Master's Thesis of Public Administration

Local Innovation Activities and Regional Economic Growth

- Focus on the R&D Subsidy of Korean Government –

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1. Introduction

1.1. Backgrounds and Purpose

The export-oriented policy of Korea was one of the main reasons behind the country's economic development (OECD, 2012). Starting in 1962, the government established 'the National Economy Development Plan', renewing it every five years, and implemented it rigorously. The plan necessarily adopted a biased strategy to select and concentrate on the capital region and the southeastern costal area of the Korean peninsula. Intensive industrial complexes supported the growth of the economy during the ensuing compressed-growth period. Unintended consequences of such a policy in return appeared as asymmetric development among regions. Concentrated public investments, manufacturing infrastructure and educational institutes widened the gap between the selected regions and the others. Regional disparities were related to limited access to qualified education and a lack of opportunities for entrepreneurial achievement in non-capital regions, which was mainly brought about by the government strategy.

Korea has recently applied measures to counterbalance the over-concentrated economic opportunities in the capital region, especially after the Asian financial crisis in 1997. The government established a balanced development policy among regions in 1997, enacted a Special Act in 2002, and created a special budget account in 2003. Social overhead infrastructure

projects such as roads, railroads, bridges, ports and airports were constructed for the same purpose in less developed areas of Korea. The penetration rate of public utilities has increased dramatically throughout the country during last decades. Recently, the government has relocated government ministries to the newly established Sejong city in the Chungcheong area, starting in 2012. Hundreds of public organizations also moved to what are termed the ten 'Innovation Cities', to provide a foothold of growth for non-capital regions. A considerable amount of the national budget has been earmarked for the purpose of management support and local research.

Starting in the 1990s, the Korean government changed the paradigm of its regional development policy from compensation logic to a competitiveness approach (OECD, 2012). Korea has tried to strengthen the competitiveness of non-capital regions by providing a subsidy of more than 10 billion USD to local manufacture industries, particularly over the last decade. The rationale of the new approach was to develop the local economy in terms of both scale and competitiveness. In particular, it was established to support local research and development activities so that local economies would gain in economic competitiveness. Subsidies to local industries mostly consist of R&D funds targeting local firms, universities and research institutes.

In the early stages, the regional R&D policy of the central government focused on external growth, with two main pillars. The first provided support to

make R&D possible in non-capital regions through various programs, including subsidies for R&D infrastructure, employment, prototype making, and technology consulting. As a result, the scale of local industries grew and the R&D basis increased. The second strategy was to discover new industries and to make them growth engines of their respective local economies. Local governments attempted to attract investments nationwide or to persuade firms in other area to move to a province. The efforts of stakeholders with R&D subsidies promoted new types of industries. New industries have sprung up gradually, creating revenue and offering decent jobs in some regions. Optical industry of Gwangju, bio of Gangwon and carbon of Jeonbuk are the good examples.

However, in terms of regional innovation and R&D, there has not been significant progress in non-capital regions in spite of the regional development policy for a balanced economy. Initially, economic development accompanied with productivity increases and decent jobs were expected. However, the level of competitiveness of non-capital regions still lags far behind that of the capital region. More job seekers flock to the Seoul metropolitan area and local industries face challenges given the lack of labor. The proportion of jobs in non-capital regions dropped from 54% in 1999 to 49.7% in 2011; 32% of college graduates in non-capital regions were employed in the capital region, while 91.5% in the capital region remained in the area. Only the percentage of patents granted in non-capital regions increased significantly. The ratio of R&D

expenditure remained unchanged, while the proportion of researchers dropped by 3%p in spite of the government subsidies (KoSIS, 2014). The Korean government is proud of the increases in external indexes such as revenue, production and others, but the government also admits that the expected results have not been fully met. It was dubious as to whether local economies became competitive with nationwide firms or globally small but strong businesses, such as the hidden champions of Germany.

