

동태적 생태계(Dynamic Ecosystem) 모형을 활용한 한국의 공공데이터 개방 정책 연구

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A Study on the Policy of Open Government Data Using a Dynamic Ecosystem Model

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요 약

공공데이터 개방 정책은 2013년부터 공공데이터법 시행과 더불어 정부차원에서 본격 추진되었다. 비교적 다른 국가에 비해 늦게 공공데이터 정책을 시작하였지만 한국은 OECD 공공데이터 개방평가 2회 연속 1위를 달성하는 등 각종 지표에서 빠르게 미국, 영국 등 공공데이터개방 선진국을 앞질렀다. 이러한 성과에도 불구하고 공공데이터 개방 정책에 관한 학술적 논의는 거의 전무한 실정이다. 본 논문은 이러한 학문적 공백을 메우기 위하여 2013년~2016년 사이에 추진된 공공데이터 개방 정책의 변화를 생태계 관점에서 분석하고자 하였다. 생태계 관점은 국내외 학계에서 최근 널리 활용되는 모형으로 단순 지표에 매몰되는 것을 지양하고 공공데이터의 창출, 개방, 활용, 성과 등을 일관적 관점에서 분석을 가능하게 하는 장점이 있다. 하지만, 기존 문헌연구를 통해 알게 된 점은 공공데이터 개방 정책은 시간적 요소에 따라 생태계의 주요 요소인 행동기(actor), 데이터의 흐름(data flow), 상호작용(interact) 등은 시시각각으로 변할 수 있으며, 이런 동태적 요소의 중요성이 미치는 영향이 크다는 것을 알게 되었다. 이에, 동태적 요소는 공공데이터 개방정책과 밀접한 열린 정부 정책을 통해 도출하였다. 따라서, 본 연구는 동태적 생태계 모형을 제안하게 되었고, 이를 통해 한국의 공공데이터 개방정책을 시간적 요소에 따라 단계별로 분석하였다. 분석한 결과 전반적 우수하다고 분석되었다. 특히, 초기 발아단계(Seed stage)에는 법제도, 우선순위, 추진체계 등이 우수하였다. 또한, 중기 성장단계(Incubating Stage)에는 데이터 이용과 서비스 부문에서 공공데이터를 활용한 창업 등 일자리 관련 부문에서 우수하다고 평가되었다. 하지만, 장기 성숙단계(Growth Stage)는 피드백과 소통부문, 정책부문에서 정책의 피드백 체계, 시민의 참여 및 커뮤니티 활동에 대한 정책기반은 개선될 부분이 있는 것으로 분석되었다. 앞으로의 공공데이터 정책은 미진한 부분의 개선에 좀 더 집중할 필요가 있다.

Key Words : open government data, public data, open data, dynamic ecosystem model

ABSTRACT

The open government data policy has been promoted at the government level since 2013 as well as the implementation of the Open Data Act. Although South Korea initiated its open government data policy later than other countries, the OECD ranked South Korea first in the OECD open government data evaluation two consecutive times. Despite these achievements, there has been almost no academic discussion on open government data policy. This study attempts to analyze the changes in open government data policy from 2013

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to 2016 from an ecosystem viewpoint to fill this academic gap. The ecosystem perspective is a widely used model in domestic and international academic circles. It has the merit of avoiding the burial of simple indicators and making it possible to analyze the creation, opening, utilization, and performance of public data from a consistent perspective. However, we learned from existing literature that open government data policies can change the actor, data flow, and interaction, which are major elements of an ecosystem according to time factors. The importance of these dynamic factors has had a large impact. Dynamic factors are derived through open government policies closely related to public open data policy. Therefore, this study suggests a dynamic ecosystem model, which analyzes the policy of South Korea's public data opening step-by-step, according to time factors. As a result of the analysis, it is determined that overall, the open government system is excellent. Especially, the early stage of germination (seed stage) was excellent in terms of the legal system, priority, and promotion system. In addition, the Incubating Stage was evaluated to be excellent in terms of jobs related to data use and startups using public data in the service sector. However, in the long-term Growth Stage, the feedback system of the policy, citizens' participation, and the policy base for community activities were improved in the feedback and communication sector and the policy sector. Future open government data policies need to focus more on minor improvements.

I. Introduction

1.1 Research Objective and Background

South Korea's Open Government Data Policy was enacted in July 2013, and the Act on the Promotion of Open Government Data Provision and Use was enacted and implemented in October 2013. Government 3.0 established three strategies: transparent government, competent government, and service government in order to realize a happy nation. Among the three strategies, public data openness was included as part of transparent government. Policies of public data opening have been implemented abroad for many years. For example, the United States and the United Kingdom have pursued policies to open public data as part of national innovation policies of open government.

