Open Innovation Maturity Model for the Government: An Open System Perspective

Research-in-Progress

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Abstract

To meet the increasing expectations of citizens, governments have become increasingly open, transparent, accessible and consultative to deliver efficient public services. These trends can be fulfilled through open government data provision and usage. Governments can generate social and economic values by using data-driven open innovation processes, such as by adopting citizens' ideas or knowledge related to open data and by providing government data to the public. Despite the trends of open innovation in the context of government, research on open innovation is lacking. Furthermore, most studies disregard the differences of countries in the level of open innovation maturity of open data provision and usage. Therefore, this study aims to understand data-driven open innovation practices in government by developing a government-level open innovation maturity model, evaluating the current status of open innovation of the government, and suggesting appropriate future directions and guidelines for the government.

Keywords: open innovation, open innovation maturity model, open government, open data, open systems perspective, general systems theory

Introduction

Open innovation denotes the paradigm shift of firms from closed to open (Chesbrough 2003). That is, open innovation pertains to "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand markets for external use of innovation, respectively" (Chesbrough et al. 2006, p. 1). In this paradigm, firms can use both external and internal ideas to market as they advance their technology in a rapidly changing business environment. The basic assumption of open innovation is that internal and external knowledge and ideas can be combined and taken to market to generate additional value (Chesbrough et al. 2006).

To be competitive and to meet the increasing expectations of citizens, governments also need to innovate their public services by delivering them in an efficient and effective manner. According to the Organization for Economic Cooperation and Development (OECD) (2005), the governments of OECD countries are becoming more open, transparent, and accessible. At present, around 90% of countries have a 'Freedom of Information Act,' and more than 50% have standards for customer service. A continuing challenge for governments is to provide more accessible and high-quality information and services to social entities (e.g., citizens, institutions, and organizations) to meet their high expectations. These requirements can be fulfilled through open data provision and usage. Thus, governments have tried to realize social and economic values by data-driven open innovation processes (Jetzek et al. 2014), such as by adopting citizens' ideas or knowledge (i.e., outside–in process) and by providing government data to the public (i.e., inside–out process). Although many scholars have focused on open innovation at the firm level, studies on open innovation in the government context remain scarce (Christos et al. 2013; Feller et al. 2011; Fuglsang 2008; Nam 2010). Specifically, little attention has been given to the manner of designing open innovation processes and to the procedure of evaluating the performance of open innovation at the government level (Habicht et al. 2012), considering that most scholars and practitioners address the importance and necessity of adopting open innovations for the government (Dobni 2006).

Open data innovation involves the implementation of open data provisions and usage in the government context. Governments are getting involved in open innovation initiatives by focusing on the shift toward open paradigms (Assar et al. 2011). Open data facilitates the open innovation of services by allowing external parties to access government data and build useful applications for the public. However, literature on open data innovation lacks the appropriate governance mechanisms for providing insights into open government data provision and usage (Janssen et al. 2012). Moreover, uncertainty exists on the value of open government data and the manner of their evaluation (Helbig et al. 2012; Jetzek et al. 2014). In practice, the level of open data provision and usage differs from country to country. Therefore, important questions can arise: What factors should be measured?; How should the as-is situation of the data-driven open innovation of the government be assessed?; and How should its specific level of maturity be assigned? (Becker et al. 2009).

In summary, two major phenomena exist in open innovation in the context of government, namely, the government's paradigm shift from closed to open and the different levels of open data provision and usage from one country to another. Therefore, the two-fold objectives extracted from these phenomena are as follows: (1) to understand open innovation in government; and (2) to develop the evaluation criteria for the current status of government-level open innovation to propose appropriate future directions and guidelines. To achieve these objectives, this study is motivated by four research questions: (1) What are the major components of the government-level open innovation maturity model?; (2) How could the evaluation criteria for the current status of the government-level open innovation be developed?; (3) How could the developed maturity model be applied?; and (4) What directions and guidelines could be suggested based on implications of the evaluation results? Given that this study is one of early attempts to develop a government-level open innovation maturity model, we believe that the results will provide governments with insight into the successful adoption, evaluation and leveraging of open innovation.