Recent policy efforts have been moving toward the development of internal capacity measures such as productivity and innovation activities. The Korean government recognized that strategies bound to physical growth cannot easily drive regional economic growth. Local firms expressed their demand for government support in more practical areas such as marketing, technology support and consulting and intellectual property. Recent regional policies aim to enforce collaborations among regional entities such as firms, universities and local experts. Ministries also believe that the innovation capacity will increase through such cooperative activities, which in turn contributes to R&D performance overall and economies at the local level. In this context, this thesis seeks to analyze to what extent government support for local innovation activities has led to local economic development. In particular, the thesis will pay special attention to major innovation activities at the firm level in order to determine which activities effectively contributed to economic growth.

1.2. Scope of the Research

The aim of this thesis is to examine changes in R&D performance in terms of innovation activities in non-capital regions of Korea through government guidance and subsidies. This research deals with three budget programs of the Ministry of Trade, Industry and Energy. The three programs of MOTIE can represent a regional industry promotion program of the central government, because they consist of 80% of industry promotion funds in a special account for balanced development.

The first program set a policy goal of promoting regional competitiveness by developing prospective products. Each economic region consists of two or three provinces. The second program pursued not only competitiveness but also balanced development. This program has implemented various sub-programs, such as those that prepare infrastructure, conduct R&D, and offer one-stop support of technical difficulties and marketing services. The last program has been carried forward on a smaller scale, involving cities, counties and districts.

The scope of the research in terms of regions and time periods is such that it covers the period from 2009 to 2013. Leading Industries Promotion Program started in 2009 and the second period of Strategic Industries Promotion Program started in 2010. Moreover, infrastructure and hardware oriented compensation was retreated in the area of balanced development policy, and competitiveness reinforcement policy was in earnest introduced with these two

programs. Government and National Assembly revised Industrial Technology Innovation Promotion Act in 2009 and the Korea Institute of the Advancement of Technology (KIAT) was established according to the Provision 38. Systematic management on the implementation of regional industry policy has been possible with this organization.

<Table 1.1> Three Regional Industry Promotion Programs[1]

	Leading Industries of Economic Region Promotion	Strategic Industries of Province Promotion	Regional Specific Industries Promotion
Policy Goal	competitiveness	Competitiveness and balanced development	Localization
Program Strategy	Developing prospective products of global competitiveness	Building infra, R&D, Technical Assistance, Marketing Support	Discovering and Developing specialized resource
Spatial Scope	5+2 Economic Regions	Provinces	Cities, Countries and Districts
Industry	Two Industries per Region	Four Industries per Province: Total 52 Industries	One Industry per Region
Project Selection Criteria	Competition in Each Region	Competition in Each Region	Competition in Each Region
Funding	National Budget and Business Capital	National Budget, Regional Budget and Business Capital	National Budget, Regional Budget and Business Capital

In terms of regions, this paper covers 17 metropolitan cities and provinces in Korea: Seoul, Incheon, Daejeon, Kwangju, Daegu, Busan, Ulsan, Gyeonggi,

[1] Ministry of Trade, Industry and Energy (2014). Master Plan for the Regional Industry Development. Ministry of Trade, Industry and Energy.

Chungbuk, Chungnam, Jeonbuk, Jeonnam, Gyeongbuk, Gyeongnam, Gangwon, Jeju and Sejong. Considering the characteristics of regional industry promotion policy, this paper would concentrated on the 13 regions except for Seoul, Incheon, Gyeonggi and Sejong. Former three provinces consist capita region and Sejong set sail only in 2012. Government policy and subsidies has mainly targeted these 13 regions from 2009 and 2013.

The research uses official statistics from National Statistics Office to brief the regional industry. More specific data would be obtained from inside government database from Presidential Committee on Balanced Development and MOTIE. MOTIE and local government have regularly conducted survey called “Firm Characteristic Investigation” to local firms from 2013. Most of surveyed companies have participated in regional industry promotion programs. Approximately 12,000 firms from non-capital provinces participate in this survey every year.

