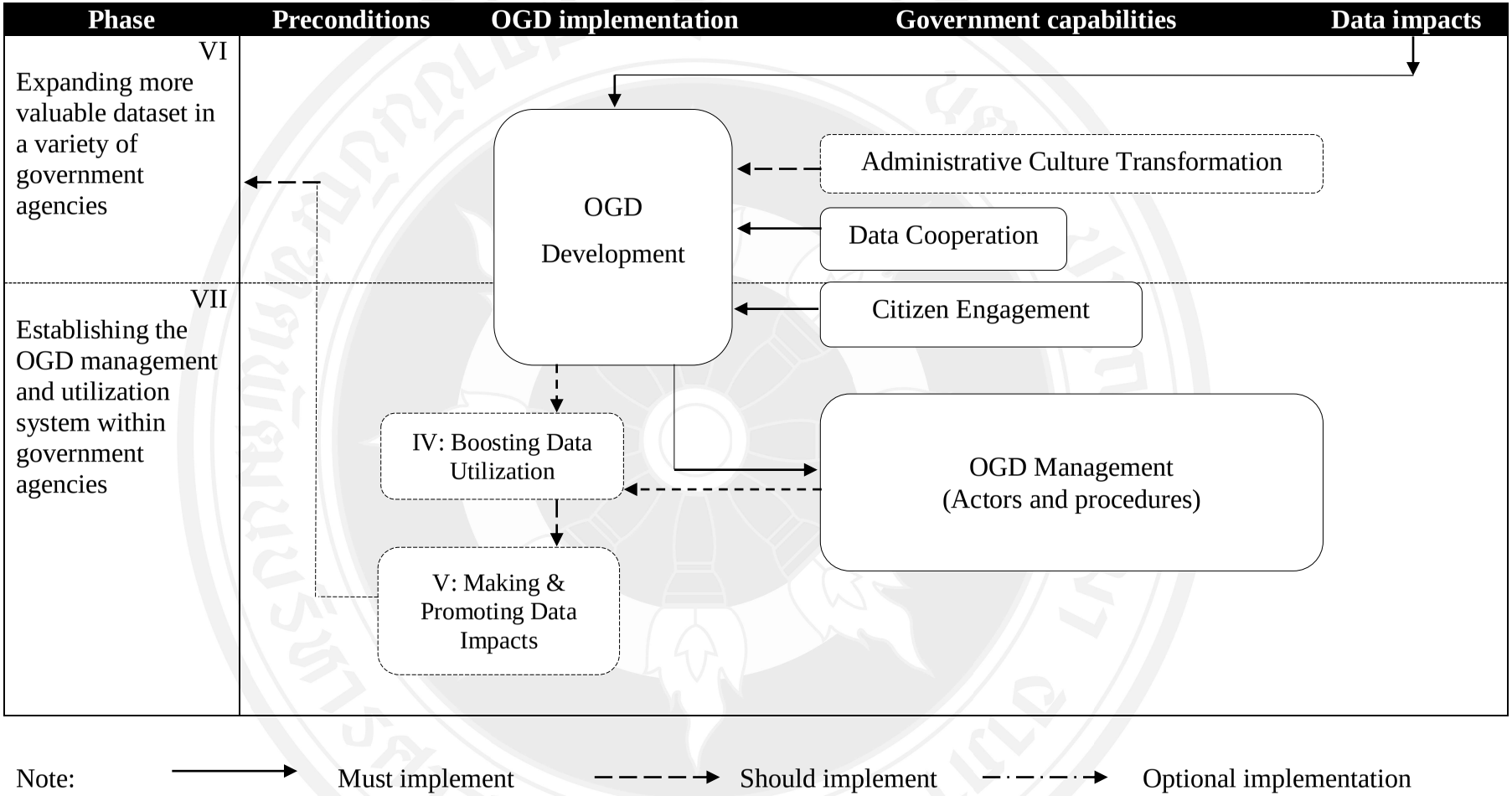
Therefore, the first step is to transform the organizational culture to support OGD development and utilization. According to the research results, open government is proposed as a new movement of administrative culture transformation to support OGD development and utilization. The more open the government, the more people will be able to participate in the development and use of OGD. In order to transform and help public entities be more open, national governments have played an important role in promoting and creating an open culture at all levels. Creating an open culture begins from the top and needs to be absorbed throughout the government. Leaders play a very important role in building the culture, and they should set a clear vision on the use of data for national development.