Theoretical Background

Data-driven Open Innovation in Government

Open data pertain to "data that are freely accessible online, available without technical restrictions to reuse, and provided under an open access license, which allows data to be reused without limitation, including across different 'fields of endeavor' (e.g., commercial and non-commercial alike)" (Open Knowledge Foundation, 2012). ***Open government data*** denote the "data and information produced or commissioned by government or government-controlled entities that are opened up for use and reuse by public and private agents alike" (Jetzek et al. 2014, p. 102). Zuiderwijk et al. (2014) explain that seven different perspectives have been appeared in open data literature, although most studies use a single perspective in their investigation. The *legal perspective* focuses on the value of open data legislation (e.g., freedom of information acts and open data policies). The *political perspective* emphasizes the importance of political developments, which are different across countries. The *social perspective* highlights the variances in agendas related to the social benefits of opening data (e.g., transparency, participation and accountability). The *economic perspective* indicates the financial benefits that can be generated with open data. The *institutional perspective* focuses attention on the manner in which institutions enable and constrain the provision and usage of open data. The *operational perspective* focuses on the usage of open data and the requirements for using open data. The *technical perspective* focuses on the importance of technologies, platforms, and infrastructures used for open data.

Although many researchers have focused on open data-driven innovation from various perspectives, open innovation in governments via open data faces several challenges because of its complexities (Zuiderwijk et al. 2014). For example, many stakeholders (e.g., open data providers, facilitators and users) involved in open data processes have various interests that may conflict with each other. In addition, given that the publication and use processes of open data are complex, the proper time and method for open data use are difficult to determine. This situation implies that understanding how value is created from open data innovation, particularly how public value is generated, is not straightforward (Zuiderwijk et al. 2014). Furthermore, various factors challenge the generation of value from open data. The most commonly identified barriers include inaccessible datasets, lack of comprehensive data policies, lack of validity, completeness of datasets, lack of motivation within public sector, lack of technical and semantic interoperability and lack of technical ability within public and private sectors (Jetzek et al. 2014).

Despite these challenges and barriers to data-driven open innovation in the government level, "the quality of open government infrastructures is steadily improving" (Zuiderwijk et al. 2014, p. ix). However, government-level open data innovation still has a long way to go before it generates the expected value. Therefore, evaluation criteria for highly qualified and useful data provision should be determined. In other words, a data-driven open innovation maturity model for the government should be developed to evaluate the current status or level of open innovation. Such a model will provide the appropriate guidelines for the future open innovation of government.

The Government as an Open System

An open system is a system that continuously interacts with its environment or surroundings (Katz and Kahn 1978; Scott and Davis 2007). Interaction takes the form of information, energy or material transfers into or out of the system boundary, depending on the discipline that defines the concept. For example, in the social sciences, an open system is a process that exchanges material, energy, people, capital and information with its environment (Scott and Davis 2007). With regard to system boundary, closed systems have tough, fixed and impermeable boundaries, whereas open systems have permeable boundaries. In the perspective of their relationship with the environment, closed systems cannot exchange matter, energy or information with environments because they seek little interaction with the environment. Closed systems also have an internal orientation and self-contained and self-sufficient characteristics. The environment is typically stable in this system. By contrast, open systems can perform exchange via inputs and transformation (Scott and Davis 2007). In this system, organizations attempt interaction and accommodation with their environment. Open systems also have an external orientation in the wide environment depending on the environmental characteristics. The environment is usually

turbulent in this system. The government continuously interacts with its environment (i.e., society), such as citizens and communities. Therefore, we can regard the government as an open system.

