

OPEN ACCESS

Institution for Regional Innovation System: The Korean case

Kang, Byung-Joo¹, and Oh, Deog-Seong^{2*}

UNESCO-WTA Technopolis Development Center and Hannam university, Republic of Korea¹

World Technopolis Association and Chungnam national university, Republic of Korea²

Abstract

There is an implicit assumption in most regional innovation policy studies that once a policy has been made the policy will be implemented. This assumption is not valid for regional innovation policies formulated in many countries. This assumption rests upon certain political and organization conditions. It is frequently said that regional innovation system in Korea is one of the successful cases because of properly established institution for the implementation of innovation policies. The components of institution for innovation are defined in this article. For the analysis of institution for regional innovation system in Korea, three aspects such as organization, policies & programs, and governance structure were taken into account.

Institution for regional innovation system in Korea is analyzed with three aspects: (1) organization for policy implementation, (2) innovation policy, and (3) governance structure. Firstly, organizations for innovation in Korea are composed of three categories such as organizations for policy formulation, organizations for policy implementation and agencies for coordination. Secondly, there are two categories of policies for innovation: (1) policies for the enhancement of national competitiveness and policies for the regional innovation capacity building, and (2) policies for fostering manpower and policy for regulatory reform. Thirdly, innovation governance in Korea is composed of three layer structure: (1) top level governance which is composed of two committee, three ministries and two agencies, (2) local level governance such as one innovation related offices and one center for regulatory reform, and (3) one category of agency for coordination as a regional platform.

Keywords

Regional innovation system, implementation, innovation policy, governance structure

1. BETWEEN INTENTION AND ACTION

Even though national competitive power is composed of many factors in the era of internationalization, innovation capacity, such as exporting excellent products and services into the global market, is conceived as one of the core factors in the national competitive power. Openness and win-win strategy for the members of the society became

important in the knowledge and information driven era, therefore establishing value chain network among the components of innovation system is required not only for the management of firms but also for the governance of the country. Nearly all of the countries today try to connect inner innovation with innovation from outside by utilizing variety of partners and organizations as open innovation is stressed. It is strongly argued that national and regional development is impossible without effective innovation system in the global competitive Society.

Innovations in science and technology are widely recognized as the engine that drives the economic transformation of developing countries. However, this recognition is only beginning to be featured as a part of policies for regional innovation system. Increasingly, the real innovation bottleneck is not the supply of new knowledge, but external factors surround-

*Correspondence to : Oh, Deog-Seong
Secretary General, World Technopolis Association
Professor, Chungnam National University, Republic of Korea
E-mail : ds_oh@cnu.ac.kr

World Technopolis Review
Copyright © World Technopolis Association

© This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited

ing the process of implementing innovation policies such as institution for innovation system. Innovation will become more advanced and diverse with significant influence on economies and the way people live. To harness innovation system and to enhance the contribution of science and technology to the growth and competitiveness of developing countries, there exists a pertinent need to improve institution for innovation system. To sustain innovation system, all countries need to continuously modify their institution for innovation system.

However, researches on regional innovation system have given little attention to the role of institutional factors such as organization that implement innovation policies, which are the strategies to be used in the innovation process and governance that facilitates implementation of innovation policies through the organizational structure.

In the past, social scientists, who are interested in regional innovation system, paid their attention to looking at how regional innovation policies are developed and plans are made. However, we seem to have reached another milestone that the good innovation policies and plans do not guarantee that we can achieve the outcomes we desire. We have finally accepted the fact the best laid innovation policies and plans and even the most sophisticatedly constructed plans and policies will, more often than not, go astray. However, despite the blossoming of interest in the analysis of implementation among some planners and policy makers, this area has not yet made for itself a significant niche in regional innovation system theory.

Policy makers in the field of innovation system appear to be divided into two major groups. One group tends to believe that better innovation system depends on further improvements in their policy-making instruments. This group is preoccupied with building models of innovation system, simulation for economic expectation techniques. The second group tends to feel that the shortcomings of the policy making process of innovation system reflect the inadequacies of the institutional aspects such as organization and governance structure within which innovation policies must be carried out more than any deficiency in the innovation system.

This article highlights one critical factor that influences the success of policy implementation for regional innovation system. The key to implementation performance is to understand the institution where regional innovation policy initiative is to be put into practice. The focus of this paper is analyzing the components of institution for regional innovation system and analyzing those components through conducting case study.

2. THEORETICAL BACKGROUND

2.1 Innovation capacity building and establishment of innovation system

Role division and networking among innovation actors, such as university, research institute and firm, are very important in innovation system because they produce, transfer and apply knowledge (OECD 1997). Environmental factors, which make individual and organization to be innovated based on creativity and let them link together, are more important than each person's capacity and talent in innovation system.

Innovation capacity building is a necessary element for the country and region, but goal and implementing tools are different for each party. The goal of innovation capacity building for the central government is finding a new growth potential and engine. Implementation tool of innovation capacity building is coordination of policies from diverse ministries for innovation and establishment of an organization, which conducts innovation projects from ministries through the compromise and combination. The goal of innovation capacity building for the local government is setting up an environment that accelerates technology innovation of local firms. Implementation tool of innovation capacity building is realized through the establishment and operation of regional platform that plans and coordinates regional industrial development policies and leads industrial development of the region.

Innovation system seems based on individual country's innovation environment and capacity. Innovation system is composed of two systems, such as national innovation system (NIS) and regional innovation system (RIS), and functions and viewpoint of each system are different.

NIS is defined as 'the network between public and private organizations performing activities and interactions related with technological development in order to acquire new technologies and expand them' (Freeman 1987). Lundvall (1992) defined that NIS is a system consisted of all components and relationships, which interact during the production, expansion, and usage of new and economically beneficial knowledge.

RIS can be defined as a system stimulating innovation capabilities of firms in a region so as to enhance the region's growth potential and regional competitiveness. Laranja et al. (2008) defined that RIS is a combination of innovation network and system in regional dimension supported by administration in which they interact with each other strongly and regularly to increase the innovation results within the corpora-

tions in the region. Cooke et al. (1997) defined that regional innovation system is a system where key innovation actors such as university, government, public institutes are interacting and learning under the institution for innovation. There may be other definitions of RIS, but they represent combination of the concepts of region, innovation and system.

