Enhancing Innovation Platform: Bitgaram Innocity Gwangju Using ICT in Korea

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Abstract

This study explores the blueprint of Innocity in Gwangju, Korea, and presents desirable alternatives for it to become a sustainable futuristic city. Accomplishing the policy aims of the Innocity based on the relocation of public agencies out of the Seoul Metropolitan Area (SMA) hinges on whether various innovation activities can be spontaneously generated. In order for Innocity to self-sufficiently lead the regional development, knowledge production and innovation through networking among the heterogeneous actors in the Innocity is needed. This study proposes a Living Lab model as a platform for communication using ICT for the construction of the Bitgaram Innocity Energy Valley. In other words, this study presents the Living Lab model, a process of knowledge production and flow through various types of Living Labs. Amongst them, this paper underlines Research Living Lab and Corporate Living Lab and proposes using business incubation centers as the core of the platform.

Keywords: Bitgaram Innocity, Living Lab, knowledge production, new venture creation, Korea

1. Introduction

The objective of this paper is to present the innovative platform model in order for sustainable regional development. In a bid to enable co-development of the capital region and local areas, Innocity project was enacted in 2007 in Korea. It is a development strategy of Korea which will bring a substantial decentralization of population in the capital region and help build a foundation for self-sufficient regional development. Then what is an Innocity? According to the central government's definition, Innocity is a new futuristic city with the most suitable condition for driving innovation and providing high-quality living environment through the relocation of central functions toward provincial cities and cooperation among industry, academia, research institution and government.

When considering the positive policy implementation, thanks to the relocation of public agencies to local areas, local areas will be able to develop themselves by using the highly talented workforce and boost their regional economy. In order to achieve this, not only the hardware of physical infrastructure but also the software of interactive systems among heterogeneous agents are needed.

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In this paper, we present our strong concerns about how Innocity can be created and operated. In other words, the aim of our research is to show how Innocity can grow by sharing the knowledge and information amongst the actors. Within the context of Innocity, public and corporate actors are faced with pressing questions regarding innovation policy and the return on public and private investment in innovation at the local regional level. To ensure the success of Innocity created through the relocation of public agencies, new companies or start-ups need to emerge, grow, and lead the development of each Innocity.

This paper is focused on the knowledge production function (Feldman, 1994) among agglomerated actors, using information and communication technology (hereafter ICT) at the Bitgaram Innocity Gwangju in Korea, as knowledge production and spillover is the key issue of regional development (Han, 2009 Han and Byeon, 2009; Han and Heshmati, 2015; Lundvall, 1992; Consoli and Patrucco, 2008; Buesa et al., 2010; Cowan and Zinovyeva, 2013; Bernhard, 2012; Bernard et al., 2013).

Bitgaram Innocity Gwangju is under construction by Korea Electric Power Corporation (hereafter, KEPCO) with the objective to facilitate the development of electric power supply in Korea. Unlike some policy studies seldom addressing concrete action plans to realize innovation, this study is distinguished from others in that it suggests an alternative Living Lab model based on ICT.

For this purpose, this study utilizes a qualitative case study. The revised Living Lab model, an open platform model proposed by this study, will contribute to the success of Innocity in the following ways. First, it is an innovation model based on real-life settings, which allows private-public partnerships to participate in those settings. In other words, the model promotes R&D and increases the outcome by allowing the users to direct the flow of knowledge and information. Second, the model allows start-ups including small and medium enterprises (hereafter SMEs) to overcome the issue of "chasm," which causes difficulties in the pre-commercialization stage, by participating across all areas ranging from innovation activities to prototype development for users. This study is distinguished from previous literatures in that it proposes possible areas of innovation created in real-life settings using ICTs. This paper is structured as follows. Section 2 presents a review of literature on related theories and methodologies. Section 3 addresses the Living Lab model using ICTs analyzing the Bitgaram Innovative city designed by KEOPCO and Gwangju city in Korea. Section 4 deals with conclusion and policy implication.