The government as an open system can be understood through open systems perspective from general systems theory. Open systems perspective explains a few major components that comprise an open system, namely, environment, inputs, transformation, outputs, and feedback. First, an ***environment*** denotes all of the elements outside the system that can potentially affect all or some parts of the system. Second, ***inputs*** pertain to the inflows of energy and information from the external environment to renew the system (Katz and Kahn 1978). Energetic inputs may include people, materials or resources from other organizations (Meyer 2010; Meyer and O'Brien-Pallas 2010). Informational inputs include negative feedback or signals about the external environment. Third, ***transformation*** indicates that energies within the system are changed by reorganizing the inputs. In other words, this component denotes the process of converting or transforming resources within the system, and indicates that the system consists of interrelated subsystems. Reorganization may entail the processing of materials, generation of products or provision of services (Katz and Kahn 1978). A large-scale organization is an open system that consists of supportive, maintenance, adaptive, production and management subsystems (Meyer and O'Brien-Pallas 2010). The *supportive subsystem* imports people, materials and energies through transactions at the organizational boundaries. The *production subsystem* transforms organizational energy by dividing the labor to accomplish tasks and generate outputs. Energetic inputs are processed through the recurring and patterned activities and interactions of individuals to yield outputs. The *maintenance subsystem* balances internal work structures relative to human inputs by formalizing activities and socializing and rewarding members. The *adaptive subsystem* deals with problems of adjustment to external forces by recommending and incorporating changes (i.e., monitoring and responding to external forces). The *management subsystem* coordinates and integrates the overall function, adjusts to external demands and cross-cuts, directs all subsystems and negotiates conflicts across hierarchical levels (Meyer 2010). Fourth, ***outputs*** may consist of materials, products or services. The product must be exported to the external environment (Katz and Kahn 1978). Fifth, ***feedback*** signifies negative entropy. To survive, an organization must overcome entropy, which is an inevitable process of disorder and dissolution caused by the loss of inputs or by an inability to transform energies. To ensure its continued existence, an open system must reduce the disorder status (Meyer and O'Brien-Pallas 2010).

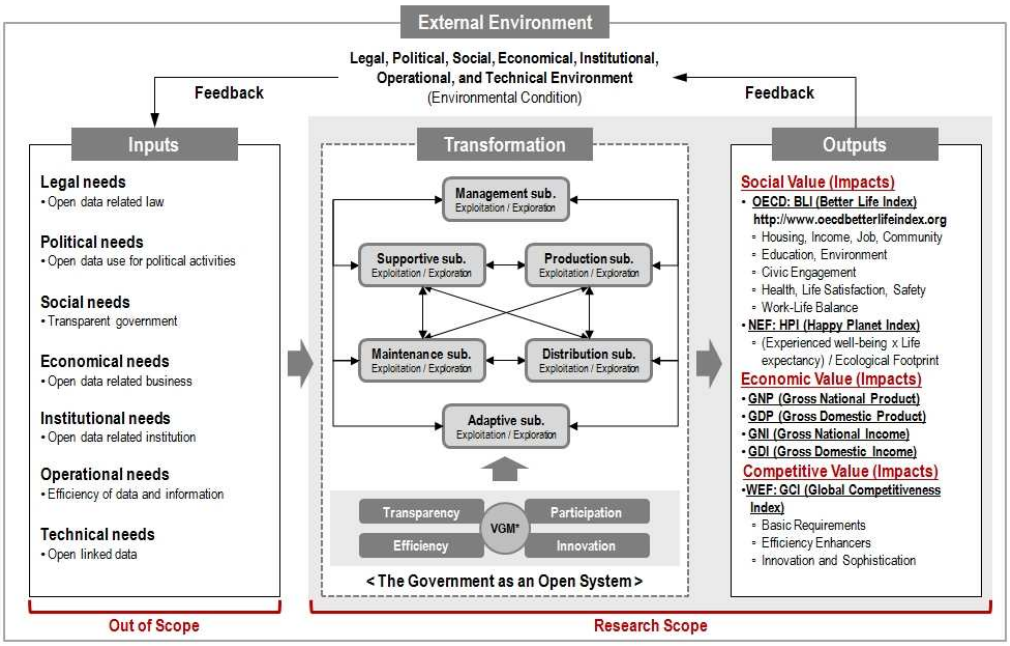
The quality of open systems perspective can be evaluated by the framework of Weber (2012) in terms of parts (i.e., constructs, associations, states and events) or as a whole (i.e., importance, novelty, parsimony, level, and falsifiability). In terms of parts, the open systems perspective consists of several components that are defined precisely. Associations between the components are defined reasonably, and states and events inside and outside the boundary of the theory are discussed. As a whole, the open systems perspective provides clear reasons why the theory is important in practice. This perspective introduces general components and associations. However, for open innovation in a government context, these components and associations can be new ones. Depending on the research context, the open systems perspective can have many possible constructs, associations, states and events. Therefore, this perspective can be understood by the maturity model in open innovation. This perspective is framed at the macro-level; however, depending on the research contexts, parts of the theory that have been articulated can be empirically tested.