In this regard, OGD policymaking is very important since it is a mechanism that can ensure and commit to driving OGD over the long term. According to this research, the open data policy should (i) declare the right to access and utilize the data by the public; (ii) indicate how OGD will be developed and how all government agencies and levels will be supported, for example regarding OGD management, OGD strategy, OGD principles, data security; and (iii) acknowledge OGD impacts and indicate them as a strategic asset for a country's development. To support this commitment, governments need to develop a framework for data management and data utilization. According to the research results, a government may establish a specialized organization to take responsibility for OGD development and utilization. Additionally, all government agencies at all levels should be encouraged by their government to initiate their own OGD strategy and plan to support the national OGD policy. In this matter, the strategies and plans of OGD management should be clear, consistent, and updated frequently. Clear data policies and data management practices will help to support personnel to prepare for the transition of a traditional organizational culture to an open culture. However, the shift towards an open government culture remains a challenge. As the traditional culture of government organizations is deeply rooted, it requires the attention of leaders.

Figure 5.9 Seven Strategies in Developing and Utilizing OGD




Phase
Preconditions
OGD implementation
Government capabilities
Data impacts
IV
Boosting data utilization
Administrative Culture Transformation
Research and Development
The most valuable and secure dataset
Government Support
Citizen Engagement
V
Making & promoting data impacts


Phase
Preconditions
OGD implementation
Government capabilities
Data impacts
VI
Expanding more valuable dataset in a variety of government agencies
VII
Establishing the OGD management and utilization system within government agencies
OGD Development
Administrative Culture Transformation
Data Cooperation
Citizen Engagement
IV: Boosting Data Utilization
OGD Management (Actors and procedures)
V: Making & Promoting Data Impacts
Note:
Must implement
Should implement
Optional implementation

Creating an OGD culture should be ongoing and tangible so as to support the new approach of the data driven government. In Thailand, although relevant legislation has been initiated to drive this development, OGD are still ineffective in being utilized for making economic, social, or governance impacts. Most of the government data are disclosed according to the needs of the organization itself, not the needs of the people; the quality of OGD does not comply with the key OGD principles. Importantly, the government agencies that hold the country's big data have yet to release government data. At this phase of OGD management, Thailand needs to be clear about the operating agency responsible for data development, as there are various agencies with authority and responsibility. In this matter, the Thai government should set up a data development committee, which should include an agency with authority and budget, an agency with technical expertise, agencies that hold big data, and stakeholders. This established committee would help to create cooperation between the main operators.

Phase II: Finding the right and most valuable data

The public sector is the carrier of colossal data and often avoids sharing the data with the public. It creates asymmetric data between the government and the people. Further, the public sector tends to open up the data that the government wants to disclose, regardless of what data that the public wants to take advantage of. This behavior makes the use or value of the data truly invisible to society. For this reason, disclosed data are not always useful if they are not the right data to use. Currently, there may be governments that are excited about investing in data. However, the collection and dissemination of OGD are a high investment. Collecting and disseminating as much OGD as possible might be unwise.

Rather than beginning with data, goals should lead the data. A government should begin by defining a vision and the goals for leveraging the data to solve problems, improve services, create innovation, and so on. In order set the vision or goals for data utilization, a government should therefore create cooperation with the private and public sector; a government must always consider them as the data users. Opening up government data is not the only function of government; it is everyone's

responsibility to work together. Importantly, a government is not the data owner, but all citizens also own such data.

Thus, we focus on citizen engagement in OGD development at this phase. The open government data must be the data that people want to use it. Establishing common goals between stakeholders will lead to a way to find the right and most valuable data, and finding, building, and gathering the right data to utilize will save cost and time for a government. OGD are truly useful when it meets the goals or needs of an organization or business unit to generate true value or results. The right data also support and facilitate the goals of the data users. Doing little but getting more is one strategy that the government should focus on. Further, citizens should have the opportunity to contribute to the design of a platform or an open data portal. A user-friendly and easy-to-understand platform will provide a more convenient way to access and utilize the data.

Phase III: Starting pilot projects

Selecting the right data for development goals means that there are specific groups of public agencies where the data are located; or, there are public agencies that have the power and roles to access and collect the data. The public sector, together with the private sector, may consider trying to take advantage of OGD in order to overcome organizational goals, the problems and needs of society, to build products and services, and to initiate innovation. Leveraging the right data from such relevant agencies for pilot projects will help stakeholders, such as public agencies, the private sector, and the public, so that they can understand and see opportunities to use the data to drive development. In particular, implementing pilot projects will help to identify factors or obstacles that can lead to success or failure in data development and utilization.

Once pilot projects are established, a government should begin by exploring the available data in all formats to find out what data are available in order to achieve the projects' goals. Cooperation among public agencies may be needed to find the proper and linked data. However, if these data are not found, a government should be able to find, collect, release, and leverage the data together with the private sector to execute the pilot projects. In this matter, a government may consider using data

technology suitable for a country's conditions, such as the availability of technology and communication infrastructure, financial readiness, and so on.