The “firm characteristic investigation” surveys not only asses the status of each firm, such as the industry classification, financial status, employment status, and R&D status of each, but also the level of policy demand, such as specific needs for support in terms of R&D, human resources, networking and financing. Through this information from policy customers, central and local governments gain insight and establish regional industry promotion policies. Details of this investigation is as Table 1.2.

<Table 1.2> Contents of Firm Characteristic Investigation[2]

Policy Area	Specific Programs
Industry classification	Company name, Founded Year Location (headquarter, laboratory, production line) Firm's Korean Standard Industrial Classification and etc.
General and Financial Status	Sales for last 4 years Sales from new products, Sales from export, Customer distribution(B2B/ B2C, domestic/global) Employment Status for last 4 years
R&D status	Number of employment, Degree status of human resource (Doctor, Master, Bachelor and etc.) Career of human resource, Form of R&D organization (separate laboratory or division, task force team) Amount and source of R&D investment (Internal, Public/Private funding) Type of expenditure (personnel, equipment and material, technology transfer and etc.), R&D performance
Policy demand	Technological support (prototype production, tech. consulting, certification, patent application, tech. exchange) Commercialization (Design, Marketing, Exhibition, Networking, Establishment, Product Planning) Human Resource Training (Equipment training, CEO education, license, production training, employment promotion subsidy)

[2] Ministry of Trade, Industry and Energy (2014). The Result of Firm Characteristic Investigation. Ministry of Trade, Industry and Energy.

2. Theories and Literature Review

2.1. Innovation Activities

<Table 2.1> Definition of Four Types of Innovation[3]

Type	Definition
product innovation	A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.
process innovation	A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
marketing innovation	A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
organizational innovation	A new organizational method in business practices, workplace organization or external relations.

Innovation activities of firms refer to any actions to develop, produce and sell enhanced products/services. Innovations also consist of any cultural or institutional improvement of activities. Moreover, any methodology to promote innovation activities and to enhance the foundation is another form of innovation. This paper covers innovation of industry or technology sector and

[3] Organization for Economic Cooperation and Development [OECD] & EUROSTAT (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Pairs: *OECD Publishing.*

this scope comes within the definition of OECD's Oslo Manual (OECD, 2005), which deals with the mechanisms to measure the technological innovation activities, classify the innovation into four types and define them: product innovation, process innovation, marketing innovation and organizational innovation.

One important characteristic of innovation is openness. Chesbrough (2003), who promoted a term "Open Innovation", consider it as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology though the idea and discussion about some consequences (especially the inter-firm cooperation in R&D)." In a world of distributed knowledge, a firm's innovation cannot rely entirely on their own research, but should instead share and utilize pre-developed intellectual properties through open competition, knowledge diffusion, collaborative processes or networks. Through open innovation, a company can increase its value compared to non-innovation companies or those focusing on internal-only innovation.

Not only individual firms but also governments, universities and certain research institutes must promote innovative R&D activities. Public and non-profit organizations also believe that they can move forward with R&D processes incorporating innovation activities. Government subsidies and guidelines can increase the accessibility of small and medium-sized enterprises to technology while also enhancing their efficiency with reduced risk. The

financial support from the public side can affect innovations at firms by stimulating internal R&D in both a direct and indirect manner. Public subsidies can help small local firms to share the risk of R&D failure with the government and to reduce the cost of developing new technologies. In this manner, the R&D policy of the Korean government has achieved success in promoting private R&D investment (Lee, 2010). R&D subsidies in US mostly consists of R&D tax credit and credit from federal and state government has promoted investment of private sector and helped innovation-based economic development (DeVol, Harris and Ratnatunga, 2015).

There are various innovation activities throughout the R&D process, and it is difficult to find a prototype of such activities. The number of intellectual properties and the quality of R&D manpower, such as the portion of master's and doctoral degrees among researchers, were used in Shin (2011). Kim (2012) explains the education level of R&D staff would be variables which represents innovation ability of human resources and the amount of R&D investment is good for assessing R&D input.