NIS provides mutual networking between various sectors of science, technology and industry to acquire new growth engine and potentials. New and effective generation of knowledge from universities, public research centers and firms and accepting existing knowledge from outside are important in NIS. Meanwhile, RIS provides good places for firms to do business. Combination of industrial production system of local area and science/technology and supporting system is very important, and industries are the key factors in RIS.

Well-functioning innovation systems depends on how well governments can bring together and coordinate the activities of the various actors and stakeholders fundamentally for advancing science, technology, and innovation in various sectors of the economy. According to innovation system theory, innovation and technology development are results of a complex set of relationships among actors in the system, which includes enterprises, universities and government research institutes.

2.2 Components of institution for innovation

Institution could be defined in many ways according to

history, tradition and social context. Institution for innovation includes three components in this study: 1) institute and organization that manage and implement innovation policies and programs; 2) policy and program which are the strategies to be used in the innovation process; and 3) innovation governance which facilitates implementation of innovation policies and programs through the organizational structure.

Institution for innovation is composed of three components such as organization for innovation policy implementation, innovation policy and governance structure of innovation.

The first component is further subdivided into three types of organizations. Central and local governments play the most important role in proceeding innovation policies. Central government intervenes in the establishment of regional innovation system through the implementation of various innovation policies such as establishment of supporting and related organizations, supporting regional strategic industries and R&D investment to R&D institutes. Role of central government is important at the beginning stage in building innovation ecosystem. However, role of local government is stressed as system works and coordination between related organizations are needed.

Since success of innovation ecosystem depends on activation of private firms in the long run, role of PPP should increase as time pass, and keeping good relationship between central and local governments are very important.

Table 1. Roles and functions of innovation organizations

Innovation Organization	Role	Major functions and affairs
Central government	Manager and supporter	<ul style="list-style-type: none"> Gathering opinions of universities, firms and public research centers and providing various support for firm's innovation Technical support to universities and TPs, managerial support to BIs and financial organizations, physical support such as building industrial parks and ware houses
Local government	Executor and coordinator	<ul style="list-style-type: none"> Coordinating demands from various local innovation actors and putting coordinated demands in innovation plan Operating plan and coordinating organization that coordinates relations and functions of various innovation projects
Public-private partnership	Connector for private and public sector	<ul style="list-style-type: none"> Networking industries and public research centers and universities through the strengthening of links between inner innovation actors to enhance national innovation capacity.

Two types of organizations are used for implementation of innovation policies at regional innovation platform level. First one is RDA, which is used as a regional innovation platform in UK. Second is TP with Planning Board for Strategic Industries, which is currently used in Korea. Regional Development Agency was

launched as an organization of implementing regional development policies over the wide economic zones, and techno-park was launched to carry out industry-academy-research institute cooperation projects. Both organizations are now used as an organization implementing innovation policies over the world.

Table 2. Organizations for the implementation of innovation policies

Classification	Role and function
Regional Development Agency	<ul style="list-style-type: none"> • RDA was originally established as an organization to implement regional development policies. • Planning and managing regional industrial development through concentrating regional innovation actors and coordinating interests of each regional platforms and related programs.
Technology Park	<ul style="list-style-type: none"> • TP was established to conduct cooperation projects among industry, university and research center. • TP provides infrastructure to local start-ups and companies located in the TP and provides technological and administrative support to whom looking to extend their core development offshore.
Planning board for strategic industries (PBSI)	<ul style="list-style-type: none"> • PBSI prepares long and mid-term development plans for regional strategic industries and manages R&D projects through the control and coordination of related plans established by various organizations for innovation.

Secondly, innovation policy is public action that influences technical change and other kinds of innovations. Innovation policies and programs are primarily responsible for the promotion of innovations or the creation of suitable basic conditions for innovations. Innovation policies are made to achieve goals and objectives planned based on the major features of the innovation environment such as strengths and weaknesses of a nation's innovation system. Policies of innovation are categorized into several groups depend on goal settings of innovation system in each country. Every society has to find the ways and means to innovate that correspond to its needs and capabilities. Its innovation environment is largely determined by its overall macroeconomic, business, and governance conditions. Well-designed and well-implemented innovation policies are very relevant.

Thirdly, innovation governance is about the handling of complexity and the management of dynamic flows of innovation. It is fundamentally about interdependence, linkages, networks, partnerships, co-evolution and mutual adjustment in innovation process (De la Mothe 2001). Innovation governance tells something about what roles the various actors in the innovation process play, how the rules of the game work, how decisions are made and how changes in the overall inno-

vation system come into being existed. The focus of innovation governance is put on mutual relationships among various actors of innovation rather than priorities, strategies and outcomes of innovation.

According to Arnold et al. (2003), innovation governance is composed of three layers of organizations. The most important layer for policy design and overall strategy formulation for innovation lie at the level of governments, departments and to varying degree advisory bodies. The degree to which the national governments (Cabinet and Prime Minister) are involved in deciding on overall co-ordination and strategy formulation in innovation differs enormously, but can have great impact. The composition of these bodies and the links with key decision makers decide on their importance.

Each of the countries have an important 'middle level' consisting of research funders (typically research councils, funding institutes, and dedicated agencies) which have the responsibility for allocating funding to the research performers (universities, research organizations and laboratories, firms). The level of independence of this middle layer shows large variations in terms of their role in policy design and decisions on allocation of funding.