2. Theoretical Review and Methodology

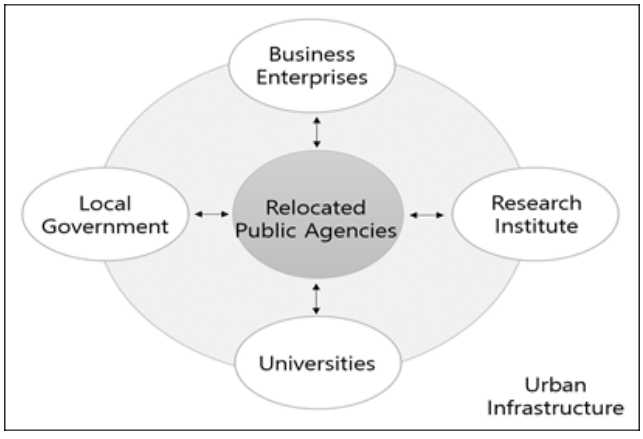
2.1. Conceptualization of Innocity

An Innocity is defined as geological space that spurs regional development by creating, spreading, and utilizing innovation through the cooperation and networking among public agencies (Komninos, 2002). Therefore, an Innocity performs the role as knowledge-producing institutions, just like universities and research institutes, and as creators of innovation. The recent trends in the innovation theory emphasize the interactive innovation created and distributed through networks and partnerships with various actors, rather than one-way or lineal innovation created by universities and research institutes, then disseminated to the other sectors (Etzkowitz & Leydesdorff, 2000; Sternberg, 2014). In this sense, an Innocity city is a place where innovation is created and disseminated through close engagement and networking between companies and universities as well as research institutes and public agencies that are placed in the same geological space. An Innocity features the following characteristics. First, it is a place where continuous streams of new knowledge are created. For this reason, companies, universities, or research institutes are located in an

Innocity as actors who create innovation. These innovative actors are linked by organic networks (Sternberg, 2014). Second, in accordance with the innovation theory, the sociocultural substructure of a region holds greater significance than its physical substructure in creating and disseminating innovation. That is why innovative cities have communitarian culture based on regional cooperation and trust. In addition, an Innocity continues to grow in terms of population, employment and functions as a focal point for regional economic development by exerting positive influences on the surrounding areas (Sternberg, 2014; Han, 2015).

In this paper, an Innocity can be conceptually defined as a geological space that spearheads regional development by creating, spreading, and utilizing innovation through the cooperation and networking among heterogeneous actors (e.g. public agencies relocated out of the SMA as well as industries, academia, research institutes, and public sector of the region).

Figure 1. Components of Innovative City relocation



2.2. Conceptualization of Platform and ICT

The role of a platform is to mediate among various actors by coordinating interactions between two or more members from distinct groups of stakeholders (Evans, 2003; Rochet & Tirole, 2003). Jacobides et al. (2006) emphasized that a platform creates value and is an important structure of the industry architecture in the ICT sector. Also, a platform in the ICT sector can be referred to as a hardware configuration, an operating system, a software framework or any other common entity shared by users (Ballon et al., 2008). Gawer & Henderson (2007) stated that we can conceptualize a platform as a technological system where a product or a service is one component that is functionally interdependent on other components. Thus, a platform provides a number of benefits to its users. As a result, the demand of the user is for the overall system, and hence, there is no demand for individual components when they are isolated from the overall system (Gawer & Henderson, 2007).

From the literature, we can induce that a platform is a set of components and rules that are commonly employed when users conduct transactions. Such components include hardware, software, and service modules, along with an architecture that specifies how they fit together.

A successful platform coordinates the interaction among individuals belonging to various stakeholder groups, and it is also able to internalize the externalities created by one group for the other group. Technology platforms are two-sided or multisided markets that bring together various types of participants (Rochet and Tirole, 2003). Unless a business that serves two or more distinct types of customers who depend on each other in some forms, it is not a platform. When various types of customers interact with each other, then it is called a platform. Prior to reviewing platforms in greater detail, we can conceptualize the function of a platform as follows: a platform is "open" to the extent that no restrictions are placed on participation during its development and/or utilization. For a given platform, each of these roles may either be open or closed. Consequently, a platform can be characterized by its openness.

ICT is a tool that provides for participating

in a face-to-face intervention, which is designed to address several applied services. Through ICT, we can provide actors more efficient outputs. The ICT system will be implemented by integrating different technologies into an interoperable system. ICT means all kinds of transfers of information. Distance is no longer an issue when it comes to accessing information, e.g., working from home, distance learning, and e-government are now possible from any place with an Internet connection and a computing device. By underlying the ICT system, each actor, for example, firm, university, public organization, and research institutes, can get core competencies. These core competencies are the collective learning of the organization, especially on how to coordinate various production skills and integrate multiple streams of technologies (Prahalad. et al., 1990).

ICT platform is the architecture of the generic resource layer, which describes the computer, networks, peripherals, operating systems, and database management systems that will be used as a platform for the construction of the system for entities belonging to clusters in Innocity.

2.3. Living Lab Concept and Value Creation

Living Lab is a concept to support the processes of user-driven ICT systems. One precondition in Living Lab activities is that they are situated in real-world contexts, not constructed in laboratory settings. The Living Lab model is a user-led, open-ended innovation model. Professor Mitchell (2003) at the MIT proposed the living lab as a space where the behaviors of users toward machines are identified under real-life settings using information and sensor technologies. Over the recent years the concept of Living Labs led to the creation of many different types of Living Labs, especially in Europe. Living Labs concept stimulates methodology development and pilot for ICT-based innovation (European Commission, 2008).