Developed countries including OECD (2005) had established indicators to assess innovative activities and most popular indicators are as follows: the number of cooperative R&D project with local universities and research institutes, the portion of new products within total revenue, the number of produced or purchased intellectual properties and the diversification of

subcontractors and clients. Lauren and Salter (2006) defined 'Firm's Innovative Performance (FIP)' as the portion of new products within total revenue and argued that innovative actions or capacity is positively related to the performance of enterprise.

2.2. Local Innovation

Local innovation is cooperative activities with regard to learning, R&D and networking for regional development especially among local entities. Principal agent of local innovation program could be any entity related to industry, education or research and outside organization could help local innovation led by local entities. For example, local university and enterprise cooperate while developing curriculum, educating and employing students. Manpower training, technology, production and financial assistance could be core elements of local innovation system and these elements are connected with each other through organic solidarity (Ministry of Strategy and Finance, 2010).

There are three major trends reshaping innovation and creating a role for local organizations. First, globalization demands local entities to be endowed with competitiveness based on innovation. Moreover, societal and environmental changes have stimulated regions to develop new types of supply and demand. Finally, the roles of regions as arbitrators or moderators have

grown with the importance of network innovations (OECD, 2011).

The concept of an "innovation system" has been gradually diffused from the national to the local level, and there are several rationales associated with this. Tödtling wrote of the "…observed variety in regional economic specialization patterns and innovation performance; the spatially bounded character of knowledge spillovers; the importance of tacit knowledge, which cannot be transferred easily across space because it relies on trust-based relationships favored by geographical proximity; and the fact that some institutional competences and policy resources relevant for innovation are devolved to sub-national authorities" (Tödtling and Trippl, 2011).

Local collaborative partnerships can create advantage in terms of innovation. When the scope of policy is limited to a specific region, networking among local entities plays an important role in helping to achieve the policy goal (Cooke and Leydesdorff, 2006). When we study regional development, the location and concentration of local talent, such as human capital and creativeness, should be examined with technology or the effects of technology (Florida, Mellander and Stolarick, 2008). Studies of local development based on collaboration are supported by the 'localized knowledge spillover' (LKS) theory. Scholars have researched local development based on collaboration, depicting LKS as a prototypical externality. LKS relates to local innovation, in which one or a few local entities investing in R&D will facilitate other agents' innovative

efforts either intentionally or unintentionally (Breschi and Lissoni, 2001).

National and local governments provide evidence of the spillover effect and the positive externality that they invest in research and development programs at the regional level. Leahy and Neary (1999) argued that the spillover effect over R&D is reciprocal among collaborative partners. In the case of the Korean regional development policy, the national government provides as a subsidy more than one billion US dollars every year, and local governments allocate one third of their budgets to these program. The California state government is one example of a local government which understands the effectiveness of R&D tax credit programs.

According to Kirkham of Los Angeles Times (2014), the state government subsidized 150 million US dollar to the tax credit program in 2014 and 200 million in 2015, and twenty five percent of budget was allocated to the SMBs where positive externalities are highly expected.

In a regional innovation system, firms and other organizations are systematically engaged in interactive learning within an institutional environment characterized by embeddedness, that is, interactions and networks rooted in a specific local economic, institutional, social and cultural contexts. According to Tödtling and Trippl (2011), the regional innovation system could be recognized as a combination of two subsystems: the knowledge application and exploitation sub-system centered on firms, and the knowledge generation

and diffusion sub-system centered on public research, education and technology diffusion organizations. Tödtling and Trippl also insists that policy acts on the endowments and relationships within and between these sub-systems.