South Korea initiated open government data policies relatively later, but it quickly surpassed the advanced countries with its policies of open public data in various indexes; it has achieved first place in the OECD open government data evaluation two consecutive times. According to the public data portal (www.data.go.kr), as of July 2017, there are 23,074 documents of open public data and 34,099 documents in open format data. More than 75.3% of the 5-star standards were above the third level. In South Korea, 690 institutions participate in the public

opening, including the central government, local governments, and public institutions. The public data utilization rate is 3,154,507 downloads, and the open API traffic is 14,390,000 visits. In addition, there were 1,334 cases of applications/web service development using public data.

Nonetheless, domestic companies are still unhappy. According to a survey of users of public data in 2016, users were satisfied with the free provision of data and the amount of data, but there were many opinions stating dissatisfaction with the delay of data updates, search hindrances of portals, and problems with data formats. As a result of applying the type of data utilization encouraged by the World Bank, Open data 500 Korea, a joint project between Govlab and NIA conducts comprehensive, internationally comparable studies of private sector entities. In Korea, most entities utilizing the data are app/web development companies, public corporations, analyst firms, and consulting firms. Almost no users have been domestic industrial companies.

In sum, the number of public data openings seems to be high. Data quality is equally high as in other countries. Many related organizations have been participating and contributing to the open government data policy. Comparably, the number of people utilizing public data is high, and the quantum of

real-time data utilization is very high. However, unlike these figures, domestic firms' satisfaction and the industrial market are not the same. Satisfaction is concentrated in specific companies. In other words, the industrial ecosystem has not been well-developed, and although it works well sometimes, it seems that some steps or relationships have been wrong. By contrast, international assessments were very well-received.

What do domestic academics think about such public data opening policy? There has been almost no domestic scholarly debate on the open government data policy. This study seeks to analyze the open government data policy of South Korea from the ecosystem viewpoint to be very academic empty. The ecosystem perspective is widely used in domestic and international academic circles. It has the merit of avoiding the burial of simple indicators and making it possible to analyze the creation, opening, utilization, and performance of public data consistently. We will also analyze open government policies and their ecosystems that are closely related to public data. Therefore, the open government data policy in South Korea is analyzed from the ecosystem viewpoint, and suggestions for improvements are given.

1.2 Research Scope and Procedure

The scope of this study is to analyze the effects of the open government data policy in Korea in the four years (2013 - 2016) after its implementation through the Public Data Act. Specifically, we analyze highly reliable data, such as basic plans and policy research reports. The analysis is conducted through an ecosystem model, and the limits of the applied ecosystem model, learned through the analysis, are grasped and a new ecosystem model is proposed.

The research method is to study the ecosystem model that can analyze the public data production, openness, utilization, and performance consistently. We also study the ecosystem of public data and the open ecosystem of government that is closely related to public data. Based on this, case studies that apply the excavated ecosystem model to South Korea's open government data policy are analyzed. Therefore,

we derive the current status, effects, and problems of the open government data policy in South Korea from the ecosystem perspective and propose points of improvement.

II. Literature Review

2.1 Open Government Policy

In January 2009, at the beginning of the Obama administration, the United States launched the Transparency and Open Government Act and a memorandum on the Freedom of Information Act (FOIA). "Transparency and Open Government" refers to the three principles of open government: transparency, citizen participation, and public-private partnership. Based on this, the Open Government Initiative, which is the foundation of the US Open Data Policy, was launched in earnest and the agencies in the federal government started the open data strategy based on the three principles.

The United Kingdom has pursued open government policies three times in recent years. The UK sought to realize government policies that were divided into three periods: the first was 2011 - 2013 (six strategies), the second was 2013 - 2015 (21 strategies), and the third was 2016 - 2018 (12 strategies). The primary plan focused on public data, the second on open government, and the third on government reform and innovation through government transparency and the opening of high-quality public data. The operational plan was based on cooperation with civil society. The key strategies were to complete 21 tasks, including carrying out a leading role in resolving corruption, strengthening transparency in information disclosure, and investing in improving the national information infrastructure. The UK, in pursuing this aggressive policy, recognized the social and economic effects of information openness and took the lead role in the G8 and the Open Government Partnership (OGP).

2.2 Open Government Data

To define public data, in the major domestic and foreign policies and legal systems, all of the data generated by public institutions in their work can be

said to be public data. For example, weather data from the Korea Meteorological Administration, information on aircraft channels and bus arrival information are public data. According to the Act on Providing and Utilizing Public Data (hereinafter referred to as the "Open Data Act"), public data are in institutions' databases, electronic files, etc. that are created or acquired for the purpose specified by laws and ordinances and processed by optical or electronic methods. The European Union defines public data as "public sector information" and includes all media (recorded on paper, stored in e-government format, audible, visual, or audiovisual recorded and stored) in the content (Directive on the Re-use of Public Sector Information, 2013). The United States defines public data as government data and states that public knowledge of government, society, and the economy is a valuable national resource (OMB A-130).