The Living Lab refers to a "user-led," "open-ended" ecosystem of innovation where public research centers, private companies, and the civil society combine their efforts to carry out innovation activities in a certain region or space (Schaffers et al., 2009). Schaffer et al (2010) assert that Living labs is innovation mechanism for collaborative working in rural area.

A Living Lab is viewed as a space that promotes the participation and cooperation of stakeholders involved with innovation, motivates behavioral changes in innovative actors, and spearheads market development (Schaffer et al., 2010). Aside from views mentioned, it is also considered as a space where new ventures in line with social changes are carried out at regional, national, and global levels.

A Living Lab also reduces the gap between the creation and development of technological ideas, realization of the conceived products, and the actual entry into the market. It brings together various actors involved in innovation and carries out user-centered and simultaneous innovation in a user-led space of innovation. A Living Lab involves applied research, prototype development for users, demonstration activities, and product development. It also assists on overcoming chasm. The user-led approach under the living lab model enhances the efficiency of innovation processes, promotes the outcomes of R&D efforts, and provides substantial support for innovation activities by small and medium-sized companies. Therefore, the Living Lab model creates a space where the participating actors can continue to exchange their needs. The flow of knowledge and technology created by each actor can be facilitated with ICTs.

3. Energy Valley

3.1. Composition of Bitgaram Innovative City

Bitgaram Innovative City is a new-level futuristic city where KPECO and other 15 public agencies relocated out of the SMA, where the industry-academia-research partnerships, the central government, and the local governments work together to create the best conditions for innovation and living environments. The relocated public agencies and the industry-academia partnerships will join their efforts to create the foundation for new driving forces for the region's growth, and the city is intended to be an innovative focal point that spearheads regional development. After the enactment of the Act on the Development of and the Support for Innovative Cities in February 2007, the development of innovative cities began in relevant cities and provinces under their respective development and action plans. The percentage of construction work completed is 58.3% as of December 2014 (Ministry of Land, Infrastructure and Transportation). Bitgaram Innovative City is located in Naju-si, Jeollanam-do. To preserve the natural landscapes and ensure pleasant living environments, the city is developed with low to medium density with a population of 250–350 people per hectare. The intended population of the city is 50,000, and the development is proceeding in three phases. Phase 1 involves the settlement of the relocated public agencies (2007–2014). The intended number of employees of the relocated public agencies and the related companies is 4,000, and the population generated by the development is intended to be 25,000. Phase 2 involves the settlement of the industry-academia-research partnerships (2015–2020). The intended number of employees in private companies, universities, and research institutes in the city is 8,000, and the population generated by the development is intended to be 50,000. Phase 3, which involves spreading the innovation (2021–2030), is expected to change the number of employees and the population created by the development as the innovative clusters spread. Bitgaram Innovative City is being developed in a 7,334,000㎡ area with a budget of KRW 1,322.2 billion and with 16 relocated agencies through the efforts of LH Corporation, Gwangju Urban Corporation and Jeonnam Development Corporation (Ministry of Land, Infrastructure and Transportation). A list of public agencies to be relocated is provided in Table 1.

Table 1. List of public agencies to be relocated to Bitgaram Innovative City

Affiliation	Relocated Public Agencies		
	Public Corporation	Quasi-government Agencies	Other public agencies
3	1	9	3
National Radio Research Agency Food & Agricultural Officials Training Institute Post-business Information Center	KEPCO (Korea Electronic Power Corporation)	Korea Power Exchange, Korea Communication Agency, Korea Internet & Security Agency, Korea Rural Community Corporation, Korea Agro-Fisheries & Food Trade Corp., Arts Council Korea, Teachers' Pension, Korea Creative Contents Agency, Korea Institute for Planning & Evaluation for Technology in Food, Agriculture, Forestry & Fisheries	KEPCO KDN, KEPCO KPS, Korea Rural Economy Institute

The central government seeks to develop innovative cities as a catalyst for the enhancement of independent cities and for the promotion of the urban development of regional cities by creating high-quality jobs in the regions. The Special Act on the Construction of and the Support for Innovative Cities through the Relocation of Public Agencies, which took effect on January 1, 2015, provides for the establishment of the "Industry-Academia-Research Cluster Construction Plan" to efficiently propel the development of clusters within innovative cities so that private companies, research institutes, universities, and public agencies in the cities may closely cooperate with each other. The site for the Industry-Academia-Research Cluster in Bitgaram Innovative City measures 415,000 m^2, comprising 5.7% of the total city area. Agriculture-bio, information & communication, culture & arts, and the energy industry are included in the vision of the cluster. By developing innovative cities and innovative clusters, the central government intends to garner the expected effect of enhanced innovation capabilities of the regions, improved quality of education in the regions, increased regional tax revenues, and the development of regional economies.