Progressively, the government may invest in essential digital infrastructure, such as high-speed Internet, smart devices, automated processing programs, and mass storage technology that can process information in blazingly fast time. Potential and appropriate digital infrastructures will support public agencies and private sector units in sourcing, collecting, storing, processing, and visualizing data to leverage the insights of the data. The development of such technology infrastructure should take into account the data governance that has data stakeholders as an essential part of the system.

Moreover, data security, citizens' rights, and privacy need to be protected by laws and regulations. A government must establish the relevant laws and policies regarding such issues as fundamental guidelines for public agencies and data users to comply with. Data utilization must be balanced with data privacy and security. Additionally, public sector organizations' readiness to respond to cyber-attacks and the restoration of data systems need to be always available. A government may build a specialized organization to be responsible for cybersecurity, sharing knowledge, addressing systemic vulnerabilities, developing an authentication system, and implementing the privacy impact assessment in order to identify and manage cyber risks. A formal cybersecurity emergency response plan should be developed in each public agency.

Phase IV: Boosting data utilization

The potential power of OGD appears only when it is utilized, and this utilization requires the competence of stakeholders. Encouraging stakeholders, such as governments, private corporations, non-profit organizations, and individuals, to play a role in the data utilization would create concrete value and impacts. Based on the research results, the ways in which to support stakeholders to utilize OGD vary, such as strengthening digital competence, enhancing knowledge or skills, implementing necessary measures, organizing conferences, annual presentations, competitions, rewarding, and providing incentives.

In particular, a government should support the knowledge and analytical skills of government officials, the private sector, non-government organizations, and the public. Retraining and reskilling data stakeholders ensure that they can have knowledge and understanding of the data, and use it correctly. Additionally, the public sector should support research and development. Besides analyzing and processing all necessary data, research will take into account environmental factors that numbers or data may not be able to reflect, or that are difficult to quantitatively measure. Developing hypotheses or analytical models will help to avoid making inaccurate conclusions that lead to inaccurate policy decisions.

Phase V: Promoting data impacts

Since the development and utilization of OGD are in the beginning stages of its implementation, the understanding of it may not be clear. Therefore, communicating the results of information is very important. The public sector needs to systematize, support, and publicize the OGD impacts on a country's development in all dimensions, such as economic, social, and government aspects. Projects on the use of OGD, whether public, private, or public, should be promoted and supported for publicizing the results. In particular, a government should assess the benefits or value arising from the exploitation of OGD. These governmental supports and public relations will help to increase and boost the understanding and appreciation of OGD regarding various dimensions of national development. The private sector and the public will also see more opportunities and ways to take advantage of OGD.

Phase VI: Expanding more valuable datasets in a variety of government agencies

After data have been empirically utilized, governments should expand the scope of the types and sources of government data that citizens or the private sector wish to disclose and take advantage of the OGD. At this stage, the goal of the disclosure may be extended to the national big data-holding agencies, especially demographic data, quality of life data, economic data, tourism data, etc.

In Thailand, aside from finding the right data, finding the right government agencies which hold vast and important data of the country could also be an option to

enhance OGD development, such as the Ministry of the Interior, which holds data on some of the basic minimum needs of Thai citizens, Thai National Statistical Office, which conducts statistics to monitor, evaluate, and support the implementation of government policies and plans. The government data from these agencies reflect the situation of people's quality of life and the country's development situation. Since the government data are of great assets in terms of public policy formulation for various areas of development, it will increase the opportunity to make public policy formulation to address people's problems and needs based on evidence. It should thus be publicly released on a national open data portal according to the principles of OGD.

When expanding the scope of the types and sources of OGD, governments should also support data utilization as in step 4 and promote the results of data utilization as mentioned in step 5.

Phase VII: Establishing an OGD management and utilization system within government agencies

As more diverse OGD are utilized more empirically, this step is to establish a formal OGD management and utilization system within government agencies at all levels, such as ministries, public departments, regional public agencies, and local governments. Establishing a system within government organizations will help to standardize and secure the development of OGD. It will set a new standard in government practice that must be linked to empirical data as evidence.

Creating an OGD system within government organizations may learn from a law in the United Stated entitled the “Foundations for Evidence-Based Policymaking Act of 2018” established on January 14th, 2019. The law is intended for United States public agencies to develop OGD and to take advantage of OGD in terms of public policy and operations as evidence. The law defines organizational structure for the development and utilization of OGD, as shown in Figure 5.10.