2.3 Open Government Data Ecosystem

The components of the open Government data ecosystem are actors, data flows, and interactions. Actors consist of data intermediaries, data owners, and data governance for the government that produces the data. In addition, companies are divided into large corporations, small and medium enterprises, and startup companies. Citizens are ordinary citizens who use services formed using public data and citizen organizations that demand government transparency and trust. This is also the case for the civil technical community, which has the expertise and knowledge of public data, and even the ability to point out errors in services. The data flow is the production of data, the openness of the enterprise, the utilization of public data, and the advocacy groups. Finally, the interaction between the environment, government, businesses, citizens, and the data they produce or utilize is a major component of the ecosystem.

III. The Dynamic Ecosystem Model

3.1 Dynamic Ecosystem Model

First, dynamic factors are derived from case studies of leading UK and US government policies

that are closely related to South Korea's public open data policy. Changes in time, a dynamic factor, lead to stepwise implementation of the policies and various factors related to the success of the policy. Second, ecosystem elements are derived from broader studies such as openness to public data and values, general ecosystems, open government ecosystems, and open data ecosystems from the existing literature. The proposed dynamic ecosystem model is composed of actor-centered data flow generated by actors' decision making and interactions between actors. We applied the temporal factor step-by-step as a dynamic factor to these factors. This chapter describes the dynamic ecosystem model in detail, in two parts. First, we explain the relationship between components and components of the dynamic ecosystem model. Second, we explain the changes in the dynamic ecosystem model over time. Figure 1 is a graphic representation of the model.

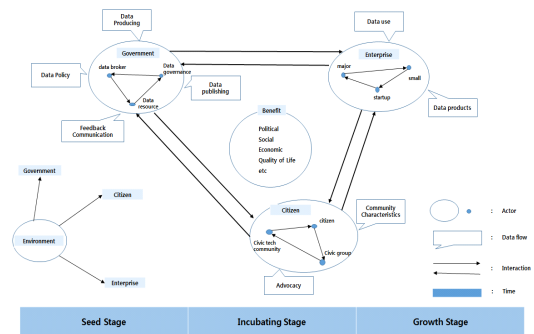


Fig. 1. Dynamic Ecosystem Model

3.2 The Components of Dynamic Ecosystem Model

The dynamic ecosystem model works as outlined below. The components are governments, corporations, people, and environments that correspond to actors. Data flow is created and opened by the government according to the data environment. When an enterprise develops a data service, the people utilize the service. The people using the service give feedback to the company or government about the service and the enterprise then requests better data from the government or gives feedback to the support base to improve the service.

The government, which receives a request for data release from the public, also operates an open policy on data.

The details of the components of the ecosystem are as follows. First of all, the environment affects governments, businesses, and people in the national agenda, new business, new culture, and so on. The national agenda is an environmental factor affecting the government; the national agenda includes changes in regime, national social issues, international changes, and other countries' movements. Environmental factors that affect the enterprise include new technology, new industry, new business, and so on. Environmental factors affecting the people are new culture, such as social fashions or changes in trends.

The actors are largely divided into three groups: government, enterprises, and citizens. The role of producing, processing, storing, and opening public data is the responsibility of the government. The government is divided into central government and local government. The central government is related to national public institutions and affiliated institutions, and the local government is related to local public enterprises.

The internal government consists of data owners, data intermediaries, and data governance entities. The data owner is usually the business department. Data intermediaries are usually the ICT or e-government department, and the IT department plays a role. Data governance is a decision-making body that ultimately decides to open public data within the ministry.

The process is as follows. First, when a request for data opening comes into the ministry, it is referred to data governance. Then, data governance determines the elements of opening the public data, such as which departments hold the data to be opened, what extent of openness is possible, and what actions should be taken on systems and budgets. The data broker helps with the details. Second, the data brokers look for the business department that owns the data and give it a detailed understanding of the current level of data to be opened, the affected departments, and the basis for opening. Third, the business department, who is the

data owner, decides whether to open the data at the practical level. Fourth, the experts in the business department along with data governance determine the final target and level of openness.

A corporate actor can be a large corporation, small and medium enterprise, or a startup company. The types of data enterprises are divided into data processing, app/web development, data analysis, data consulting, and data platforms. Large corporations have venture companies and finance data startup companies. The growth venture will spin off and grow independently as a small and medium-sized company or a high-tech startup. Large companies ask small and medium enterprises to process and analyze data in order to utilize relatively cheap technology and manpower to do platform development. Small and medium-sized enterprises (SMEs) ask entrepreneurs to identify needs for new ideas and data. Entrepreneurs create their own businesses ideas and offer them to SMEs or large corporations. The creation of enterprises utilizing public data is generally in the order of startups, small and medium enterprises, and large corporations.

Large companies usually have huge funds and a large workforce. SMEs have long-accumulated know-how and expertise. The startup companies have new ideas and special skills, although they have less funds and manpower. In terms of the types of data that companies handle, apps and web companies are mainly the milieu of entrepreneurs, small and medium enterprises are mainly engaged in data consulting, analysis, and processing, and large corporations have a large profitable platforms.