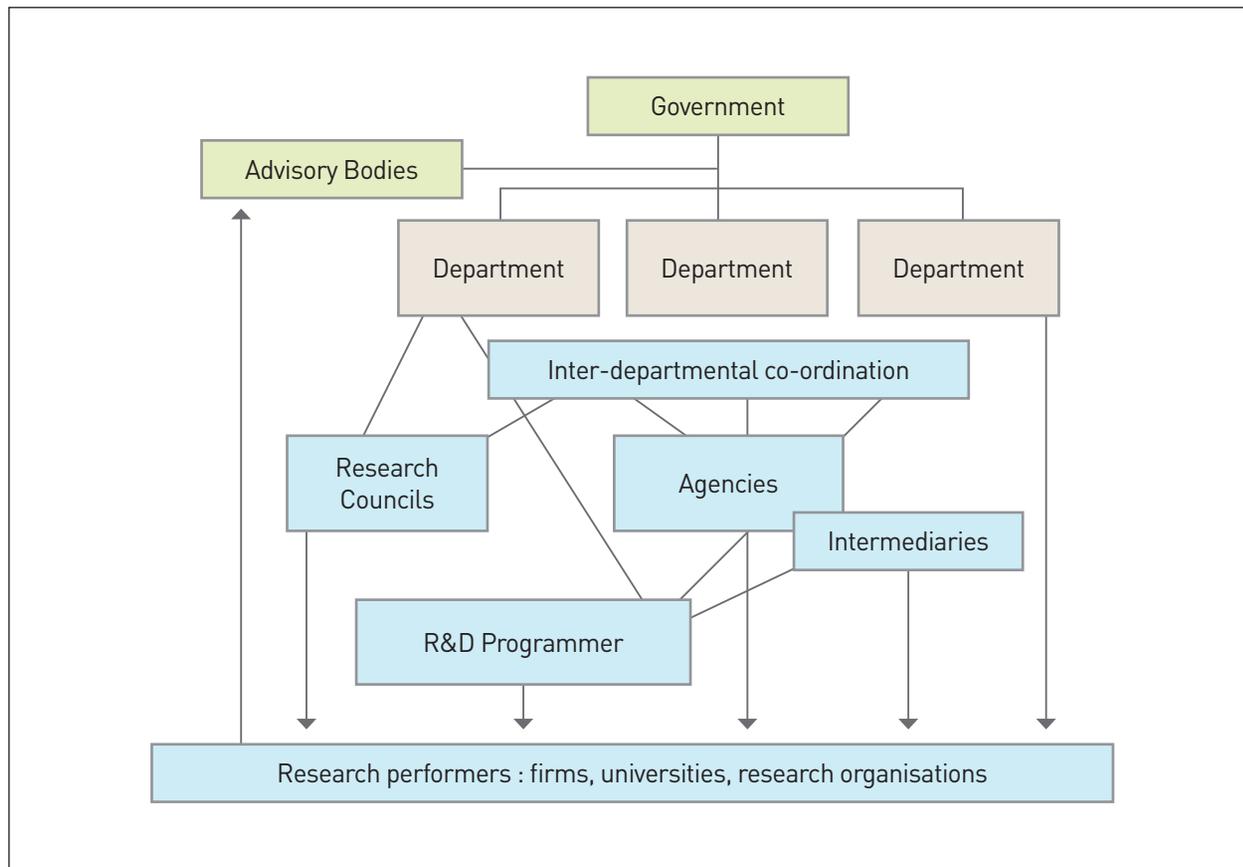


Fig. 1. Typical innovation governance structure

Source: Arnold et al. (2003), p. 28.

The third level in the governance system consists of those actors that perform research and innovation and are the direct beneficiaries of public funding for R&D. This is where countries patterns vary most.

3. STRATEGIES OF REGIONAL INNOVATION SYSTEM IN KOREA WITH RESPECT TO INSTITUTIONAL ASPECTS

3.1 Trend of NIS/RIS to enhance competitiveness

Trend of innovation system in NIS & RIS in Korea could be analyzed in three periods: initial stage (1990~2002), developing stage (2003~2012), and matured stage (2013~).

Initial stage (1990~2002)

The first NIS was launched as a technology imitation innova-

tion model in the process of industrialization in 1960s, and innovation was progressed by individual innovation actor base. Innovation capacity was accumulated in Korea in the process of commercialization through the digestion and revision of fundamental technologies, which were imported from advanced foreign countries. Strategy of innovation for firm was imitation of advanced technologies which were imported from foreign through revising imported technologies and enhancing manufacturing capability

The first RIS had begun in mid 1990s, but the focus of innovation projects was on capacity building of local universities and activation of research, instead of regional economic development through the establishment of regional innovation system. Representative projects at that time were Regional Research Center Project (RRC) of Ministry of Science and Technology in 1995, Technology Innovation Center Project (TIC) of Ministry of Industry and Resources in 1995, and Joint

Technology Development Project for industry-academy-research institute cooperation of Small and Medium Business Administration in 1993, etc. Local Science and Technology Policies emerged from late 1990s, and representative regional innovation projects at that time were Techno-park Building Project of Ministry of Industry and Resources in 1997, Business Incubator building Project of Small and Medium Business Administration in 1998, and etc.

Developing stage (2003~2012)

Escape from imitation began in NIS in 2004, and National Competitive Power Strengthen Committee and National Balanced Development Committee were established under the supervision of the president at that time. Major jobs of Na-

tional Competitive Power Strengthen Committee were regulatory reform, innovation in public sector, attraction of foreign investment. National Balanced Development Committee was in charge of scattering facilities and population over the local areas evenly to solve excessive concentration of population and facilities in capital region.

Direction of national innovation had changed from applied science and technology oriented approach to basic science and fundamental technology centered approach in 2009. The government had believed that to enter into advanced countries, strengthening capacity of basic science and fundamental technology is necessary to get rid of bottleneck in acquiring national competitive power. Establishment of International Science and Business Belt Project that involves building huge

Table 3. Contents and representative projects of national/regional innovation system