3.2. Bitgaram Energy Valley and Development Strategies

Bitgaram Energy Valley refers to the "Global Smart Energy Hub" that creates creativity-based values for the future by creating a power/energy industry ecosystem centered around the Industry-Academia-Research Cluster in Bitgaram Innovative City. The Smart Energy Hub is the name of the smart energy creation site designed to promote R&D efforts for new technologies and to create the value chain under the cooperation between KEPCO and other related agencies by creating an ecosystem of energy-related industries and lead the future of the energy industry.

Through the Smart Energy Hub, new business opportunities are created, and knowledge is shared through industry-academia partnerships. The R&D efforts and externalization of the energy industry development capabilities of the Industry-Academia -Research Cluster in Bitgaram Innovative City are expected to create an ecosystem for regional companies and new convergence markets among heterogeneous industries.

The Bitgaram Energy Valley, as a new driving force and a smart energy creator for the growth of Bitgaram Innovative City for the next 100 years to come, represents a model for new growth, which

Figure 2. Location of Bitgaram Innovative City

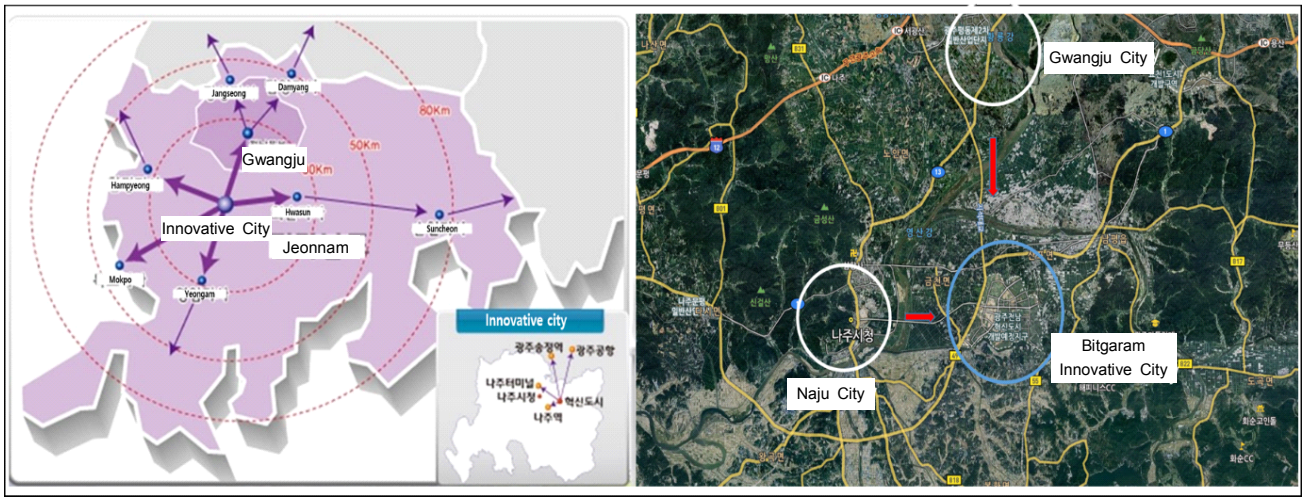


Table 2. Road map for Bitgaram Innovative City

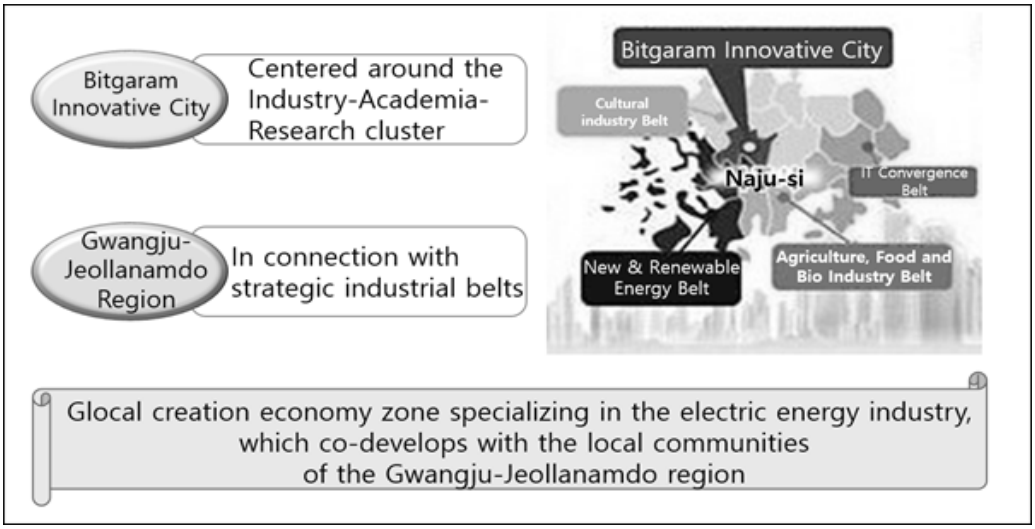
Items	Short-term Goals	Description
Phase 1 (2015–2017)	New Industries Testbed	Secure 200 venture companies, including start-ups. Train 400 experts.
Phase 2 (2018–2020)	Energy Cluster	Secure 500 companies, including SMEs. Train 1,000 experts; create 12,000 jobs.
Phase 3 (2021–2025)	Global Energy Hub	Secure 500 R&D facilities of large/global companies. Train 1,000 experts; create 30,000 jobs.

creates the foundation for new driving forces for growth and sustainable development, responds to the changes in the global power market, and advances into the world by converging with the specialized energy industries in the region.