Conceptual Framework

On the basis of the open systems perspective, we developed a framework for open data innovation in the government (see Figure 1). Five components comprise this framework, namely, *environment, inputs, transformation, outputs,* and *feedback*. First, ***environment*** pertains to all elements outside the government that can potentially affect all or some parts of the government. As an open system context, the government can operate in various types of environment (i.e., legal, political, economic, institutional, operational and technical) (Zuiderwijk et al. 2014). Second, ***inputs*** refer to open data-related needs or requirements that are obtained or received from the external environment for the government's open innovation. Third, ***transformation*** denotes the conversion of input needs or requirements within the government system that consists of interrelated six subsystems, namely, supportive, production, distribution, maintenance, adaptive and management subsystems (Meyer and O'Brien-Pallas 2010). A mechanism is a special mode (or collection of fundamental processes) of accomplishing tasks within a

particular system. Jetzek et al. (2014) propose four types of value-generating mechanisms of open government data, namely, transparency, citizen participation/collaboration, efficiency/effectiveness, and innovation mechanisms. These mechanisms drive the creation of public value from opening data through innovations that create new products, services and models of service delivery or engagements with citizens (Zuiderwijk et al. 2014). In these value-generating processes, the maturity level of the open innovation of governments will be differ depending on the capability levels of each subsystem. In this study, we provide guidelines for growing these transformation phases depending on the maturity levels. Fourth, ***outputs*** pertain to the outcomes of the government system, which will be exported back into the environment. These outputs include social, economic and competitive values. The level of these outputs will vary depending on the maturity level of the transformation processes (i.e., maturity level of open innovation of the government). Finally, ***feedback*** refers to a continuing source of information concerning the relationship with the external environment; this information is used to make the necessary changes for ensuring the survival and growth of the government.

This study develops an open innovation maturity model by focusing mainly on the relationship between transformation and outputs (i.e., areas with a grey background in Figure 1) because inputs (i.e., open-data related requirements) can vary depending on the status of the external environment. After validating the proposed model in this study, we will also consider the changing environment, inputs and feedback in the future. We believe that the model proposed in this study is the best means not only to assess the current maturity level of the open innovation of a government but also to provide the government with appropriate future directions and guidelines to increase the maturity level.



Note: * VGM: Value Generating Mechanism

Figure 1. Open System Framework for Open Innovation in the Government

Developing an Open Innovation Maturity Model for the Government

We applied the development approach of the maturity model proposed by Becker et al. (2009) and Hevner et al. (2004) to build our development processes, which involve three procedures: (1) problem identification; (2) comparison of existing maturity models and determination of a development strategy; and (3) iterative maturity model development.

Procedure 1: Problem Identification

This phase was performed in the introduction and theoretical background sections of this study.