Classification	Major contents of innovation system	
	National innovation system	Regional innovation system
Initial stage (1990~2002)	<ul style="list-style-type: none"> • Imitative technology innovation had begun from 1960s in the industrialization process and innovation was progressed by individual innovation actor base. • Fast follower was the policy of innovation for firms after reforming imported technologies and enhancing production and manufacturing capability. 	<ul style="list-style-type: none"> • RIS had begun from the mid 1990s and innovation capacity building and activation of research were the focus. • Local science and technology policies emerged from late 1990s and TPs(supported by Ministry of Industry and Resources) and BIs(supported by SME Administration) were the representative examples.
Developing stage (2003~2012)	<ul style="list-style-type: none"> • Escape from imitation began from 2004 and National Competitive Power Strengthen Committee and National Balanced Development Committee were established. • Innovation was moved from applied science and technology oriented approach to basic science and fundamental technology approach from 2008 and ISBB project had begun. 	<ul style="list-style-type: none"> • After National Balanced Development Law was enacted in 2004, regionally different strategic industry oriented regional development project such as Project of Fostering Regional Strategic Industries (supported by MIR) is the representative example. • Regional innovation projects were conducted in 7 wide economic zones, and four industries were chosen as leading industries in each area from 2009. Project of Fostering Leading Industries in Wide Economic Zone(supported by MIR) was the representative example.
Matured stage (2013~)	<ul style="list-style-type: none"> • A new model of innovation system, which is creative economy, was introduced from 2013 to protect cut off between knowledge generation and the creation of market value. 	<ul style="list-style-type: none"> • Concept of space such as "region" was disappeared and ICT, material science, applied industry etc., became basic industries and industries began to be conversed from 2013. • Project of Fostering Center for Creative Economy & Innovation (supported by MSIFP) and Project for Regional Industry Promotion (supported by MIR) was the representative examples.

facilities, such as Research Institute for Basic Science and Isotop Separator, and linking these facilities with regional economic development are under progress in Korea now.

Regional innovation related projects were activated from the beginning of 2000s. After National Balanced Development Law was enacted in 2004, regional innovation projects began to be implemented actively due to the creation of Special Account for National Balanced Development. Regional development projects based on regional strategic had been carried out in Korea. Representative regional innovation projects after 2003 were Fostering Regional Strategic Industries Project based on local potential and capacity, Fostering Innovation Cluster Project (Daedeok R&D Special Zone Project) and Fostering 7 Industrial Site Cluster Project, etc.

Regional innovation projects were conducted for 7 wide economic zones in 2009. Four items of industries were chosen as leading industries and one university was designated as a base university in each wide economic zone. Each wide economic zone received support from Special Account for Regional Balanced Development. The aim of RIS was to enhance competitive power of each wide economic zone by linking designated leading industries, to manpower projects and SOC as a package after considering current situations, to develop potential and vision of each zone.

Matured stage (2013~)

A new model of innovation system, which is creative economy, was introduced in 2013 to protect cut off between knowledge generation and creation of market value. It was diagnosed in Korean NIS that activity of knowledge creation and activity of market value creation was disconnected from each other, and market's capacity of knowledge absorption was weak and investment to knowledge generation activities was not linked to social and economic value creation. NIS was resettled under the name of creative economy with the concept that once new knowledge is created, it would be connected to commercialization model and connected to generation of new market value. (Lee 2013)

Aims of RIS in 2013 were generation of jobs by applying information technology oriented high science and technologies to all of the industries and enhancing national competitive power. Concept of space such as "region" was disappeared for innovation projects in matured stage and strategy of fostering simultaneously four basic industries, which are the base of ICT and material science was a main policy of innovation. Policy of conversing industries began in 2013 with fostering nine ap-

plied industries, which are the national growth engine in the future.

3.2 Components of institution for regional innovation system

1) Innovation organizations

Organizations for management and implementation of innovation policies are classified into three groups such as central level organizations, local level organizations and public private partnership level agencies.

① Organizations for policy formulation Committee

There is one presidential committee such as Regional Development Committee, and Advisory Council on Science & Technology belongs to the Ministry of Science, ICT and Future Planning. Members of these committees are composed of experts from various related fields, and provide consulting opinions on innovation.

- Advisory Council on Science & Technology

Main function of the Advisory Council on Science & Technology is provision of advisory opinions for the development of science and technology and direction of major issues on innovation, information and manpower fostering to promote national science and technology. Members are composed of citizens, and they act as a bridge between president and science and technology fields and exchange free opinions in terms of macro and long-term perspectives. This council belongs to the Ministry of Science, ICT and Future Planning, and chairman of this council is the president and related law is "Law of Advisory Council on Science & Technology".

- Regional Development Committee

This presidential committee provides advisory opinions on effective implementation of regional development policies. Role of this committee is evaluation and providing advices on regional development policies and plans in principle, but actually provide variety of functions such as planning, evaluation, education, provision of consulting services, and related law is "Special Law for National Balanced Development".

It is written in this law that the Regional Development Committee covers variety of activities such as investigation, evaluation and coordination of regional develop-

ment policies, regional development plans and regional development projects, contracting and managing regional investment agreements, moving public organizations into local areas, etc.

- Committee on Green Growth

This committee was established to evaluate national policies and plans on low carbon and green growth. This committee covers many activities such as evaluation of basic policies and strategies of green growth, related laws and R&D activities, fostering manpower and green industries, education and promotion of green growth, climate change and renewable energy, etc. This committee belongs to the Prime Ministry Office and related law is “Basic Law for Low Carbon and Green Growth”.

Ministry

Three central government organizations such as Ministry of Science, ICT and Future Planning, Ministry of Education, Ministry of Trade, Industry and Energy are in charge of managing innovation. Functions of these organizations are setting up management principle of innovation and making guidelines of implementing agencies.

- Ministry of Science, ICT and Future Planning

Main functions of MSIFP are establishment of global start-up ecosystem to reinforce national competitive capacity and building private initiative innovation centers for creative economy. MSIFP also carries out fostering science, technology and ICT centered new industries, expanding Vitamin Project, and excavating and fostering future growth engine. MSIFP tries to change engineering university from lecture oriented education to firm and site centered education, and expand investment to basic research and R&D to enhance innovation capacity for creative economy.

Main job of MSIFP is management of Advisory Council on Science Technology, which is the highest decision making organization dealing with coordination of R&D policies and projects on science and technology from various institutes (Basic Law for Science and Technology is related law).

Representative project of MSIFP is “Supporting Project for Specialization of Industry-University Cooperation”. Contents of this project are provision of excellent manpower and supporting new technology development to

SMEs, hiring students, providing start-up opportunity to students, and supporting professor’s research activity.