Other views of regional innovation systems refer to the "regional innovation ecosystem," where the roles of users and markets with regard to innovation is prominent and where the distinction between the two subsystems is blurred as innovation is "co-created" by actors in all parts of the system. Therefore, "the region is increasingly seen as the level at which innovation occurs most effectively through networks of innovators, local clusters and the cross-fertilizing effects of research institutions. These theoretical and empirical concepts have shifted the policy focus towards local and regional policy interventions in favor of innovation" (World Bank & OECD, 2013)

2.3. R&D Performance

The regional industry promotion programs of the Korean government have dealt with applied R&D to contribute to the production and sale of products. Scholars utilize the competitiveness of brand-new products and the level of intellectual property to measure R&D performance. This research recognizes R&D performance via an extended meaning that includes the overall business performance of local firms, as successfully concluded R&D projects

would not be meaningful if the results cannot easily be applied to the production and sales processes.

Earlier studies have attempted to verify a causal effect of innovation activities on R&D performance, and most of them agree upon such causality. Recently, the innovation activities of local firms have been assumed as meaningful R&D performance at the field level given that good R&D projects are usually accompanied with innovations, and this relationship is obviously recognized by firms and governments.

Collaboration and subsidies improve R&D performance. Collaborations usually take place inside an organization, but cooperation across organizations is also important. Internal communication is positively related to R&D performance. The best source of information for an R&D engineer is a colleague within the organization (Allen, Lee, Denis and Tushman, 1980). Collaboration tends to increase innovative performance of participating firms and R&D subsidy induces incentive for small firms to invest in Europe (Czarnitzki, Ebersberger and Fier, 2007).

Financial subsidies from government help local business to increase its competitiveness. Negative correlation between government subsidies and financial/technical risk of privates is noticeable in Israel (Lach, 2002). R&D subsidies from central and local government have played as seed money for regional small and medium sized businesses to invest further. DeVol (2015) also

insists that public sector should increase R&D tax credit to promote local economy and explains that the state of California can achieve 60,000~84,000 jobs in ten years when it doubles its tax credit volume. Moreover, DeVol expects additional positive externalities: increase of private R&D investment from 4.5 billion US dollars to 6.8 billion and increase of state production from 7.7 billion to 10.5 billion.

Competent small and medium-sized businesses are equipped with innovative activities, which have in turn contributed to their R&D performance and corporate earnings. SMEs in Korea achieve more revenue and profit when they have an enhanced R&D organization, an established infrastructure to accumulate and exploit technology, and when they promote their production capabilities to be compatible to newly developed technologies (Lee & Chung, 2008). Shin (2011) argues that subsidized industry in Daegu shows greater innovation ability than non-subsidized does and the quality of R&D manpower affects firms' performance. However, it is unclear that local innovative activities in every non-capital region of Korea leads to excellent R&D performance.

This research will gauge the comprehensive effectiveness of regional industry promotion policy by central government. If this research can find that the innovation of local SMEs affects R&D performance, government can extend competitiveness oriented policy less depending on the factor investment.

2.4. Evaluation on the government R&D program

The goal of regional R&D innovation can be achieved when the policy aims to create a regional industrial ecosystem by boosting cooperation and association between leading industries and SMEs in the region. Collaboration can be a shortcut to obtain R&D capabilities, since capabilities are embedded in the organization level (Kogut, 1988). Collaborative performance seems to be maximized when the diversity of allied firms are guaranteed (Sampson, 2007). It is very significant to measure the level of collaboration to evaluate the R&D performance of that region. Governmental R&D funding and networking with universities and research institutions as well as downstream partners are essential for the growth of companies in local area (Kang, 2011).

It is mandatory for Korean national and local government to evaluate the on-going and finished regional polishes in term of both process and outcome. Various evaluation researches have been fulfilled by public institutes and academia. Korea Institute for Industrial Economics and Trade (KIIET, 2007) evaluated the outcome of the strategic industries promotion program, which was started by Ministry of Industry in 1990s. The research of KIIET (2007) argued that subsidized local firms have grown up more rapidly compared to non-subsidized firms in terms of revenue and employment, but statistical significance was not verified.

National Assembly (2009) also assessed the plan, implementation and

outcome of the strategic industries promotion program: the execution process of policy was reasonable; particular programs experienced frequent change; the governance between regional entities had overlapping roles; budget were concentrated on forging hardware facilities; and performance management was insufficient in terms of data collection.