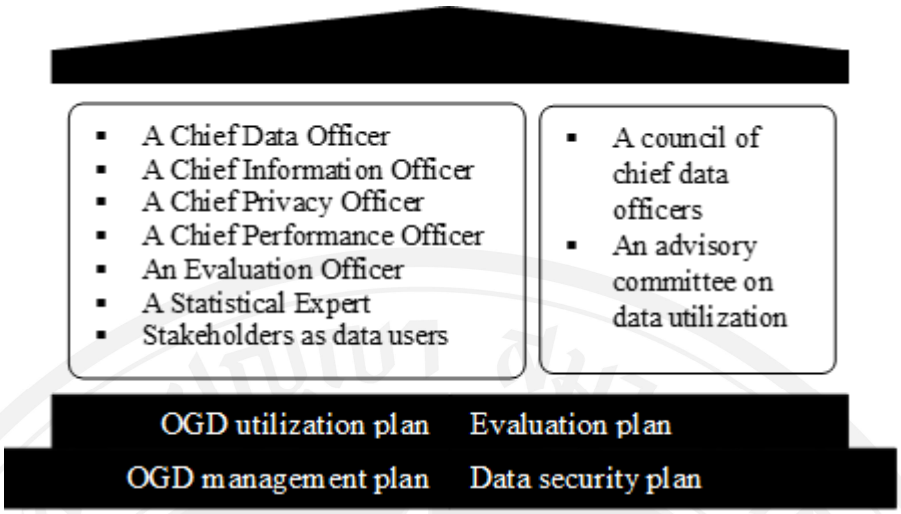


Figure 5.10 Guidance of OGD Management and Utilization System within a Public Agency

Source: Adapted from “Foundations for Evidence-Based Policymaking Act of 2018”

An organization should define the responsible officers within an organization, including a chief data officer, a chief information officer, a chief privacy officer, a chief performance officer, an evaluation officer, a statistical expert, and stakeholders as data users, and cooperate with other organizations as a network, including a council of chief data officers and an advisory committee on data utilization.