- Ministry of Education

Ministry of Education is in charge of managing four representative innovation programs such as NURI, LINC, BK21, CK, which are programs operated by universities for specialization of university, reinforcement of industry-university cooperation and fostering excellent talented students.

The key of NURI program was achieving regional development by establishing a few departments in the universities which are located in 13 non-capital regions as an innovation capacity building project.

Content of LINC is to support job generation for the students by revising university education system with industry-university cooperation. Focus of BK21 is to support the project of fostering world-class graduate school and excellent research manpower. Goal of CK is reinforcement of national competitive power by making university as a new growth engine of regional economy through enhancing quality of education for undergraduate students and diversification of major fields.

- Ministry of Trade, Industry and Energy

Representative innovation project of MTIE is “Innovation Project for Industrial Technology”. This project was planned to support making creative business idea that could be target of technology development from stage of developing business model to stage of finishing core technology development (Law for Industrial Technology Innovation is related law).

Agency

One agency such as Small and Medium Business Administration is in charge of innovation program operation. Function of this agency is operation of innovation programs from corresponding ministries.

- Small and Medium Business Administration

Representative innovation projects of SMBA are Project of Fostering Technology Innovation Oriented SMEs (Inno-Biz) and Project of Technology Innovation Development for SMEs. Contents of Inno-Biz project are excavating and selecting SME that has competitive power in technology and growth potential for the future and foster-

ing it as an innovative firm, which has global competitive power, by connecting to public supporting mechanism such as fund, technologies and marketing, etc. Contents of Project for Technology Innovation Development are provision of expenditures needed in developing new products to SMEs who hold technology development capacity. This project accelerates technology innovation, and Act on the Promotion of Technology Innovation for SMEs is related law.

② Organizations for implementation

Two types of organizations such as Innovation related office and Center for Regulatory Reform are the organizations for the implementation of innovation policies at the local government level.

Innovation related office

There is no exclusive office handling on-going innovation projects by MSIFP, ME, MTIE and SMBA at the local government organizations. Therefore, innovation policies are handled with other policies together at the ordinary office according to conditions and situations of each local government. Innovation policies are handled at the Center for Driving Vision and at the Center for Strategy Evaluation together, and both centers are belonged to Innovation Headquarter of City Affairs in case of Busan Metropolitan City. Innovation policies are handled at the Department of High-tech Industry that belong to Center for Creative Economy in case of Daegu Metropolitan City, and Department of Strategic Industry and Department of Science and Technology, which belonged to Bureau of Economy and Industry, are handling innovation policies in case of Kwangju Metropolitan City.

Center for regulatory reform

IMF and OECD think that the most effective part of growth policy now in Korea is part of regulatory reform in “Three Year Economic Innovation Plan” (Ministry of Public Administration and Security 2014). Every metropolitan city in Korea has a public-private joint office for regulatory reform and “Center for Regulatory Reform”, where regulatory reform related policies that are transfer from MOPAS are handled as a local implementing organization. Major jobs of this center are implementation of regulation reforming affairs that are entrusted by the central government and excavating and solving difficulties arising from the site.

③ Organizations for coordination

Two types of organizations such as Techno-Park and Center for Creative Economy & Innovation are the organizations for the implementation of innovation policies at the public private partnership level.

Techno-Park

Since main functions of TP are to support technology innovation such as new technology oriented start-up, R&D, test bed production, information circulation and training, etc., TP is one of the best organizations as an organization for implementing innovation policies. There are 18 TPs in Korea now with three types such as demo TP, late start TP and private initiative TP, etc. Since the third sector type of TP, which is public-private partnership TP, is managed based on cooperation among local governments, universities and local firms, TP is managed under the close relationship with local situations, so synergy effect is huge.

Center for Creative Economy & Innovation

Korean government has been thought that creation of local government initiative regional development model, which is appropriate to the regions, was possible through the effective linkage and using local resources such as TP, which is regional innovation infra, supporting center for SMEs, SBC (Small and Medium Business Corporation), Total Supporting Center for SMEs, etc. Center for Creative Economy & Innovation is a business hub offering startup services and commercialization of fresh ideas from local as a strategic business. It encourages the innovation of local economy and supports small sized business in the local specialized industry.

It is expected that about 17 Innovation Centers for Creative Economy would be built over the country sooner or later, and private firms such as K-Start-up, Posco, Venture Partners, Google Korea, Samsung Electronics, SK are currently participating in this project. Major functions of this center are to foster small and medium corporations in the field of specialized strategic industries, which were selected by the local entities, linking related institutes and programs of searching global markets and reinforcing start-up capacity of local people through the education of entrepreneurship and technology commercialization.

Table 4. Roles and functions of organizations for innovation

Classification of organizations			Main functions
Policy formulation	Committee	Advisory Council on Science & Technology	• Main function is advising organizations for policy on innovation of science and technology
		Regional Development Committee	• Main function is advising organizations for policy on balanced development
	Ministry	Ministry of Science, ICT and Future Planning	• Main function is establishment of start-up ecosystem and innovation center for creative economy to enhance national innovation capacity
		Ministry of Education	• Main function is operation of four representative innovation programs such as NURI, LINK, BK21
		Ministry of Trade, Industry and Energy	• Main function is developing business model by supporting creative ideas and locating core technologies for business
	Agency	Small and Medium Business Administration	• Major functions are operation of Inno-Biz project and conducting related projects
KIAT		• Main function is operation of programs for innovation from Ministry of Trade, Industry and Energy	
Policy implementation	Innovation related office		• Main function is implementation of innovation policies for ministries of central government
	Center for regulatory reform		• Major function is implementation of Policies for regulatory reform
Coordination	Techno-Park		• Major functions are supporting new technology based start-ups, R&D, pilot production and supporting education for technology innovation
	Center for Creative Economy & Innovation		• Major functions are connecting and synthesizing related programs for SMEs in the field of regionally specialized strategic industries

2) Innovation policies

There are 7 fields of innovation policies in 3 categories to conduct enhancement of national competitive power, regional innovation capacity building and other innovation capacity building.