KEPCO, the heart of Bitgaram Energy Valley, plans to invest more than KRW 10 billion per year into the region's Industry-Academia-Research Cluster along with KEPCO KPS and KEPCO KDN to identify promising ideas for the future; cooperate with local governments in the Gwangju-Jeollanamdo region in order to provide meaningful supports under the goal of securing 100 energy companies with leading technologies into the region; and develop companies customized to the Energy Valley by creating a model that ensures the coexistence with subcontractors and covers the overall processes from product development to export. KEPCO, in particular, plans to build an integrative energy management system called Smart Grid Station for public agencies moving into Bitgaram Innovative City, thereby utilizing the power-ICT convergence technologies under the goal of increasing the energy efficiency by 10% by the year 2020.

To ensure the successful development of Bitgaram Energy Valley, Gwangju Metropolitan City, Jeollanam-do, Naju-si, and KEPCO signed an MOU for mutual cooperation, under which the participants plan to build the Energy Valley Center and a business support center by investing KRW 200 billion to further support SMEs. The MOU will contribute to the early vitalization of the Energy Valley by

Figure 3. Overview of the Energy Valley



supporting the companies moving into the regions, incubation for start-up companies, and R&D cooperation. In addition, 21 companies, including Hyosung, Co., Ltd., a leading company in the green energy and ESS sectors, and Omnisystem, Co., Ltd, a power equipment manufacturer, signed an agreement for corporate investments in Bitgaram Energy Valley as well as a financial support agreement and a bank to develop SMEs.

KEPCO, Jeollanam-do, and Gwangju Metropolitan City are building a system to create a virtuous cycle for companies in Bitgaram Energy Valley, which spans the whole process from start-ups to exports. To build the Energy Valley, the central government and local governments will provide the following support.

First, the central government, the Gwangju Metropolitan City, and Jeollanam-do needs to provide income tax, property tax, and acquisition tax reduction or the exemption for companies moving into the Energy Valley. They should also provide support in finding a location, facility investment, training and education, as well as employment subsidies. Second, the government shall plan to provide supports in the R&D area. By organizing R&D contests that are exclusively targeting start-up companies and increasing the budget ceiling for cooperative research projects and commissioned research projects from KRW 1 billion to 2 billion, they plan to enhance supports for technology convergence and joint R&D efforts through industry-academia-research partnerships. The government will also establish the Energy Valley Center for business incubation. The construction of the center will begin in the latter half of 2015 on a floor area of 8,000 m^2 and with a budget of KRW 20 billion (co-funded by Naju-si, Korea Basic Science Institute, KDN, and KPS). The center will provide information on power equipment and incubation support for start-up companies moving in to the region. Third, in terms of the financial support for SMEs, the government plans to invest KRW 200 billion in SMEs suffering from lack of financial resources, support technical business start-ups through low-interest unsecured loans, and provide loans for SMEs operation. In addition, KEPCO will create cooperative R&D projects between the said organization and the SMEs where it provides up to 85% of the research expense to support technical research, start-ups, and relocation. These supportive measures will be combined with a program where KEPCO pre-purchases R&D results with superior quality. The fourth category of support concerns human resources. Securing regional companies is a prerequisite to establish and maintain human resources in a region. Training human resources is a crucial issue to create industrial ecosystems such as the Energy Valley. As such, KEPCO plans to expand R&D training programs for university students in the Gwangju–Jeollanamdo region, on-the-job training programs where students carry out research projects, the "Power Transmission and Distribution Technology Camps" for university students in the region, and scholarship programs for elementary school, middle school, high school, and university students in the region. KEPCO also entered into an agreement with Chonnam National University to set up an MBA course that is specialized for the energy industry (KEPCO 2015). KEPCO further plans to open practical training courses for the Energy Valley in collaboration with Korea Electrical Engineering & Science Research Institute; organize job fairs and outreach programs for regional universities such as Chonnam National University, Chosun University, Mokpo University, Suncheon University, and the GIST; and hold job fairs with public agencies relocated into the region with the goal of enhancing the competitiveness of university students in the region.