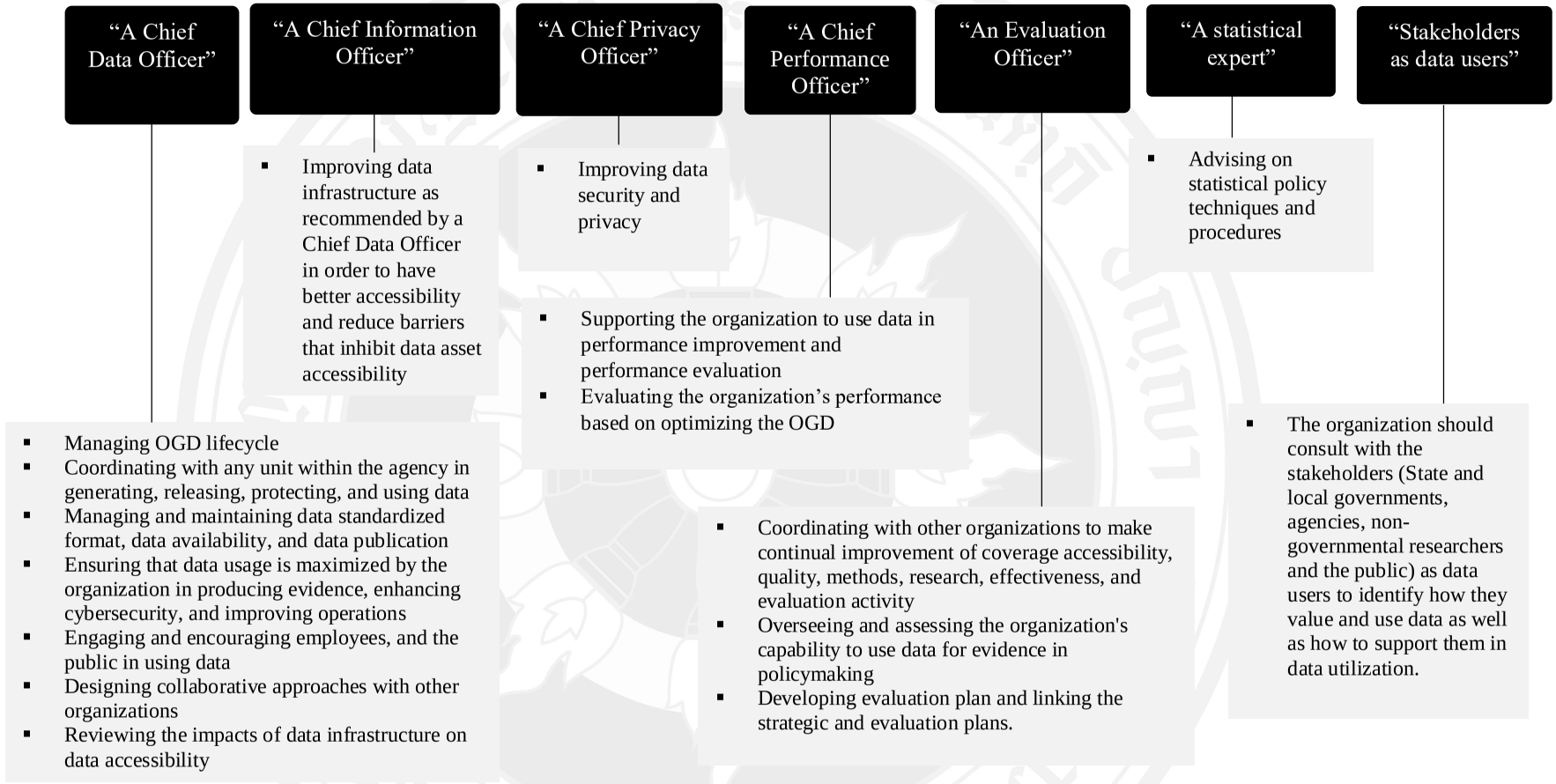


Figure 5.11 Organization Structure for OGD Management and Utilization Systems
Source: Adapted from "Foundations for Evidence-Based Policymaking Act of 2018"

Figure 5.12 Cooperation between Organizations for OGD Management and Utilization Systems
Source: Adapted from “Foundations for Evidence-Based Policymaking Act of 2018”

Applying this legal framework may help governments institutionalize the government agencies. In addition, governments should require organizations to formulate and implement the relevant OGD plans for the development and utilization of OGD within the organizations as follows.

OGD management plans should explain the following: (i) what data categories or data lists would be acquired, collected, stored, and released; (ii) what methods or tools are to be collected, acquired, and analyzed so that the OGD will be used; (iii) how the data will be updated and publicly released on the OGD portal after the data are finalized in terms of timeliness; (iv) how an agency facilitates engagement and collaboration with data users to improve the management system of OGD, such as non-governmental researchers, the public, and the private sector (business entities); (v) how an agency evaluates and improves the quality of OGD.

OGD utilization plans or strategic plans should be formulated in order to identify how OGD can help an organization accomplish its missions. It should contain (i) policy-relevant questions that address where the agency has the intention to develop and seek OGD as evidence to support policymaking; (ii) a list of analytical tools or methods that the agency would use to maximize data to support evidence in policymaking; (iii) a list of restrictions or challenges that the agency may be faced with; (iv) a process description that the agency would undertake; and (v) a process to ensure public engagement and collaboration in utilizing OGD, such as how to request more specific government data, and how to support data utilization (i.e. hosting events, competitions, and other initiatives).

After optimizing OGD, an evaluation plan needs to be prepared for performance assessment and what plan to do in the next coming year. The evaluation plan must include (i) key questions with their description for significant evaluation planned to be carried out in the next budget year; (ii) key information with its description that an organization plans to implement in the next fiscal year. In developing those two plans, the agency needs to consult key stakeholders that are specified in the act, including the public, state and local governments, and researchers.

A data security plan should be initiated correctly and consistently. It should indicate how OGD is protected securely by controlling data use and accessibility, how an organization operates under a pledge of confidentiality, how the organization

ensures confidential information protection, and how the organization utilizes OGD under confidentiality assurance.

5.3.3 Limitations of this Research

OGD have been a trend over the years, but it is still an early phenomenon and many topics are being discussed. For this research, although it yielded interesting results, there are some limitations. Although it revealed that OGD impacts were found in various dimensions from the case study analysis, the secondary data used in the model testing were only in terms of transparency and accountability for governance impacts. This was a limitation of this research.

Moreover, since the political instability variable as the moderating variable aimed to investigate its influence on the relationship between government capability and data impacts, this influence of political instability was therefore not studied in terms of the development of OGD. This study may not reflect the influence of political instability on the creation and development of OGD. Additionally, it may not reflect other political contexts, such as regime, democratic environment, and so on. These issues should be investigated further.

5.3.4 Recommendations for Further Research

There are opportunities for future research to explore this phenomenon in order to foster data driven approaches for country development. The directions for future research can be introduced in two main aspects: (i) the directions for future research based on the limitations of this dissertation, and (ii) the directions for future research based on the research findings.

5.3.4.1 Directions for Future Research Based on the Limitations of This Research

1) As this study used secondary data for both the qualitative and quantitative methods, future research may broaden the findings and prove them again by conducting primary research. Especially in quantitative analysis, since some of the variables (i.e. data impact) had not yet been fully measured, future research may measure them again or re-test the model to see if the measurements of the variable can be built and if there are data for the variable measurements that can be made available.

2) As this research only examined the political context affecting the relationship between the government capability and data impacts, further study may find the influence of political context on the formation, release, and development of OGD. The political issue will provide insights into why a government releases its government data to the public or why a government produces a policy of OGD. Further, it will provide an understanding of why a government does not disclose its data, or why OGD formulation or implementation is successful or has failed. Researching the political context as an institutional condition influencing the creation and development of OGD will help us understand the nature of OGD practices. Importantly, studying such political issues will help us design mechanisms to regulate or examine the political contexts that impede development.