Procedure 2: Comparison of Existing Maturity Models

Five types of strategies may be used to develop a maturity model: (1) designing a completely new model; (2) enhancing an existing model; (3) combining several existing models into a new one; (4) transferring structures; and (5) applying contents from existing models to new domains (Becker et al. 2009). Based on the comparison results of the goals, targets and measurability and applicability of existing maturity models in both the public (i.e., government context) (Andersen and Henriksen 2006; Kalampokis et al. 2011; Layne and Lee 2001; Lee and Kwak 2012; Lee 2010; Siau and Long 2005) and private (Enkel et al. 2011; Habicht et al. 2012) sectors, we decided to develop an entirely new maturity model of open innovation for the government because a maturity model that is specifically designed for open innovation through open data in the government context remains nonexistent. Most existing maturity models that are related to the public sector exhibit limitations in terms of practical applications because they are conceptually developed or developed only for a specific context of the government of a particular country.

Procedure 3: Iterative Maturity Model Development

The first step of this procedure is determining the design depth and overall structure of the proposed maturity model. We derived the fundamental structure of an open innovation maturity model for the government, as shown in Figure 2. First, each subsystem consists of generic and subsystem-specific processes. Second, each generic and specific process is defined and measured based on the operational definition. Third, the capability type of each subsystem can be extracted from the measurement results (see Table 1). Fourth, after ascertaining the type of each subsystem, the synthesized capability level of the entire subsystem (see Figures 2 and 3) can be calculated (e.g., calculate average score for each capability) and mapped. Finally, the data-driven open innovation maturity level of a certain government can be determined based on the aforementioned procedures.

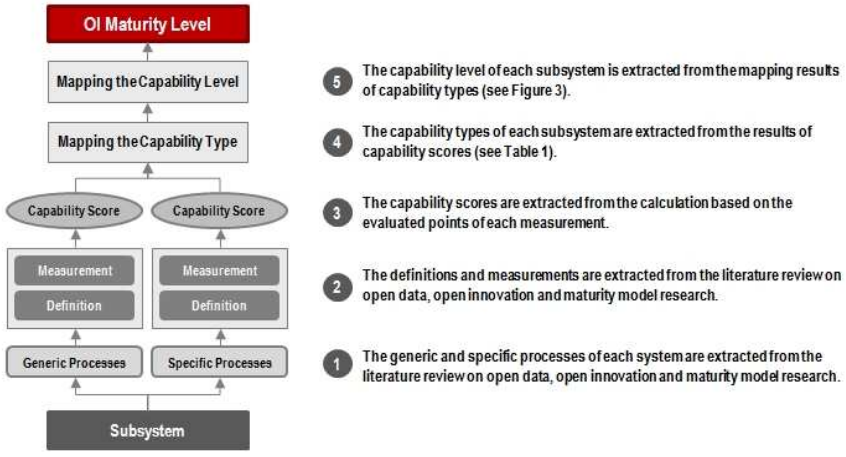


Figure 2. Fundamental Structure of the Open Innovation Maturity Model for the Government

The second step of the procedure involves the selection of approaches or methods for conducting each procedure in Figure 2. The generic and specific processes, together with their corresponding definitions and measurements, are extracted from the literature review on open data, open innovation and maturity model research. Capability scores, types and levels are then extracted from the evaluated points of each measurement item (refer to the Appendix).

The third step of this procedure entails designing an open innovation maturity model for the government and justifying its maturity level. First, the capability types of open innovation for the government are derived from the related literature review listed in Table 1. The scope of open innovation for the government consists of two axes, namely, open data provision and open data use. In the latter, two types of open data use are available, namely, exploitation and exploration. *Cell A1* indicates that open data are provided and used by the government. In such situation, the government uses the data to improve its current social, economic and competitive status. Therefore, the *application capability* of the open data of the government is required to accomplish this purpose. *Cell A2* denotes that although open data are