In the Energy Valley, as a part of the specialization project for the advanced energy industry, five industrial complex networks will be established

under the theme "The Valley of Light Illuminated with Smart Energy." The Gwangju Metropolitan City is actively providing support for industrial complexes because most of them are located in the city. The city decided to develop advanced urban industrial complexes in the Cheomdan 3 District, Pyeondong 3 District, Bitgreen, as well as in Nam-gu and Buk-gu. It also plans to raise the incentives for companies moving into the region by 10%. The advanced urban industrial complexes in the Daechon-dong area, Nam-gu, and Gwangju, is one of the largest advanced urban industrial complexes in South Korea. The city plans to establish the Gwangju branch of the Korea Electrotechnology Research Institute. Lastly, the Gwangju advanced urban industrial technology aims to become an energy cluster by attracting companies that are specializing in electricity or energy in collaboration with KEPCO.

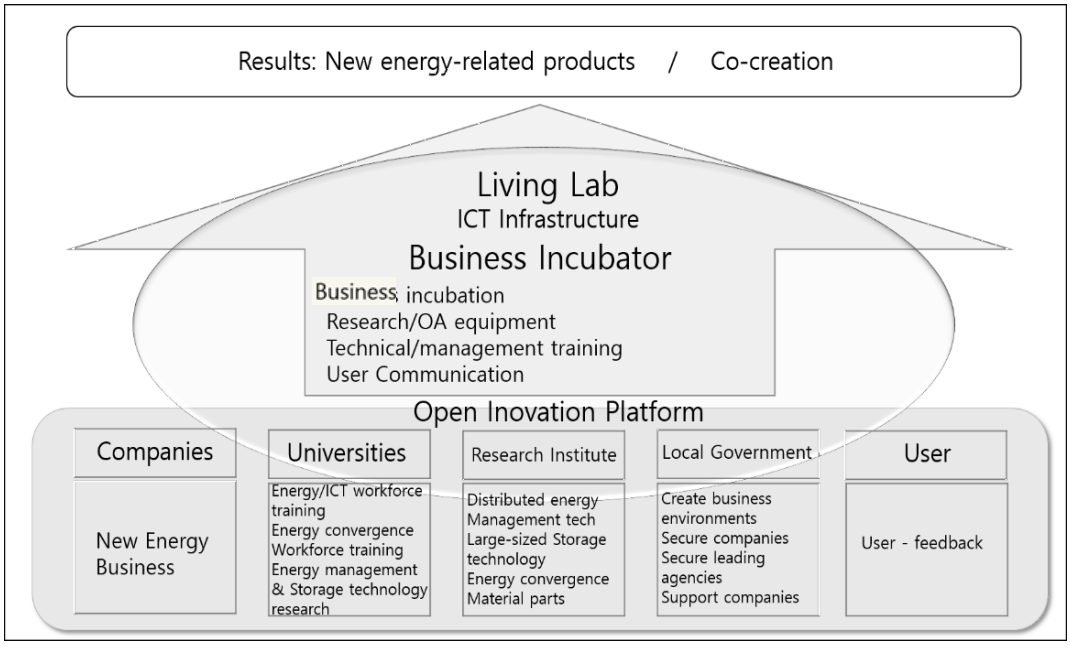
Table 3. List of enterprises investing in Energy Valley

New Energy Industry	Power ICT	Power Equipment & Materials	Others
Dokun System, Co., Ltd. Bohae Brewery, Co., Ltd. EDS, Co., Ltd. HK Energy, Co., Ltd. Hyosung, Co., Ltd. Destin Power, Co., Ltd. Munam E&R Backkwang Electric, Co., Ltd. CIS, Co., Ltd. Incell, Co., Ltd. Dongchun Electric, Co., Ltd. IDR Service, Co., Ltd. Solar Light, Co., Ltd. RTS Energy, Co., Ltd. Pyungsan Power Tec, Co., Ltd. LSIS, Co., Ltd. ABB Korea, Co., Ltd. Grid Power, Co., Ltd. Hi-Rex Ice, Co., Ltd. EN Technology, Co., Ltd. Green Tech, Co., Ltd. Willings, Co., Ltd. Nuri Telecom, Co., Ltd. Sunkang Engineering, Co. Ltd. TDL, Co., Ltd. Gaga Electric Power, Co., Ltd. Ihwa Industry Electric, Co., Ltd.	DMI Systems AD Capsule Soft, Co., Ltd. System Security Service & Integration, Co., Ltd. Grid Tech, Co., Ltd. Nexchal, Co., Ltd. The Solutions, Co., Ltd. Open Time, Co., Ltd. Hemann Tech, Co., Ltd. IT Man, Co., Ltd. Line Information Systems, Co., Ltd. Korea Firstec, Co., Ltd. MCS Tech, Co., Ltd. Power Plus Information Technology, Co., Ltd. Huron	Bosung Powertec, Co., Ltd. NEOPIS, Co., Ltd. Ewoo Tec, Co., Ltd. Techpro, Co., Ltd. Shinhan Precision, Co., Ltd. Daewon Electric, Co., Ltd. Omnisystem, Co., Ltd. Seondo Electric, Co., Ltd. Seungil Power Industry, Co., Ltd. Bohae Electric, Co., Ltd. JH Solution, Co., Ltd.	Jeonwoo, Co., Ltd. Woojin Electric Machinery, Co., Ltd. Sunun ENG, Co., Ltd.