Korea Development Institute (2012) fulfilled assessment in terms of propriety, effectiveness and implementation process. To measure the policy effect KDI tried several approaches: compare revenue and employment between subsidized and non-subsidized firms using propensity score matching (PSM). KDI could not find significant difference between two groups. KDI applied uniform standards to many government policies though they were not designed with identical policy goals and reviewed a policy where they cannot assess the outcome due to the short history of policy.

3. Research Methods

3.1. Analysis Method

From the 1990s, five to ten industries in each metropolitan council have received government support, but subsidies in a few industries were only temporary. The research does not review all of the industries which have received policy support, focusing instead on typical industries of each region. This study sets a high value on the persistency of a policy and chooses three industries for each region, all of which received steady policy support and funding from national and local governments. Most of the regions have tried to enlarge the number of representative industries for political reasons, but funding has focused on a few industries with a long-term view.

This research reviewed how innovation activities affect the performance of local companies which received some form of policy support from 2009 or earlier. If a firm began to receive government subsidies after 2009, this study excludes that firm from the analysis because we cannot assess how much government subsidies have affected the business performance of such firms during the short time frame used here.

The National Statistical Office provides business statistics when the number of employees is ten or more. Therefore, this research could not gather data from those firms with small number of employers, which a regional development policy has supported regardless of the number of employers.

3.2. Variables

This research defines four independent variables: the number of patents, the ratio of new products, the quality of R&D human resources and R&D investment as a percentage of total revenue. The number of patents is measured by summing patents applied for or registered during the period of 2010-2013. The study also measures the ratio of new products sales to total sales in 2013. The quality of R&D manpower is enumerated as the percentage of master's or doctoral degree holders among the employees of the firm's R&D division. This study computes the R&D investment variable as the ratio of R&D investment to total sales from 2010 to 2013.

One independent variable is used in this study to measure the performance of each firm: the average sales growth rate from 2010 to 2013. When dataset is not surveyed from 2010 in some regions, the study used averaged values from 2011 to 2013.

Two control variables are selected in this study: firm history and firm size. Firm history refers to when the firm was founded and how long it has been sustained. The year 2014 is the standard year. Firm size is measured using the number of employees hired by the firm in 2013.

<Table 3.1> Variable Descriptions

Variables	*Description*
Dependent Variables	
Sales Growth Rate	
Independent Variables	
Number of Patent	Number of Patent registered and applied (from 2010 to 2013)
New Product	Percentage of new products in total sales (in 2013)
R&D Manpower	Percentage of Master and Doctor degree
R&D Investment	Percentage of R&D investment in total Sales (from 2010 to 2013)
Control Variables	
Firm History	Gap between 2014 and foundation point
Firm Size	Number of Employees

3.3. Hypotheses

Hypothesis 1:

Local firms subsidized by regional industry promotion policies have shown significantly faster growth than non-subsidized firms in terms of the three representative industries of each region. Using a one-sample T test with a 95% confidence interval, this research compares the compound annual growth rate of subsidized firms to the rate of non-subsidized firms in each representative industry.

Hypothesis 2:

Four independent variables, i.e., the number of patents, the ratio of new products, the quality of R&D human resources and the R&D investment out of the total revenue, have positive causal effects on the growth of firms.

Precedent researches also insist that innovative activities of SMEs can promote both R&D performance and overall outcomes. This study set a similar hypothesis in the non-capital region of Korea: The innovative activities of local firms in non-capital regions cause increased R&D performance. Focusing on the local firms participating government operating annual survey, this research would verify the causal relation from innovation to R&D performance: the growth of total revenue, the portion of new products within total revenue and the number of produced or purchased intellectual properties.

<Fig. 3.1> Hypothesis

This study regress the independent variables on the dependent variable to prove the relation between the innovation activities and the performance. Before regression analysis, the research applied correlation analysis and set regression equation.