5.3.4.2 Directions for Future Research Based on the Research Findings

Future research may investigate what the limitations or barriers are to building the preconditions of OGD development, improving OGD quality, and enhancing the seven government capabilities to unleash the power of OGD. The issues of future research are presented as follows.

1) Regarding the preconditions for OGD, future research can be initiated by the interesting research issues as follows.

(1) Data technology infrastructure may emphasize innovative tools or applications for collecting, storing, integrating, analyzing, and protecting the data. Additionally, research issue regarding the value assessment of data technology investment is interesting. For example, a cost-benefit analysis will

assist with society's decision-making for investing in data technology infrastructure for OGD development, and cost-effectiveness will measure costs in monetary terms while measuring OGD results in non-monetary aspects. This will allow for the effectiveness of the various social dimensions.

(2) In the data security aspect, the more data are disclosed and the more value they have, the more important it is to secure the data. Research issues vary, such as what data security technology is appropriate, what the approaches are to addressing urgent situations when the data are threatened, what guidelines exist for establishing partnerships between professional private companies or white hackers, and how to simulate scenarios if data are lost or damaged.

(3) For trust in the government, although the quantitative method revealed that there was no significant influence on OGD development, qualitative research from some case studies was found to be important. Trust itself is complex, as this study found that it can be both a precursor to OGD development and a result of OGD utilization. Future research may thus emphasize the relationship between trust and OGD implementation again through primary research, which will provide a better understanding of the relationship.

2) For OGD development, future research may find out what types of government datasets should be released to the public, or what types of government datasets can produce economic, social, and government benefits. In addition, future research may also look at ways to link or integrate the government data among the types of the data, or among the federal government, local governments, and public agencies.

3) For required government capabilities to unlock the potential of OGD, there are interesting issues for future research as follows.

(1) One of the most challenges for OGD development and utilization is the culture of public administration. As revealed, an open government culture needs to be established. The complexity of this issue may lie in the different cultural and institutional conditions across countries and government agencies. Future research may find what the cultural conditions or cultural factors influencing OGD are, and how the configuration of the cultural conditions or factors will determine the options for the strategy to transform government agencies to become more open

cultures. Importantly, such an open government culture needs to be cultivated at the behavioral level of workers to support the data culture (i.e. collecting data, storing data, protecting data, utilizing data, and so on) at an individual level. Future research may adapt the models of e-government application to draw a conceptual framework to study why and how individuals will recognize the importance and benefits of OGD and implement it in practice. For example,

i. The technology acceptance model (TAM) developed by Davis, Bagozzi, and Warshaw (1989) aimed to explain the factors or mechanisms for deciding to accept and use technology. If applying it to OGD, it can offer variables concerning the perceived ease of OGD use, the perceived usefulness of OGD, attitudes toward OGD utilization, decides to use OGD, and actual usage of OGD. Additionally, the evolved versions of TAM developed by Venkatesh and Davis (2000) may be also adapted for further research to investigate the determinants of the acceptance of OGD use such as social influence (i.e. subjective norm, voluntariness, image), and other factors covering cognitive processes or knowledge creation (i.e. job relevance, output quality, result demonstrability, perceived ease of use). The versions of TAM can provide relationships among the variables as well.

ii. The theory of reasoned action (TRA) offered by Ajzen and Fishbein (1980) aimed to describe human behavior in decisions to take or not to take. It assumed that behavioral beliefs, which would continue to influence a person's attitudes and normative beliefs which would influence a person's norms. It can provide a logical action of OGD at an individual level. It provides an understanding of the variables in terms of beliefs, attitudes, intentions, and behavior of an individual regarding OGD. TRA can also offer an understanding of the relationships among the variables as it assumes that the behavior of any person is a function of his or her inclination to do or avoid doing that behavior based on psychological variables: belief, attitudes, and intention.

iii. The theory of planned behavior developed by Ajzen (1991) aimed to describe decisions to take advantage of large and complex systems. The elements of this model include a person's attitudes, a person's norms, and the perception of control over a person's behavior, and a person's actions.

iv. The motivational model developed by Davis, Bagozzi, and Warshaw (1992) aimed to describe the adoption of technology. Its components include external motivation (i.e. perception of benefit or value of usage), and internal motivation (i.e. joy in using it).

v. The unified theory of acceptance technology and use of technology developed by Venkatesh, Morris, Davis, and Davis (2003) and Venkatesh, Thong, and Xu (2012) can be adapted for future research to explain the intentions of OGD users in using it. The model drew on key structures, including expected performance, effort expectancy, social influence, and facilitating condition. These are the essential components in accepting and using technology under moderating variables, such as gender, age, experiences, and voluntariness of OGD use.