The development of the Energy Valley must be combined with the efforts to promote the co-development and coexistence with the people of the local community. Co-development with the region improves the living quality for the vulnerable classes. To this end, the actors involved in the development should cooperate and communicate with the local community by providing various supports to the region. KEPCO plans and implements various support projects in collaboration with the Gwangju Metropolitan City and Jeollanam-do. First, KEPCO plans to build a smart energy infrastructure by setting up electric vehicle charging networks within the Energy Valley around the Naju Station and the Songjeong Station in Gwangju as well as introduce the smart drive service into airports, stations, and bus terminals for electric bicycles. Second, the corporation will build a smart grid for the innovative city by promoting the S/G station projects, the smart home project, and other advanced energy industries (The S/G station monitors the energy consumption of a building in real-time and induces effective energy consumption). The third category of support is aimed at providing assistance with the living quality of the vulnerable classes in the region. KEPCO spent KRW 5.3 billion to set up solar panels on the rooftops of social welfare centers and changed the heating system into a nighttime heating system that reduces the electricity cost of heating equipment by half.

KEPCO also entered into an agreement with Gwangju Metropolitan City under which it provided watch-type bracelets to single senior citizens suffering from the Alzheimer's disease. The bracelets allow their relatives or caretakers to identify their location in real time. They are also linked with the positioning sensors installed in remote-gauging poles to show the position or electricity consumption of single senior citizens. Through such use of the Internet of Things (IoT), KEPCO establishes the social security net in the region by providing healthcare services to single senior citizens suffering from Alzheimer's disease. This serves as one of the many ways to communicate with the local community using ICTs.

Figure 4. Bitgaram Living Lab Model



The relocation of public agencies out of the SMA, in tandem with the relocation of a substantial portion of companies affiliated with KEPCO, has resulted in the formation of an electric energy industry network. Efforts are currently being exerted in the areas of human resources and university development, thereby securing and revitalizing regional companies. Building energy parks and social safety nets that utilize ICTs and energy, the two strong suits of KEPCO, allows them to experience the economic benefits of such development at a closer distance. KEPCO plays the leading role in developing the Bitgaram Energy Valley into a global smart hub. The corporation will lead the future industries that centers around ICTs and energy.

In order to realize the full potential of the Energy Valley and to ensure its effective operation, the endless flow of knowledge, information, and technology is required. This study proposes the Living Lab model as a way to ensure the effectiveness of such flow of knowledge. What is the value of value in Living Lab? Living Lab processes support value creation in at least two different ways: for their partners (e.g. SMEs) in terms of business value and for the presumptive customer or user of the developed innovation in terms of user value. Business value includes aspects such as employee value, customer value, supplier value, managerial value and societal value. One way to mitigate competition and open up entirely new markets is by focusing on creating advances in customer value.

How can it be implemented in Living Labs? Living Lab processes support the process of understanding if the customer or user has a need for a service and how intense their attraction or repulsion for that service is in the real-world context. Living Labs can support processes by allowing users to elaborate with the service in their context to determine if it provides a value for them. In addition, a Living Lab can also provide insights about how users perceive value. These insights can guide the innovation process to deliver innovations that are perceived as valuable from a business and a customer perspective.

The platform for the Living Lab model is the Business Incubation Center. The Business Incubation Center conceived under this model is a new type of incubation center that combines the extant start-up incubating function with the use of ICTs and urbanity. In the majority of researches in the field, existing companies assumed the central roles in building the clusters. Most of them focused on drawing out the innovativeness of existing companies. On the contrary, the Living Lab model of this study proposes a cluster that maximizes the use of the electricity ICTs, and the Business Incubation Center is at the heart of the cluster. The Energy Valley will be more than just a simple physical integration of existing companies. Existing companies, however, are involved in the value chain-type relationship model that contributes to the emergence of new industries and companies. The Business Incubation Center, as the platform for the Living Lab mode proposed by this study, is required to create values. Real-time exchange of information shall be established between the center and university labs, along with spontaneous exchange of technological development information derived from the innovations achieved by the existing companies. To create such value for coexistence, other than the traditional actors participating in a cluster, the flow of information (Malecky, 1991; Maskell and Malmberg, 1999) involving local residents (customers) holds a great significance. This point distinguishes the model in this study from the existing clusters.