provided and used by the government, the government mainly uses the data to create new and innovative social, economic and competitive values. Therefore, *acquisition capability* is the basic requirement to attain this purpose. *Cell B1* indicates that open data are provided by the government and used by the society. That is, the society uses the data to improve its current social, economic and competitive status. Therefore, *delivery capability* is required to achieve this purpose. *Cell B2* signifies that although open data are provided by the government and used by the society, the society uses the data to create new and innovative social, economic and competitive values. Therefore, the basic capability required for this Cell is *extension capability*. *Cell C1* denotes that open data are provided by the society and used by the government. In this situation, the government uses the data to improve its current social, economic and competitive status. Therefore, *absorption capability* is basically required to realize this purpose. *Cell C2* also indicates that open data are provided by the society and used by the government, but the government mainly uses the data to create new and innovative social, economic and competitive values, which indicates that *creativity capability* plays an important role in accomplishing this purpose. *Cell D1* signifies that open data are provided and used by the society to improve its current social, economic and competitive status. Therefore, *diffusion capability* is required in this situation to achieve this purpose. *Cell D2* denotes that although open data are provided and used by the society, the society mainly uses the data to create new social, economic and competitive values. Therefore, the basic requirement to achieve this purpose is *emergence capability*. The activated value-generating mechanisms in each cell are explained with each capability in Table 1.

Table 1. Capability Types of Open Innovation for the Government

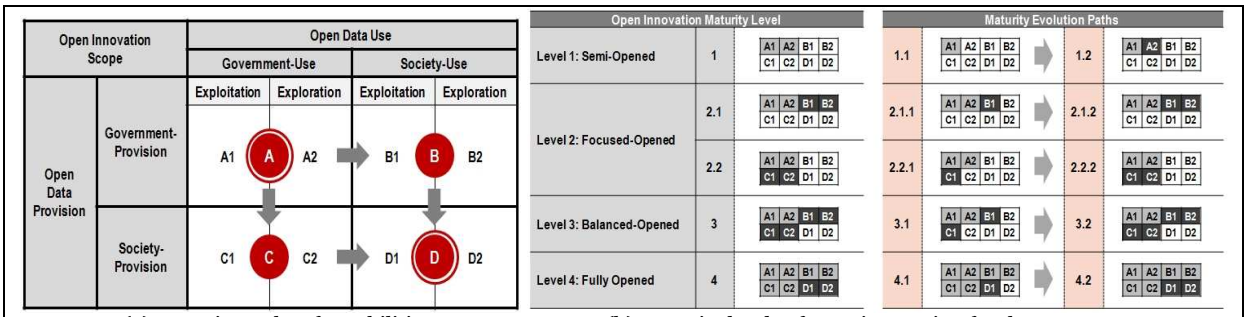
Open Innovation Scope		**Open Data Use**			
		Government-Use		**Society-Use**	
		Exploitation	**Exploration**	**Exploitation**	**Exploration**
Open Data Provision	**Government -Provision**	**[A1]** • Application capability • Efficiency VGM*	**[A2]** • Acquisition capability • Efficiency and innovation VGM*	**[B1]** • Delivery capability • Transparency, participation, and efficiency VGM*	**[B2]** • Extension capability • Transparency, participation, efficiency, and innovation VGM*
	Society-Provision	**[C1]** • Absorption capability • Efficiency and participation VGM*	**[C2]** • Creativity capability • Efficiency, participation, and innovation VGM*	**[D1]** • Diffusion capability • Transparency, participation, and efficiency VGM*	**[D2]** • Emergence capability • Transparency, participation, efficiency, and innovation VGM*

Note: * VGM: Value Generating Mechanism

We posit three assumptions to understand the capability levels. First, we assume that exploration should be preceded by exploitation (Benner and Tushman 2002; Gupta et al. 2006; Lewin et al. 1999). Based on the open systems perspective, exploitation and exploration are respectively related to morphostasis and morphogenesis. Morphostasis refers to processes (e.g., characteristics, properties) that tend to maintain the given form, structure or state of a system, while morphogenesis refers to processes that change a system (e.g., growth, learning, and differentiation) (Buckley 1967). Therefore, we assume that morphogenesis should be preceded by morphostasis. Second, we assume that the basic maturity level is *Cell A [A1+A2]* and the final maturity level is *Cell D [D1+D2]* (Lewin et al. 1999). *Cell A* can be considered a default sharing economy platform. In this platform, governments can innovate by sharing their data. *Cells B* and *C* can be considered a limited sharing economy platform. In this platform, governments do not only provide their data to society members in *Cell B* (i.e., inside-out processes of open innovation) but also use the data of society members in *Cell C* (i.e., outside-in processes of open innovation). Therefore, the members of both governments and societies can innovate by finding new opportunities. *Cell D* can be considered a full sharing economy platform. In this platform, the role of the government is to provide an open platform that serves as intermediary in data sharing among society members to enable them to find new generable opportunities. Third, the open innovation capability for the government consists of three levels based on the evaluated score, namely, performed (Level 1), managed (Level 2) and defined (Level 3). Therefore, reaching Level 3 of each capability is ideal to move to the next maturity level.