3.4. Representative Industries

The study could not analyze the growth rates of common industries in terms of all the provinces, because it was controversial to choose common industries valid for 13 provinces. For this reason, the research set a few independent representative industries for each province and analyzed if those industries have any significance in each region. In Korea, main industries usually have significant relation with specific provinces and there are a few reasons for this close relation.

First of all, Korean government, while promoting export-orient policy from nineteen-sixties to nineteen-eighties, allowed only a few large companies and their vendors to enter into the market for any key industry and authorized the right of export and import to those groups of companies. Main industries have developed where those companies settled down. For example, Hyundai in Ulsan and Kia in Gwangju have led automobile industries, and Hyundai in Ulsan and Daewoo in Gyeongnam have shared dominant position in shipbuilding industries of Korea.

Moreover, correlation between provinces and specific industries have manifested while metropolitan council have promoted representative industries to find out regional growth engine. Leaders of metropolitan councils attracted enterprises which could enjoy economy of concentration with existing industries, manpower and natural resources. Display industry of Chungnam and light-electronics industry have developed rapidly with the help of local government and settle as the representative industries of the region. Jeju and Jeonnam have fostered food processing industry, the material of which can be easily found in the nature of region.

The number of representative industries would be three. The number of meaningful industries in a province is finite, usually less than ten. Korean government and local governments have continuously supported three to five industries since 1990s. This research set three representative industries of each province considering the history of industry and industrial policy.

4. Analysis

4.1. Busan Metropolitan City

The classic shipbuilding industry has declined and technology-intensive and value-added offshore plant industries have become more common. Investments in offshore plant industries are very active on both the private and public sides. Machine parts and metal processing industries, closely related to shipbuilding and offshore plants, consist of competitive local companies. The digital contents industry has accelerated its growth, with momentum from, for instance, the Pusan International Film Festival (PIFF) and content exhibitions. The city makes a great effort to realize this industry as a growth engine of Busan. During the period of 2010-2013, the machine and machine parts industry grew by 0.37% on average. Additionally, the digital contents industry grew by 26.47% and the metal processing industry grew by 0.37% (KOSIS).

This study analyzed 247 companies in machine parts, digital contents and metal processing industries in Busan. Ninety-nine firms in the machine parts industry achieved sales growth of 4.46% on average. In addition, 44 digital contents firms saw growth of 20.21%, and metal processing realized a 6.20% growth rate. In the machine parts and metal processing industries, subsidized firms grew faster than average in the same industry, with this finding showing a 95% confidence level.

<Table 4.1 > Growth rate of Busan

	Machine Parts	Digital Contents	Metal Processing
Mean	4.46%	20.21%	6.20%
95% CI	1.46-7.47%	7.54-32.88%	2.81-9.58%
Growth[4]	O	▲	O

<Table 4.2 > Correlation among variables in terms of Busan

		1	2	3	4	5	6	7
1	Sales Growth Rate	1.000	.020	-.040	-.062	.436	-.100	.019
2	Patents	.020	1.000	-.032	.122	.128	.174	.156
3	New Product	-.040	-.032	1.000	.105	.008	.053	.088
4	R&D Manpower	-.062	.122	.105	1.000	.142	.152	.145
5	R&D Investment	.436	.128	.008	.142	1.000	-.199	-.088
6	Firm History	-.100	.174	.053	.152	-.199	1.000	.328
7	Firm Size	.019	.156	.088	.145	-.088	.328	1.000

Before regression analysis, correlation analysis is taken among variables. Correlation among variables is in <Table 4.2.>. The research verifies multicollinearity during the regression analysis using the variation inflation factor (VIF). If VIFs are less than 2, independence be insured between variable.

According to the R^2 and F value, the research achieved meaningful regression analysis result in digital contents industry. R&D investment ratio effects positively to firm's performance with 95% confidence level.