If we look at the relationships between the actors, when a company creates an app with open public data and ideas, a large company may buy the services of the entrepreneur or takes over the entrepreneur itself to act as a platform company. In addition, SMEs usually handle data processing, analysis, and consulting, and startup companies and large corporations use them to handle these services or do platform business.

The citizen group is composed of ordinary citizens, civic groups, and civic technology communities. The general citizen is the target user of

the data service created by the enterprises. In addition, citizen organizations review open data and offer opinions. Civic organizations participate and offer enthusiasm for data openness and they may public claims and demands for change, improvement, or innovation in various fields of society. Civic organizations have a considerable knowledge of their fields but lack the technical expertise to solve problems in terms of data. Therefore, they have a high demand for government to provide data but do not have suggestions or technical opinions about it. Another group is the civic technical community that can technically support the civic groups and makes demands on them. They are largely composed of developers that are involved in data-related specialization and have the ability to support or improve the government's data opening policies or make professional judgments about enterprise data services. They pursue social innovation or change with data technology and provide civic groups and citizens with expertise in data or suggest solutions.

Data flow is largely composed of policies, data production, data opening, data utilization, data production, feedback, communication features, and advocates for data. Each stage has a different role, depending on the actor. Policies on data and production, openness, and feedback play a major role in government. Data use and data production play a role in enterprises. The communicative characteristics and advocates for the data are the responsibility of the people.

The most important factor in the ecosystem is the interaction between actors. Interaction changes the flow of the actual data. Businesses' profit creation comes through the flow of data. There are different behaviors attributed to the environment, the government, the enterprises, and the public. The interaction of the environment with the government has a great influence on government data openness. For example, the importance of open data policies globally and aggressive activities by other countries can be a major factor in determining whether to implement substantive data policies for a national government. In other words, influence from other countries is a major factor in a government's

top-down approach. On the other hand, the impact of the environment on business and people affects the bottom-up approach, creating a phenomenon where the users of data make requests to the government to open the data. Their demands create pressure on the government's data opening policy.

Interaction between government and business is very important. The needs of the government and the needs of companies and their effects are considered. Enterprises can be a driving force for the government to push forward the open government data policy. This is because the growth of corporations leads directly to the performance of the government. Companies are very important in terms of profit creation. Private data is not profitable; public data is a key factor in creating data-enabled services. In addition, since open data from the government is very reliable, it can be of maximum value to users. People trust the government's policies and the data that come from it.

As for the interaction between the government and the people, the government wants to offer transparency and credibility to the people. To do this, it opens the data and monitors the reactions of the people and reflects them back into the policy. On the other hand, the people are opinionated about the government. Sometimes they express satisfaction, sometimes they express complaints. In particular, the public is very important in the ecosystem of the public open data policy. The role of government and corporation can only grow bigger based on the reaction and utilization of the people. Citizens may have different needs or participation depending on the specific actors. There is a strong demand for general citizens to create more services using data to improve their quality of life. On the other hand, civic organizations demand government innovation. They want direct participation in the policies for the data they need. Citizen technical communities actively engage in taking professional and technical positions on data openness that corporations and civic groups cannot address. They also insist on connectivity and standardization with the world community, beyond their own country.

Looking at the interactions between businesses and

Table 2. Dynamic changes by major elements in the Seed Stage phase

Division	Dynamic change content
Actor	Environment (government), government (data owner, data intermediary, data governance), corporations (large corporations, small and medium-sized companies), citizens (ordinary citizens)
Data flow	Policy & Strategy, Producing, Publishing, use, product
Interaction	Environment → Government → Enterprise → citizens

the public, people seek to benefit from the convenience of business and life. To promote the utilization by the public, corporations want to receive feedback on the reactions of the public. Based on this, the required public data will be requested from the government. Citizens demand improvement of the service quality of enterprises. Because they require accurate information, as they experience various services, they will select and continue to use the best service. In this way, the public is also aware of the importance of data, and the nature of the government as an advocate or supporter of data openness.

3.3 Change of Dynamic Ecosystem Model According to Time

Let us look at changes in the dynamic ecosystem model over time. The dynamic element of time is applied to the content derived from the government policy in the previous chapter. The dynamic elements of open government policies change with time. The first stage is the Seed Stage, which is the basis for composing the foundation. This stage includes the definition of behaviors, establishment of relationships, design of the data flow system, establishment of related basic policy, and promotion of necessary laws and institutionalization. The second stage is the Incubating Stage, in which data is opened on a full scale. Here, there is standardization of data, improvement of data quality, discovery of successful models through various use cases, feedback from users using data, and evaluation of data. The third stage is the Growth Stage, which focuses on spreading various aspects of the data

Table 1. Characteristics of major policy steps according to changes in time

Policy motivation	Action plan	Global international cooperation
Basic plan Stakeholder setting Finding and improving the system Organization of execution and organization	Evaluation Discovering Success Stories Standardization Quality improvement feedback	Maturity measurement Introduction to provinces, etc.
Seed Stage	Incubating Stage	Growth Stage
Initial stage (t1)	Middle stage (t2)	Long-term stage (t3)

opening. In particular, the actors expand the scope of international cooperation and public relations on a global level and publicize the excellence of policy. Subsequently, feedback is given back to the first step and the cycle continues.