Based on these assumptions, each type of path can reach a mature capability level, as shown in Figure 3(a). The *first possible path* can be *Cell A [A1+A2]* → *Cell B [B1+B2]* → *Cell D [D1+D2]*. The *second possible path* can be *Cell A [A1+A2]* → *Cell C [C1+C2]* → *Cell D [D1+D2]*. The *third possible path* can be *Cell A [A1+A2]* → *Cell B [B1+B2]* and *Cell C [C1+C2]* → *Cell D [D1+D2]*. If the capability of the generic and

specific processes of a certain maturity level is achieved, then the maturity level is qualified to progress to the next level (Chrissis et al. 2011). Based on the possible paths, Figure 3(b) shows that the maturity levels of open innovation for the government consist of four stages: *Semi-opened, Focused-opened, Balanced-opened and Fully opened (Levels 1, 2, 3 and 4, respectively)*. One step below maturity Level 1, the evolution path of this level is maturity Level 1.1 (i.e., *Cell A1*) → 1.2 (i.e., *Cells A1 + A2*). Maturity Level 2 consists of two types. One of the evolution paths of this level is maturity Level 2.1.1 (i.e., *Cells A1 + A2 + B1*) → 2.1.2 (i.e., *Cells A1 + A2 + B1 + B2*). Its other evolution path is Level 2.2.1 (i.e., *Cells A1 + A2 + C1*) → 2.2.2 (i.e., *Cells A1 + A2 + C1 + C2*). The evolution path of maturity Level 3 is maturity Level 3.1 (i.e., *Cells A1 + A2 + B1 + C1*) → 3.2 (i.e., *Cells A1 + A2 + B1 + B2 + C1 + C2*). Finally, the evolution path of maturity Level 4 is maturity Level 4.1 (i.e., *Cells A1 + A2 + B1 + B2 + C1 + C2 + D1*) → 4.2 (i.e., *Cells A1 + A2 + B1 + B2 + C1 + C2 + D1 + D2*).



(a) Maturity paths of capabilities (b) Maturity levels of open innovation for the government

Figure 3. Capability Paths and Maturity Levels of Open Innovation for the Government

The final step of this procedure is testing the proposed maturity model. We plan to conduct an empirical pilot test to validate our proposed open innovation maturity model for the government using data collected from three to four countries, such as the United Kingdom, United States, Korea and China. (For additional details on the methods used, refer to the subsequent section. The methods for the pilot test are nearly similar to those of the main test, except for the sample size.) We will subsequently finalize our maturity model based on the results of the pilot test.

Future Research Plan and Expected Contributions

Once the maturity model is finalized based on the results of the pilot test, we will examine the appropriateness of the major components of the government-level open innovation maturity model based on the taxonomy and its evaluation criteria proposed by Gregor (2006). Then, we will evaluate the open innovation maturity model using a set of secondary data from 45 governments that provide and use open data. The list of countries is obtained from the open data website of the United States Government (www.data.gov/open-gov/). The Appendix summarizes the detailed measurement plan for the transformation and output levels in the open system framework presented in Figure 1. Note that the scope of this research primarily covers the transformation and output levels.