(2) As revealed in the research findings, the private sector or business units are the essential OGD users that leverage and increase the potential of OGD. This importance paves the way for in-depth and comparative studies, such as how the private sector or business units utilizes OGD value in practice, how the data are used to run business in terms of services, products, and innovation, and what the differences or similarities of data development and utilization are between public and private sectors. These questions will be useful to identify the practical ramifications of the different types of strategies, methods, and ideas from both the public and private sectors. When governments have seen the obvious benefits of using OGD in business cases, the ability to define guidelines for implementation becomes clearer. It will help to design and formulate a cooperative approach for the public and private sectors to develop and leverage OGD. Moreover, future research may explore policy-making guidelines of OGD based on stakeholder participation at all levels.

4) In terms of OGD impacts, as it was revealed that an OGD project can generate benefits and value in many ways, future research may study in-depth the value chain of the benefits of OGD. It will enhance and emphasize the ongoing value chain of OGD. This research question will help to spot the differences that OGD can produce to make changes in a country's development. Importantly, evaluating the success of OGD development is another very interesting and important issue. As revealed that the roles of public engagement play an essential role in the use

of OGD, evaluating OGD success from the citizens' perspective as a stakeholder is thus of great importance. In assessing such issues, future research may apply the model of cost, benefit, risk, and opportunity (COBRA) developed by Osman et al. (2014), a model for assessing the success of public service by e-government systems through the perspective of citizens or users. It is rooted in social exchange theory, expectation theory, and the SWOT analysis model. Its components include (i) cost (i.e. personal costs required to access services, length of time required for service); (ii) opportunities (i.e. eases of OGD access anytime and anywhere, up-to-date OGD); (iii) benefits (i.e. service efficiency, service effectiveness, cost reduction, flexibility, convenience); and (iv) risks (i.e. personal data security).

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APPENDICES

APPENDIX A - Cases of OGD Utilization Categorized by Countries

No.	Case	Country	Data impacts		
			Economic	Social	Governance
1	Open data 500 Australia study	Australia	/		
2	Sense-T	Australia	/		
3	National map	Australia		/	
4	Energy rating tools	Australia		/	
5	Tasmania's sense-T	Australia		/	
6	Landsat satellite data	Australia		/	
7	DoseMe	Australia		/	
8	Australian public service big data strategy	Australia			/
9	eTax pre-filling	Australia			/
10	Developer’s corner	Canada	/		
11	FinCom or DataPublica	France	/		
12	OpenFisca	France			/
13	Intelligent transport system	Japan		/	
14	Made by Japan agriculture	Japan		/	
15	ANZ bank	New Zealand	/		
16	MarineMate app	New Zealand	/		
17	HERE maps	New Zealand	/		
18	Nest finder	New Zealand	/		

No.	Case	Country	Data impacts		
			Economic	Social	Governance
19	ANZ Truckometer	New Zealand	/		
20	Homes.co.nz	New Zealand	/		
21	Dumpark	New Zealand		/	
22	Tracking equality at work	New Zealand		/	
23	GeoNet	New Zealand		/	/
24	Coffey geotechnics	New Zealand		/	
25	Access aware	New Zealand		/	
26	SaferMe	New Zealand		/	
27	LINZ data	New Zealand		/	
28	Waka digital	New Zealand		/	
29	GPS application	New Zealand		/	
30	ThunderMaps	New Zealand		/	
31	Affordability in NZ	New Zealand		/	
32	New Zealand fishing rules	New Zealand		/	
33	Product recalls NZ	New Zealand		/	
34	Land, air, water, aotearoa (LAWA)	New Zealand		/	
35	School finder	New Zealand			/
36	Kamo place race - Town planning made lean and agile	New Zealand			/
37	The Norwegian state educational loan fund	Norway		/	
38	Farm maps	Norway		/	
39	Norwegian tax administration and the a-ordning scheme	Norway		/	/

			Data impacts		
No.	**Case**	**Country**	**Economic**	**Social**	**Governance**
40	eBevis (eDocumentation)	Norway		/	/
41	Brønnøysund register	Norway			/
42	Kimgisa	South Korea	/	/	
43	GoodDoc	South Korea	/	/	
44	Modu parking	South Korea	/		
45	Naver map	South Korea	/		
46	K-weather	South Korea	/		
47	Red table	South Korea	/		
48	e-People website	South Korea			/
49	City as a platform of London	United Kingdom	/		/
50	Ordnance Survey Open data (OS Open data)	United Kingdom	/	/	
51	Citrus analytics	United Kingdom	/		
52	HM land registry	United Kingdom	/		
53	Carbon profits	United Kingdom	/		
54	OS Minecraft	United Kingdom	/		
55	Transport for London (TfL)	United Kingdom	/		
56	Open data user group (ODUG)	United Kingdom	/		
57	Open data challenge series	United Kingdom	/		
58	T4 media	United Kingdom	/		
59	TheyWorkForYou	United Kingdom			/
60	Open public services network (OPSN)	United Kingdom			/