This can be summarized as shown below in Table 1.

The changes in time derived from these open government policies and the characteristics of the major policies with dynamic changes are applied to changes in the dynamic ecosystem model of public data openness.

In the first stage (t1), the Seed Stage, we apply the characteristics of the main policy, as shown in Figure 2.

First, the behavioral landscape affects governments, and governments work with data owners, data intermediaries, and data governance. Enterprises are influenced by large corporations,

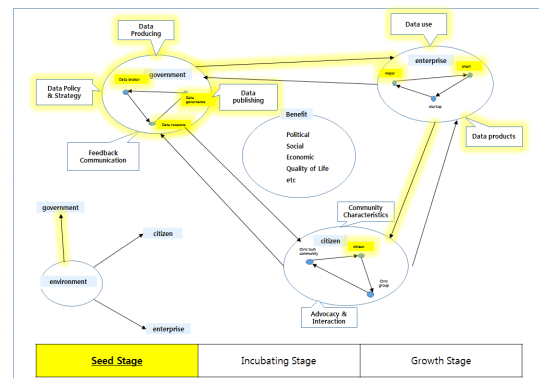


Fig. 2. Changes in the dynamic ecosystem model at the Seed Stage

small and medium enterprises, and citizens affect only ordinary citizens.

Second, data flow affects data policy, data production, data openness, data usage, and data production, and detailed policies related to it operate.

Third, the interactions between actors are influenced by the environment, governments, businesses, and the public.

In the Seed Stage, the five elements of policy development—basic planning, stakeholder setting, institutional discovery and improvement, implementation mechanisms, and organization arrangements—should work when applied to the public open data policy.

The Seed Stage is a series of cycles from policy to effect. In summary, the yellow parts in Figure 2 indicate how the cycle works, indicating the change in the dynamic model.

The Incubating Stage phase, which is the middle stage (t2), operates to develop a new policy based on the dynamic change that occurs after the Seed Stage phase and to introduce a full policy based on the improved policy. Applying the table mentioned above to the Seed Stage phase, dynamic changes are identified for each major component of the ecosystem, as shown in the table below.

First, at this stage, behavioral environments affect governments and corporations, and governments are in full swing with data intermediaries, data owners, and data governance. Companies are influenced by large corporations, SMEs, and startup companies, and the people influence ordinary citizens and civic groups.

Second, data flows operate on data policy, data production, data opening, data usage, data production, and feedback on data usage. Detailed policies related to this will also develop.

Third, interactions between actors affect the environment, governments, businesses, people, and governments, and major policies related to them operate. The people make demands on the enterprises, and the enterprises make demands on the government.

When the characteristics of the main policy corresponding to Figure 3 above are applied to the

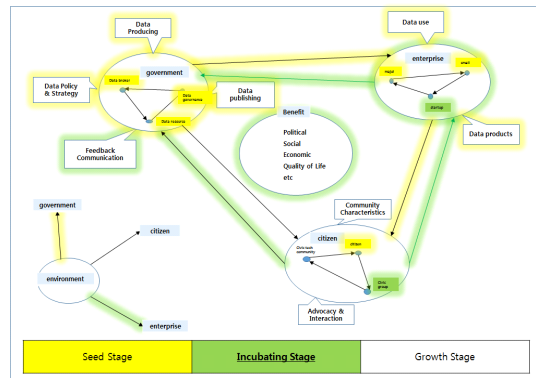


Fig. 3. Incubating Stage Phase Change of Dynamic Ecosystem Model

Growth Stage, which is the long-term (t3) stage, the dynamic change contents are derived by the main elements of the ecosystem, as shown in Table 3.

In the Incubating Stage, first, behavioral environments affect governments, businesses, and the public, and governments contain data intermediaries, data owners, and data governance. Companies are influenced by large corporations, SMEs, and startups, and citizens are influenced by ordinary citizens, civic groups, and civic technology communities. Second, data flow will work on data policies, data production, data opening, data usage, data production, feedback on data usage, data communication characteristics, and data advocates. Third, the interaction between actors affects the environment, government, business, and the public. The people make demands on the enterprises, the enterprises make demands on the government on this basis, and the people make demands on the government.

Table 3. Dynamic changes by major elements in the Growth Stage

Division	Dynamic change content
Actor	Environment (Government, business, citizen), government (data relay, data owner, data governance), enterprise (large corporation,
Data flow	Policy & Strategy, Producing, Publishing, use, product, feedback communication, Communication Characteristic, Advocacy & Interaction
Interactions	Environment → Government ↔ Enterprise ↔ Citizens ↔ Government

The above information is summarized in Table 3.3.