① Policies for enhancing national competitive power

The aims of policies for enhancing national competitive power are acquisition of new growth engine, promotion of com-

petitive power in science and technology, and green growth.

Firstly, new growth engine is new technologies, new products and services which are expected to contribute to the sustainable economic growth and quality of life through the good quality job generation, growth of firms and preoccupation of world market and are expected to be developed as main industries of next generation that would lead Korean future economy (KIET 2011). Fostering new growth engine is ongoing policy from 1992 in Korea, and major industries for three stages are shown in <Table 6>.

Table 5. Main industries of new growth engine in three period of time

Growth engine industries for next generation (2003 ~ 2007)	New growth engine industries (2008~ 2012)	New growth engine Industries (2013 ~)
<ul style="list-style-type: none"> • Digital TV/Broadcasting • Display • Mobile communication for next generation • Intelligent robot • Bio new medicine • Digital contents • Next generation battery 	<ul style="list-style-type: none"> • New renewable energy • LED application • High tech green city • New convergence industry in media • New material, Nano convergence • Bio medicine, medical equipment • Global healthcare 	<ul style="list-style-type: none"> • Smart automobile • 5G mobile communication • Deep sea marine plant • Intelligent robot • Wearing smart equipment • Tailored health care • New renewable energy

Table 6. Contents of policy for national balanced development

Classification	Contents of policy	
Goals	• Enhancement of national and local competitive power through the balanced national development	
	• Enhancement of national competitive power	• Enhancement of regional competitive power
Policy direction	• Enhancement of efficiency in territorial management by reducing gap between capital and non-capital areas	• Enhancement of local competitive power through the development of regional industries
Items of policy	<ul style="list-style-type: none"> • Rational role division between capital and non-capital areas • Scattering main public functions into non-capital areas • Differentiation of regional development policy for areas standing at different development stage and introducing competitive system between non-capital areas which stand same development stage 	<ul style="list-style-type: none"> • Formation of cluster for strategic and specialized industries • Building strategic industry centered regional innovation system (Reinforcement of local university's role of leading industries and expansion of regional innovation infra)
Related law	Five Year Plan for National Balanced Development	Five Year Plan for Regional Innovation

Secondly, advanced countries have expanded investment competitively in reinforcing capacity of science and technology, and have built institutional settings to support development of science and technology as they think science and technology are the main source of national competitive power in the era of knowledge driven economy.

Korean government thinks that creation and expansion of new high technology is necessary to enhance competitive power in science and technology. Currently, policy under the name of “International Science and Business Belt Project” is

under progress as a way of capacity building via promotion of basic science research. Projects such as building Research Institute of Basic Science and establishing huge research facility, such as Isol Separator, is under progress. Fostering manpower in science and technology field that would lead knowledge driven society is also under operation.

Planning for science and technology, setting up of fostering manpower in science and technology, and setting up of regional innovation policies are conducted through the establishment of KISTEP. Four R&D Special Zones were designated

to promote competitiveness power.

Thirdly, currently Korea needs sustainable economic growth model because of environmental damage occurred from high speed and concentrated growth policies in the past many years. Green growth policy means that economic growth is necessary but it should go with environment friendly way. Korean government thinks that traditional profit generation model, which stress low price of commodities for export oriented manufacturing industrial policy, should be changed because of high global competition. The government decided to enhance growth potential of industries by converting current industrial structure to low carbon-oriented structure and to settle down virtuous circle of environment friendly industrial development.

② Policies for enhancing regional innovation capacity

There are two policies for enhancing regional innovation capacity such as policy of balanced regional development and policy of fostering locally specialized industry.

Firstly, Korean economic growth in the past was achieved through the policy of concentrated investment to capital region for the sake of efficiency in policy implementation. However, continuous concentration of investment in capital region brought high cost with low efficiency because of excessive population concentration and increase in housing expenditure.

National Balanced Development Committee was established and prepared “Five Year Plan for National Balanced Development” to solve distortion of territorial management. Building up of self-operated regional economic zones through the reinforcement of regional competitive power by building regional innovation system based on strategic industries were the main contents

of that plan. National balanced development policies are effective until today to reduce gap between capital and non-capital regions by scattering many public organizations and facilities located in capital region into the non-capital areas. Main focus of Five Year Plan are enhancement of national competitive power, regional innovation through the fostering of regional strategic industries and establishment of coordination link between industry, university and research institute.

Secondly, locally specialized industries has been supported by central government as a RIS project since 1999, and it created value added through the development of specialized products by using regionally located resources or through the differentiated regional brand. Ministry of Industry and Economy is in charge of supporting locally specialized industries after dividing that industry into two groups such as regional strategic industries and regional residential industries. Building industrial site, creating specialized technologies and supporting firms are main contents of support system for regional strategic industries. Making collaboration among industry, university and research institute to produce a quality commodity and fostering marketing skill are the main contents support system for residential industries in the region.

③ Policies for other innovation capacity building

There are two kinds of policies for other innovation capacity building such as fostering manpower and regulatory reform.

Firstly, policies for fostering manpower are classified into two groups such as policy for university and policy of other agencies. Two representative projects managed by the Ministry of Education are LINC and BK21.

Table 7. Actors and contents of policies of fostering university manpower projects

Title of project	Aim and function	Contents of the project
LINC (project of fostering leading universities for the coordination between industry and university)	<ul style="list-style-type: none"> Leading regional industries by revising university educational system through the cooperation between universities and industries and solving difficulties in job generation. 	<ul style="list-style-type: none"> Revision of university structure and curriculums Reinforcement of role and position of center for cooperation between industry and academy Supporting education center for start-ups and site practice Expansion of infra for cooperation between industry and academy
BK21 (Korea Brain 21 project)	<ul style="list-style-type: none"> Supporting world class graduate school and fostering research manpower program for students at master and doctor level 	<ul style="list-style-type: none"> Fostering global manpower Fostering specialized experts Fostering future oriented creative manpower

Contents of policies for other innovation capacity building are diverse. Representative policies of fostering manpower projects are Project of nurturing industry focused manpower, Project of fostering creative manpower, project of fostering industry linked R&D manpower, project of fostering manpower for energy technology, etc.