This study can contribute theoretically in several ways. First, it suggests a holistic open innovation framework for governments based on the perspective of open systems. This framework can provide a foundation to understanding the relationships and interactions between a government and its environment in a comprehensive and macro perspective. Second, it proposes an open innovation maturity model and its corresponding measurements to assess the current status of data-driven open innovation. Although the maturity level of open innovation through open data provision and usage appears to be different from country to country, prior studies have disregarded these differences. As mentioned earlier, although a few studies have investigated the open innovation maturity model, these studies only focused on the conceptual model, which is inapplicable in practice. Therefore, we expect this study to contribute to both theory and practice by providing a comparable open innovation maturity model with its measurements to validate the model and by suggesting specific guidelines for government-level open innovation research. Third, this study is expected to enrich and expand our understanding of open innovation. Despite the importance of open innovation, most prior studies on open innovation have generally focused on the private sector, particularly the manufacturing area. Therefore, expanding the

research area to public service and suggesting new directions for the research topics and their methods are expected to make a significant contribution to the area of open innovation research. Finally, we plan to evaluate the nature of open innovation maturity for the government based on the taxonomy of theory types presented by Gregor (2006), which can help validate the appropriateness of the proposed framework theoretically and predict open innovation maturity for the government practically. In other words, it is expected that the result of this study can be an important input to understand why developing the maturity model for open innovation is important, how open innovation can be effectively conducted in government, and what governments should do to increase their maturity levels.

This study also provides several practical contributions. First, governments can improve their global competitiveness through *data-driven open innovation* processes by utilizing the proposed open innovation maturity model, along with its guidelines, as expected outcomes of the study. In particular, governments can assess the initial maturity level of their open innovation strategies using the proposed model. Through assessment process, they can then identify current issues that they encounter and the next maturity level that they can probably achieve. Governments can also recognize some critical factors that they need to manage to reach the next level. Second, this study provides insights for policymakers to propose efficient open innovation strategies for their government. Consequently, this study will present the maturity stage of all participating countries because each country may be in a different maturity stage of open innovation. Policymakers can propose strategic plans for their government by benchmarking against other advanced governments. Benchmarking typically involves identifying and studying the best practices used by other governments that produce good results, which policymakers will like to duplicate for their government. In addition, we hope that this study will provide valuable information to business managers who are seeking practical guidance in terms of how to adopt, evaluate and leverage open innovation for their business in a highly effective manner.

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Appendix: Measurements

To measure the ***transformation level*** (i.e., the current status of the open innovation maturity level of each country) in Figure 1, we will collect the data for each measurement item of each subsystem from 45 open data sites. Each measurement item can be evaluated and scored based on a related process. In case of the supportive subsystem, its main process, which should be evaluated, include whether an open innovation strategy is established, whether success and failure stories related to open data use are described, and whether government-driven open data initiative exists. For example, the process related to whether an open innovation strategy is established can be operationally defined as "the degree of existence of a government's vision or strategy regarding open data provision and use." This process can be assessed by three evaluators (i.e., data collectors) using a seven-point Likert scale that ranges from strongly disagree (1) to strongly agree (7). The evaluators of the proposed model are open data professionals. If no document or related announcement about open data vision or strategy in the open data site is available, then the evaluators can assign the score of strongly disagree (1) to the process. In the similar manner, the evaluators can answer all of the measurements for each process. Then, an average score for each cell can be calculated, which will allow the evaluators to find and map which cell (i.e., capability) a particular government is focusing on. Finally, based on the calculated scores from six subsystems, we can decide a specific maturity level for each country as shown in Figure 3(b). We plan to use the Delphi technique with the Analytic Hierarchy Process (AHP) to validate our model.

To measure the ***output level*** (i.e., the current output status from the data-driven open innovation strategy of each country) in Figure 1, we plan to collect data from global reports. For the ***social value***, we will use the Better Life Index of the OECD (www.oecdbetterlifeindex.org), which consists of 11 areas of life. For the ***economic value***, we will use global economic indices, such as Gross National Product, Gross Domestic Product, Gross National Income and Gross Domestic Income (www.imf.org). For the ***competitive value***, the Global Competitiveness Reports of the World Economic Forum (www.weforum.org/gcr) will be used. We intend to use global reports that have been published after the starting year of the open data website of each country.