In more detail, the Growth Stage has four features: global, international cooperation, maturity measurement, and national introduction such as provinces should be operational when applied to the public open data policy. First, global environmental factors affect the government. Examples include government global activities such as the OGP. Second, international cooperation corresponds to data policy on the data flows. For example, international cooperation between governments or corporations may result in excellent government data openness or internationalization of services utilized by corporations. Third, maturity measurement is a characteristic of communication during data flow. Companies and the public measure the maturity of the government's policy to open up public data. Fourth, nationwide introduction, such as in provinces, corresponds to data advocates on the flow of data. If the success model of the government's public open data policy continues, public awareness increases, and the public open data policy expands from central to local.

Considering all of the above, the Growth Stage (t3) is based on the dynamic changes that occur after the Seed Stage (t1) and Incubating Stage (t2). What happens in the Growth Stage depends on the success of the policy, the extent of successful cases, standardization, and quality excellence. To promote global cooperation for improvement, the government

pioneers the foreign exchange market for domestic companies and leads the global market for the interests of the nation, based on the excellence of its own country in the mutual exchange with other countries and carries out related public relations and marketing, forming a global community.

IV. Analysis of South Korea's Open Government Data Policy using Dynamic Ecosystem Model

4.1 South Korea's Open Government Data Policy

South Korea's Open Government Data Policy began with a legal basis with the "Open Data Act" enacted in July 2013.

According to the public data baseline plan established in 2013, the achievements and achievements are summarized as follows. First, the focus areas were expanding public data opening centered on consumers, expanding the public data opening/utilization base, creating a public data industry ecosystem. In terms of major achievements by sector, the opening rate of 146,000 18,476 openings compared to 12,654 in the past three years has been achieved with the expansion of public data opening centered on consumers. As a result of these efforts, 36 years of high-value, high-demand large-scale public data have been opened in a three-year period (2015-2017). To select the data to be opened, a private joint venture, TF, was constructed and operated as a data strategy, private enterprise, and open data activity group. There is access to 36 fields of large-scale data that is expected to be highly useful, in ways such as building information, local government permit information, national disaster management information, national spatial information, real estate transaction management information, and social security information. In addition, each year, 42 databases including food waste, labor insurance, and national electronic procurement are opened separately, considering social issues.

Second, in terms of expanding the base of public

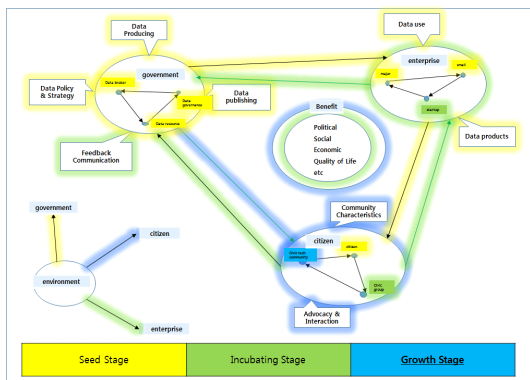


Fig. 4. Growth Stage Phase Change of Dynamic Ecosystem Model

data openness and utilization, a rating system, the “Level 5 system,” was established in 2015 and piloted with 22 databases from 2015. Several public databases in the third stage achieved a 5-Star level. The percentage of databases achieving a 5-Star level was 40% in 2015, 60% in 2016, and 70% in 2017. Several efforts to maintain data standards were implemented and the following number of databases met the standard: 11 in 2014, 43 in 2015, and 73 in 2016. The same data are not unified for each municipality and each institution. The government has also strengthened the open format. The objective was to make the format easy to use in the private sector, regardless of the specific SW. In 2013, the annual growth rate was 51.2% in 2016 from 8.7% of the total data. Big Data has also made about 80 Big Databases, such as apartment housing expenses, discovery of welfare blind spots, and strengthening of labor supervision, to share and utilize Big Data.

Third, in connection with the creation of the public data industry ecosystem, the government launched a business incubation project to foster public data-utilizing companies and create substantial entrepreneurial results. Six organizations, including the Small and Medium Business Administration (JICA), the Future Department (of the Creative Economic Innovation Center), and the Ministry of Government Administration and Home Affairs (from the Public Data Utilization Support Center) joined together. To achieve entrepreneurial innovation using public data centered on pre-founders and university students, public data-utilizing startup competitions are held every year. In addition, the OD500, which is a private-centered open data forum, operates as a forum for gathering opinions from domestic and foreign companies.

Fourth, the effort to secure sustainable driving capacity has been amended to enable entrepreneurship using public data. In addition, a new provision was introduced to prevent the development of duplicate and similar services so that private apps/web services using public data can be placed in the market. The government also actively promoted education and publicity to raise people’s awareness of the open data, which included developing and

running a nationwide education tour and online education for public institutions and companies. Annual publicity programs were initiated, including the Government 3.0 Experience Hall and the Performance Sharing Contest. In an effort to promote international cooperation, a Memorandum of Understanding was signed with ODI in the UK, GovLab in the US, and the Open Data Alliance in Taiwan.