Secondly, Basic Law for Administrative Regulation was enacted in 1998 and Presidential Committee on Regulatory Reform was built based on this law. Korean government thinks that regulations are necessary in some fields such as environment, safety, market failure but all the regulations for entering market, price and production should be abolished in principle. Even if

regulations are needed, low degree of regulation and searching alternative option is under way by the governments. Some policies such as temporal regulations, sunset of regulation and invalidation of enacted regulations are under progress.

Trading costs would decrease and market functions would recover, if total investment limit is abolished in the market, limit of holding bank stock is relieved and exhibition of broadcasting and newspaper corporations' entering media industry is relieved. Simplification of start-up process, abolishment of accumulation of minimum amount of capital and process of certification for SMEs' start-up could be achieved, if regulations are abolished or relieved.

Table 8. Objectives and contents of innovation policies

Category	Name of the policy	Objectives and contents of policy
Enhancement of national competitiveness	New growth engine	<ul style="list-style-type: none"> • Searching new technologies, new products and services which are expected to generate jobs and to become leading industries in the next generation
	Science / technology capacity building	<ul style="list-style-type: none"> • Building huge facilities such as IBS and Isol Separator as a representative facility for International Science Business Belt Project • Policy for enhancing technology competitiveness by the establishment of KISTEP and designation of 4 R&D Special Zones
Regional innovation capacity building	Balanced regional development	<ul style="list-style-type: none"> • Strengthening national and regional competitiveness by balanced development
	Fostering locally specialized industry	<ul style="list-style-type: none"> • Creation of value added through the development of specialized products by using regionally located resources or through the distinguished regional brand
Other innovation capacity building	Fostering manpower	<ul style="list-style-type: none"> • LINK Project of Ministry of Education and BK21 project (Korean Brain 21)
	Regulatory reform	<ul style="list-style-type: none"> • Regulatory reform in the field of environment, market failure, safety, etc.

3) Innovation governance

Innovation policies in Korea have been implemented by three layers of governance structure such as central government organizations, local government offices and public/private partnership agencies.

① Governance structure at central government level

National Science and Technology Committee and National Technology Innovation Special Committee are conducting coordination and negotiation of nationally influenced projects

such as "Next generation Growth Engine R&D Support Project" based on efficiency, but implementation of the projects is in charge of related department offices. Steering Committee, which is composed of National Technology Innovation Special Committee and Regional Development Committee, sets up guidelines for innovation based on the criteria of competition and coordination, and related departments propose project lists for their administrative zones. Ministry of Science, ICT and Future Planning is in charge of managing Science Parks to enhance capacity of science and technology.

② **Governance structure at local government level**

There is no specific department or office for the implementation of innovation policies at local government, but local governments have different type of offices according to their situations for the implementation of innovation policies, which were established by the central government.

③ **Governance structure at public-private partnership level**

18 Techno-Parks, which connect central and local governments and planning organizations of implementing innovation policies, are under operation over the country as platforms for

the implementation of innovation policies.

Innovation system in Korea has a complex governance structure. Government science, technology and innovation policies have long roots, and the government's overall role has been pronounced. A key challenge for Korea is to govern its rapidly growing portfolio of policy measures, and Korea is responding with efforts to improve the coherence of its policies through horizontal coordination between advisory councils and ministries and vertical coordination between ministries and the government research institutes.

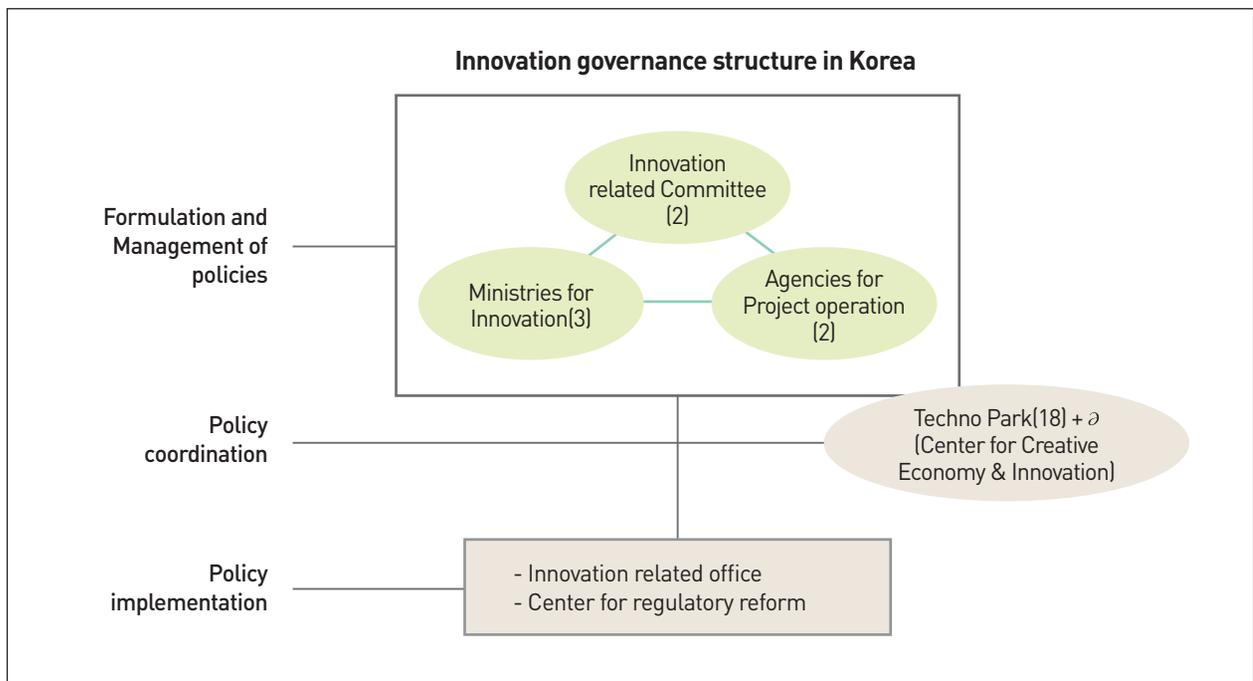


Fig. 2. Innovation governance in Korea

4. CONCLUSION

Whatever direction the theory of regional innovation system may take in the future, the concern with improving the record of policy implementation is likely to be there as it has almost always been throughout regional innovation system's theory. In recent years, this concern has crystallized into a more systematic focus on implementation process, in an attempt to learn what are the factors associated with the like

success or failure in the implementation of policies for regional innovation system.