No.	Case	Country	Data impacts		
			Economic	Social	Governance
61	Contracts finder	United Kingdom	/		
62	FixMyStreet	United Kingdom			/
63	data.police.uk	United Kingdom		/	
64	Open data: Guardian good GCSE guide	United Kingdom		/	
65	The college scorecard	United States of America		/	
66	MyStudentData	United States of America		/	
67	The U.S. energy information administration through an application programming interface (EIA API)	United States of America		/	
68	NOAA: Opening up global weather data in collaboration with businesses	United States of America	/		
69	GPS data	United States of America	/		
70	PatentsView	United States of America	/		
71	Energy data	United States of America	/		
72	Opportunity project	United States of America	/		/
73	New York city business Atlas	United States of America	/		
74	Open energy information (OpenEI)	United States of America	/		
75	City energy profile tool	United States of America	/		
76	City SDK project (Software development kit)	United States of America		/	/
77	Police data initiative (PDI)	United States of America			/

No.	Case	Country	Data impacts		
			Economic	Social	Governance
78	ForeignAssistance.gov	United States of America			/
79	eRegulations	United States of America			/

APPENDIX B - Descriptive Statistics of the First-Order Constructs

Latent variables	Items	Mean	Standard Deviation	Kurtosis	Skewness
OGD	OGDC	4.832	0.525	62.851	-7.143
	OGDT	2.439	2.372	-0.548	0.651
	OGDM	5.509	4.027	-1.081	0.23
	OGDE	7.15	1.677	-0.087	-0.581
	OGDL	2.174	3.166	1.832	1.618
SI	SI1	1.2	1.669	0.771	1.349
	SI2	0.513	0.927	2.314	1.789
	SI3	4.423	0.9	-0.758	0.284
EI	EI1	1.017	1.474	4.665	1.966
	EI2	2.191	2.699	-0.041	1.106
TAA	TAA	1.452	1.522	-0.341	0.789
ACT	ACT	0.564	0.133	0.141	0.292
POGD	POGD1	3.122	2.668	-1.067	0.469
	POGD2	4.348	2.76	-1.288	-0.094
DC	DC	2.561	3.025	-0.532	0.929
MOGD	MOGD1	3.976	0.771	0.118	0.31
	MOGD2	4.079	0.753	0.404	0.319
	MOGD3	2.809	2.56	-0.884	0.635
GE	GE	4.261	2.664	-1.182	0.062
GS	GS1	3.983	1.837	-0.251	0.512
	GS2	2.896	2.419	0.195	0.905
RD	RD1	1,851.93	1,929.54	1.196	1.328
	RD2	0.988	0.907	2.458	1.617
ICTI	ICTI	5.354	2.139	-1.081	-0.231
DS	DS1	4.913	2.812	-1.415	0.021
	DS2	4.007	0.855	-0.476	0.056

Latent variables	Items	Mean	Standard Deviation	Kurtosis	Skewness
	DS3	0.381	0.22	-1.163	0.197
TG	TG	0.46	0.178	-0.153	0.369
PI	PI	-0.104	0.877	0.054	-0.475

When considering results of descriptive statistics, some indicators seemed normally distributed, while many indicators have a standard deviation greater than the mean, indicating that the data are not normally distributed. Also, considering the values of Skewness and Kurtosis, the data are skewed. Based on the criteria, when Skewness and Kurtosis are zero, the data are normally distributed. Alternatively, if the value of Skewness is "greater than +1 or lower than –1, this is an indication of a substantially skewed distribution". If the value of Kurtosis is "greater than +1, the distribution is too peaked" or "less than –1 indicating a distribution that is too flat". Skew or Kurtosis that exceeds these criteria is not normally distributed (Hair, Hult, Ringle, & Sarstedt, 2017). Based on the results, there are many indicators representing non-normal distribution. However, PLS-SEM has no assumptions about the normality assumptions of data (normal distribution) (Henseler et al., 2009; Sarstedt et al., 2014; Vinzi, Trinchera, & Amato, 2010; Wong, 2013). PLS-SEM can handle with "all types of data (i.e., non-metric to metric) with very minimal assumptions about the characteristics of the data" (Hair et al., 2010; Hair et al., 2017; Hair et al., 2011). Thus, this research employed PLS – SEM to test the model.

BIOGRAPHY

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