4.2 Open Government Data Research in South Korea

The following table summarizes the research for the revitalization of public data that was promoted for four years from 2013 to 2016. In 2013, the Act on Open Data was enacted, and based on this, the public data opening roadmap was established and governance was emphasized. Therefore, there was no policy study on the activation. From 2014, the government has been carrying out a survey on the actual condition of public data, the status of standard technology at the time of opening, and a study of the costs. In 2015, it also studied ways to improve the legal system to establish the legal basis for public data startups and civilian anti-piracy services. In addition, it conducted policy studies, such as business incubators, to create jobs using public data. In 2016, the Fourth Industrial Revolution and intelligence information society came into being, and studies on data-based new industrial tasks and management system were conducted.

4.3 Analysis of Korea’s Open Government Data Policy using a Dynamic Ecosystem Model

First, the scope of analysis covered South Korea’s open government data policy from 2013 to 2016. Second, the data to be used for the analysis are the Open Data Strategy Committee, the first public data (2013 -2017), the Second (2017 -2019) Basic Plan, the Open Data Act, the Open Data Implementation Plan (2014, 2015, 2016, 2017), the public data portal (www.data.go.kr), the Open Data Development Strategy (2014), the national open data plan (2014), and the National Open Data Forum operation plan),

basic plans, legal provisions, major policy reports, and research reports, and all of the original data were obtained from the implementation of the policy. Third, to match the main temporal and dynamic factors with the policy in the dynamic ecosystem model, the analysis method considers the initial stage in 2013, as the Seed Stage, the mid stage from 2014 to 2015 as the Incubating Stage, and 2016 as the Growth Stage.

Based on this, we analyzed how the public data open policy in South Korea changed over time from the viewpoint of the dynamic ecosystem. Specifically, three major axes were analyzed. There were three questions: First, what are the key elements of South Korea's public open data policy in accordance with the dynamic changes in behavioral factors, data flows, and interactions, which are the key components of the dynamic ecosystem model? Second, in the dynamic ecosystem model, what kind of dynamic changes in the open data policy in South Korea are seen in the Seed Stage, Incubating Stage, and Growth Stage? Third, what are the effects of the South Korean public open data policy on the dynamic ecosystem?

4.4 Analysis of the Results and Implications

The results of applying the dynamic ecosystem model to South Korea's open government data policy are summarized, as shown in Table 4.

In the Seed Stage, the government was the main actor. The policies on opening up public data in developed countries such as the United States and the United Kingdom influenced the government. This led to the enactment of the Public Data Act, and on the basis of this, the national data governance was established early. As a result, the Seed Stage phase created a basis for the main actor, the government, to open the data and to utilize it. In particular, the enactment of the Open Data Act in South Korea played a role in the early emergence of entrepreneurs who could do business using the data.

In the Incubating Stage, the legal environment for the government data to be opened created a strong demand for data by enterprises. The main actor was the corporation, and the data flow was established by

Table 4. Analysis results

Division	Key actor	Key data flow	Key Interactions
Seed Stage	· Government	· Act enacted · Building Governance	· Creating a base for utilization (Government → company)
Incubating Stage	· Enterprise	· Data Portal Construction · Quality and standardization · Fully open · Education and PR	· Prevention of civil invasion (Company ↔ government)
Growth Stage	· Citizen	· Hackerthon · Open Square-D	· Feedback system (Citizen → government) · Industrial ecosystem (Government → company)

the government with a portal to the open data. In addition, it actively promoted data quality and standardization. It opened up the national key data, and strongly promoted education and publicity to improve the attitudes of corporations and the public. The interactions were mainly between enterprises and the government, and the government strongly enforced privacy and anti-piracy measures to develop services for the private sector to open up data.

The Growth Stage appeared with citizens as the major actors. In particular, the demands of civic organizations and the civil technology community made the government provide a feedback system. In the data flow, hackerthons and startup contests provided solutions for social issues as well as entrepreneurship. In addition, interest in entrepreneurship and jobs heightened, creating an incubation system for public data entrepreneurship called Open Square-D. In addition, major interactions took place between citizens and governments, governments and corporations, and citizens and governments occupying the data industry ecosystem in response to industry demands for feedback systems, and governments and businesses in the Fourth Industrial Revolution.

According to the results of the analysis, the open ecosystem of public data in South Korea is derived from the viewpoint of dynamic ecosystem, as shown in the following figure and table.

Looking first at the table below, the key factor in the Seed Stage was the enactment of Open Data Act. The second factor was that the open government was planned to work as a government task along with Government 3.0. Third, based on the legal and policy grounds, the government established a rapid and strong national data governance system. What was lacking was interest and understanding of the public as an actor. In particular, the absence of a citizen technical community caused an imbalance in the actor dimension. The analysis of the key factors and shortcomings of each stage are shown in Table 5.