The conceptual framework of implementation for regional innovation system presented in this paper were made in an effort to provide the basis for a more understanding of the implementation process of policies for regional innovation system. Institution for innovation is composed of three components such as organization for the management and implementation of innovation policies, innovation policy and

program which are the strategy to be used in the innovation process, and innovation governance which facilitates implementation of innovation policies and programs.

Innovation capacity building at the national level in Korea had begun in 1960s, as an imitative technology innovation approach in the process of industrialization, and innovation was carried out by the individual innovation actor base. Innovation capacity building at the local level had begun in mid 1990s with innovation governance such as Balanced Regional Development Committee, 5 Year Innovative Regional Development Plan, Special Law for Balanced Regional Development and Special Account for Balanced Regional Development. Innovation policies were very effectively progressed due to consistent policy implementation by the central and local governments.

Innovation system works with harmony as a synthesized tool in Korea. Many factors, such as appropriate selection of innovation targets, coordination among central and local governments and public private partnership organizations and strong supporting mechanism like law and finance, were under operation with properly designed innovation governance. Seven innovation policies were established to enhance innovation capacity, and those policies had been under operation for the last 20 years. Five of them are major projects, and they had been supported in terms of legal backup and financial support.

Korean experience shows that the institution for regional innovation system is effective when innovation policies are well prepared with an appropriate implementing organization and with strong supporting mechanisms such as legal backup and financial support. It is stressed that innovation policy should be made based on regional characteristics and conditions.

REFERENCES

- Arnold, E., Redman, R.S., and Rodriguez, R.J. (2003) *Research and Innovation Governance in Eight Countries: A Meta Analysis of Work Funded by EZ(Netherlands) and RCN(Norway)*, Technopolis.
- Cooke, P., Uranga, M. G., and Etxebarria, G. (1997) "Regional Innovation System: An Evolutionary Perspective," *Environment and Planning A* 30(9):1563-1584.
- De la Mothe, J. (2001) "Knowledge Politics and Governance," in editing by John de la Mothe, *Science, Technology and Governance* (London, New York: Continuum), p.3-13.
- Freeman, C. (1987) *Technology Policy and Economic Performance: Lesson from Japan* (London/New York: Printer Publishers).
- Korea Institute for Industrial Economics & Trade (KIET) (2011) *A Specialized Think Tank for Korean Industrial Economic Policy*.
- Laranja, M., Uyarra, E., and Flanagan, K. (2008) "Policies for science, technology and innovation: Translating rationales into regional policies in a multi-level setting," *Research Policy* 37(5): 823-835.
- Lee, M. H. (2013) "Direction and tasks in converting national innovation system to realize creative economy", *STEPI ISSUES & POLICY* 72.
- Lundvall, B. Å. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning* (London: Pinter).
- Ministry of Public Administration and Security (2014) *Three Year Economy Innovation Plan*, Report of Ministry of Public Administration and Security (December).
- Organisation for Economic Co-operation and Development (OECD) (1997) *National Innovation Systems*, OECD Publishing.
- Adner, R. (2012) *A new Strategy for Innovation*, Gildan Media Corporation.
- Cho, Y. A., Kim, Y. K., Nam, J. G., and Oh, J. B. (2005) *A strategy of enhancing efficiency in R&D investment to reinforce innovation capacity*, Korea Research Institute of Industry.
- Etzkowitz, H., and Leydesdorff, L. (1995) "The triple helix---university-industry-government relations: a laboratory for knowledge-based economic development," *Easst Review* 14(1): 14-19.
- Etzkowitz, H., and Leydesdorff, L. (2000) "The dynamics of innovation: from national systems and 'mode 2' to a triple helix of university-industry-government relations," *Research Policy* 29(2): 109-123.
- Fagerberg, J., and Srholec, M. (2008) "National innovation systems, capabilities and economic development," *Research Policy* 37(9): 1417-1435.
- Giacchino, S., and Kakkabadse, A. (2003) "Successful policy implementation: The route to building self-confident

GENERAL REFERENCES

- government," *International Review of Administrative Science* 69(2): 139-160.
- Iansiti, M., and Levien, R. (2004) *The Keystone Advantage: What the new Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*, Harvard Business School press.
- Kim, I. J., Kim, Y. S., and Kim, S. B. (2001) *Model in regional innovation system in the era of knowledge driven economy*, Korea Research Institute of Industry.
- Korea Institute for Industrial Economics & Trade (2001) *Innovation capacity and industrial development*.
- Lee, C. W. (2003) Environment of new industry and regional innovation, *Regional development and regional innovation*, Young Nam University Press.
- Lee, D. H., Jeong, J.Y., and Han, K.J. (2011) *A policy research for the reestablishment of designating conditions of R&D special zone*, INNOPOLIS Foundation.
- Lee, D. H., and Ju, H. S. (2013) *A strategy of fostering science and technology innovation ecosystem in Daejeon*, Korea Bank Daejeon Chungnam Headquarter.
- Lee, M. H. (2010) *Establishment of Synthesized Management System and Driving Strategy for Mega Science*, STEPI.
- Park, Y. S. (2008) "A comparative study on the mechanism of cooperation between public and private sectors in national science and technology innovation," *Journal of Korea technology innovation Society* 11(2): 194-218.
- Perkmann, M., and Walsh, K. (2007) "University-industry relationships and open innovation: towards a research agenda," *International Journal of Management Reviews* 9(4): 259-280.
- Stoper, M., and Harrison, B. (1991) "Flexibility, hierarchy and regional development: The changing structure of industrial production systems and their forms for governance in the 1990s," *Research Policy* 20(5): 407~422.

Received May 07, 2015

Accept May 15, 2015