3.3 Discussion

The Energy Valley is not to be just a simple physical integration of existing companies. Also KEPCO should positively participate in Living Lab as a player as well as a supporter. A Living Lab has an important role in supporting the innovation process particularly

to create the new venture for all involved stakeholders, from manufacturers to end-users with special attention to SMEs, with the potential users in their real world context. Based on data collected from in-depth interviews, new venture creations related with smart grid technology are expected. In order to do so, KEPCO should enlarge the support to establish business incubators, which also supports innovative activities for existing firms.

Living Lab is an answer to many contemporary trends such as, for instance: users changed roles from passive consumers to active prosumers of content; shortened time to market for innovators; a globalized market through the introduction of internet and ICT in people's everyday activities. In a Living Lab, the aim is to accomplish a helix by harmonizing the innovation process among main stakeholders: companies, users, public organizations, university and researchers. These stakeholders can benefit from the Living Lab approach in many different ways. For instance companies can get new and innovative ideas, users can get the innovation they want, researchers can get study cases and public organizations can get increased return on investment in innovation research.

The innovation activities carried out in a living lab can create value by utilizing the knowledge and information sharing through ICT. All actors (e.g., KEPCO, universities, firms, local government and research institute) can become users for innovation output. In this context, an end user is not an object to be observed, but an actor who interacts with industry-academia-research partnerships and the government to proactively participate in innovation activities and create knowledge together. In this respect, the living lab approach is practical model that can create new value. By using ICT, each actor in Living lab model can reduce the innovation costs and marketing cost as well as information. As mentioned above, under the living lab model, since a user is elevated to one of the essential actors for innovation activities, entrepreneurs who want to establish new firms can make opportunities to business new venture easier than others who do not use the Living Labs. In other words, they are carried out in real-life settings. In such, product and service development under the living lab model is done in actual places, and new venture can be created with ease.

Consequently, Bitgarm Innocity is a futuristic city that can grow and develop continually, supported by new venture firms which create new values.

4. Conclusion

The essence of the development of the Bitgaram Innovative City lies in creating a spontaneous flow of innovation in the region. The success of the Innovative City hinges on the Energy Valley to which KEPCO plans to relocate its companies.

In order to ensure the successful development of the Energy Valley, the participants will create a flow where they share and exchange knowledge and information based on the trust among the academia, the industry, the research institutes, the public sector, and the local residents. Such real-time information exchange is made possible by the infrastructure based on power ICTs. As a way to achieve such infrastructure, this study proposed the Living Lab model designed to motivate open-ended innovation using ICTs.

The Living Lab model proposed by this study allows the real-time flow of information, technology, and knowledge among the constituents (universities, research institutes, households, public agencies, customers, etc.) Under the model, the Business Incubation Center assumes an important role as a platform that connects the outcomes of innovation from participating companies into business start-ups. The Business Incubation Center proposed in this study is distinguished from the other incubation centers based on the following aspects. First, the

Business Incubation Center assumes the role of a platform for the flow of information, technology, and knowledge. To fulfill this role, the Center's physical location needs to be at the center of the Energy Valley. Second, the Business Incubation Center shall provide policy-based supports to improve the living conditions in the region because the center is not an institute designed for the simple delivery of certain functions but a forum through which various information about technologies, living, laboratories, and innovation passes through. For example, the Business Incubation Center could set up facilities preferably by young start-up entrepreneurs, such as facilities for films, music, and performing arts, as well as facilities for international conferences and exchanges with high-quality workforces abroad. The Business Incubation Center constitutes the platform for the living lab model, which is at the heart of the emergence of new industries based on power ICTs. Thus, the center needs to be developed accordingly to assume significant roles in terms of the flow of information and knowledge with users (customers and residents).

This study so far proposed the Living Lab as the theoretical model for the development of the Energy Valley. No less important, however, is the support based on the public policies listed below.

First, the success of innovative cities and innovation clusters through the relocation of public agencies hinges on whether other related agencies and companies move along the public agencies. The actual actors who lead the development of local industries are regional companies, not public agencies. Therefore, the related policy efforts need to focus on ensuring that companies with potential synergy are integrated along with the relocation of the public agencies.

Second, the interests and the goals of the private sector and the public sector do not always coincide when building and managing a city. In a way, it is only natural that the goal of the profit-seeking private sector does not coincide with that of the public interest-seeking public sector. This warrants the need for adjustments and partnerships where the two sectors adjust their respective interests and move toward mutually acceptable goals.

Third, the role of local governments is crucial. The growth of an innovative city can be accelerated by the development strategies and programs suited to the region's characteristics, implemented by the local government familiar with the region's situation.

This study proposed the new policy model that is described above. However, there still remains a room for improvement. To fill this space, more efforts shall be exerted in the future to gather more substantial opinions from experts in businesses, companies, and universities.

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