The Incubating Stage actively promoted public open data education and publicity to improve the lack of citizen consciousness at the Seed Stage. In addition, it sought to create a market by identifying and presenting successful cases to companies. Although there was a public data law, a dispute settlement mechanism was established so that the desired data could be obtained from the government. Indeed, the growth and efforts of enterprises increased the demands of corporations to open and share good quality data. The utilization of data has been dominated by app/web companies, and there has been a lack of growth of various companies utilizing the data such as data production, processing, analysis, and consulting platform. This seems to be a somewhat regrettable policy of the government.

The Growth Stage has increased the public's awareness of the openness to public data through the

government's efforts at the Seed Stage and Incubating Stage. However, a lack of citizen participation awareness and lack of technical skills of the small number of citizen technical communities were weak in demanding that government and enterprises open more public data. On the other hand, the government has focused on the data flow in accordance with the policies of a startup promotion policy and has established and operated various startup programs such as Open Square-D and startup competitions. Moreover, according to the localization and diffusion policy of Government 3.0, the public data opening policy became full policy for the provinces. Unfortunately, South Korea's activities have been weak in international cooperation with OKFN and OGP. In addition, while promoting the public open data policy for four years, portals and local government portals for each department as well as public data portals have been created spontaneously. Although it is good to be active in opening data, the lack of linkage between the portals has caused confusion about data. Therefore, there is a need to build a platform that can interconnect with more than 50 active portals.

In the end, from the viewpoint of the dynamic ecosystem, the status of public open data policy in South Korea is shown, as in Figure 5.

South Korea has thoroughly promoted its public open data policy through a government-led initiative. It has created the world's first public data law, established and implemented public education, and promoted public information. This study analyzed that the government played a very important role in early performance in areas such as excavation. However, it is clear that there is a limit to the success of public open data policy and the creation of a supportive ecosystem in South Korea due to unbalanced growth of companies, lack of participation and activities of civil society, and the civil technology community.

V. Conclusion

In this study, the literature review on dynamic ecosystem model is sufficient, and it supplemented

Table 5. Analysis of Open Government Data Policy in South Korea by stages

Stage	Key Factors	Lack
Seed Stage	<ul style="list-style-type: none"> · Establishment of the Public Data Act · Governmental Affairs task · Data Governance 	<ul style="list-style-type: none"> · Lack of citizen participation · Citizen Technical Community Growth
Incubating Stage	<ul style="list-style-type: none"> · Education and PR · Success Stories · Dispute resolution body 	<ul style="list-style-type: none"> · Share high-quality data · To foster various utilizing companies
Growth Stage	<ul style="list-style-type: none"> · Fostering a new business · Proliferation of local governments 	<ul style="list-style-type: none"> · International cooperation · Data Platformization · Civil society support

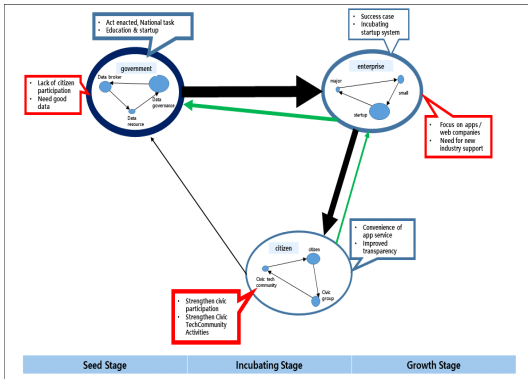


Fig. 5. South Korea's Open Government Data Policy through Dynamic Ecosystem

the empirical study.

From the beginning of the study, we have analyzed and looked at South Korea's public open data policy macroscopically looking at previous research, determining the significance and limitation of existing research, offering a proposal of a dynamic ecosystem model, and creating a dynamic ecosystem model for the open data policy. Based on this, I would like to make policy suggestions. I propose the following opinions through academic and policy studies.

First, we need to create an industrial ecosystem by opening and utilizing public data. It is important to create a data ecosystem that considers the lifecycle of production, storage, distribution, and the utilization of data. To do this, we need to upgrade the quantum of data opening, quality, and standardization so that good quality data can be opened. To foster and support data-driven new industries, data utilization should be centered on data opening. To do this, we need a comprehensive, three-dimensional data infrastructure (Data as Infra), a Data as a Platform, and a Data as a Service policy rather than fragments. For example, to support the development of autonomous mobile automobile industry, it is possible to converge between public and private databases. For private data with a high level of public-ness, excavation is required.

Second, we should promote innovation policies of citizen participation or citizen-led public data openness. Specifically, it should actively support the

activities of civic groups such as CC Korea, OK Korea, CODE, and civil society. In this way, the government's policies are driven by citizen participation and initiative, and the government's policies and services are naturally received by the public. A good circulation system of a solid open government data policy that smoothly receives feedback from the policy is crucial.

Finally, after completing exciting and dynamic research, the era of intelligent information age will continue to develop in the era of the 4th industrial revolution, and the open ecosystem of public data is very important to support it. Therefore, we hope that research on the dynamic ecosystem of openness of public data will continue to be diverse and actively pursued academically and politically, and it is hoped that these studies will be the basis for the development of the national data ecosystem in connection with government policy.

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