[4] If higher than the growth rate of similar industry, "O". If smaller, "X". If cannot verify the significance, "▲"

<Table 4.3 > Regression analysis in terms of Busan

		Entire Samples	Machine Parts	Digital Contents	Metal Processing
Constant	t	.971	.461	-.568	1.590
	p-value	.333	.646	.574	.115
Patents	T	-.640	.304	-.769	.319
	p-value	.523	.762	.447	.751
New Product	t	-.688	.393	-.300	.591
	p-value	.505	.696	.766	.556
R&D Manpower	t	-2.203	-.031	.028	-.701
	p-value	.029	.976	.978	.485
R&D Investment	t	7.749	.088	***5.041***	1.584
	p-value	.000	.930	***.000***	.116
Firm History	t	-.139	.894	.812	-1.541
	p-value	.889	.373	.422	.126
Firm Size	t	1.485	-.793	.308	2.488
	p-value	.139	.430	.760	.015
R^2		.215	.013	.431	.099
F		10.939	.198	4.669	1.774
N		247	99	44	104

4.2. Daegu Metropolitan City

Companies in the IT and automobile parts sectors have contributed significantly to the recovery of local economies. The textile industry has also sought to promote productivity by developing special-purpose textiles and conflating production processes with those linked to IT. During the period of 2010~2012, IT industry has grown by 0.19% on average (DDIPA, 2013). During the period of 2010~2013, textile and automobile parts industries have grown by 4.71% and 8.92% on average (KOSIS).

This study analyzed three hundred and seventy-nine companies in information technology, textile and automobile parts industries in Daegu. Sixty-eight firms in IT industry achieved 3.03% sales growth on average, two hundred and three firms in digital contents 1.48% growth and automobile parts 4.14% growth. In textile and automobile parts industries, subsidized firms grew up slower.

<Table 4.4 > Growth rate of Daegu

	IT	Textile	Automobile Parts
Mean	3.03%	1.48%	4.14%
95% CI	-2.33-8.39%	-0.65-3.62%	1.53-6.74%
Growth	▲	X	X

Before regression analysis, correlation analysis was conducted among dependent, independent and control variables as in Table 4.5. R&D Manpower and R&D Investment has positive correlation. However, VIFs less than 2 were acquired during the regression analysis, which suggests the study secured independence between variable.

<Table 4.5 > Correlation among variables in terms of Daegu

		1	2	3	4	5	6
1	Sales Growth Rate	1.000	.094	.000	.106	-.115	.085
2	New Product	.094	1.000	-.035	-.037	.130	.323
3	R&D Manpower	.000	-.035	1.000	.325	.105	-.063
4	R&D Investment	.106	-.037	.325	1.000	-.131	-.126
5	Firm History	-.115	.130	.105	-.131	1.000	.297
6	Firm Size	.085	.323	-.063	-.126	.297	1.000

According to the R^2 and F value in Table 4.6, the research could not find meaningful regression analysis result in any industry.

<Table 4.6 > Regression analysis in terms of Daegu

		Entire Samples	IT	Textile	Automobile Parts
Constant	t	2.373	1.688	1.692	1.114
	p-value	.018	.096	.092	.268
New Product	t	1.480	1.249	1.278	.511
	p-value	.140	.216	.203	.610
R&D Manpower	t	-.182	.487	-.227	-.985
	p-value	.856	.628	.821	.327
R&D Investment	t	1.976	1.272	1.291	.947
	p-value	.049	.208	.198	.346
Firm History	t	-2.669	-2.377	-1.968	-.607
	p-value	.008	.021	.050	.545
Firm Size	t	2.055	-.129	.882	1.711
	p-value	.041	.897	.379	.090
R^2		.045	.138	.036	.059
F		3.531	1.978	1.478	1.286
N		379	68	203	108

4.3. Gwangju Metropolitan City

From the late 1990s, the light and electronics industry has been designated as a strategic industry and has received a subsidy from the central government. A considerable numbers of firms in the industry have moved from the capital region to Gwangju for the sake of an agglomeration economy and to gain large subsidies. The light and electronics industry has become a symbolic industry, and has grown swiftly thus far. Another notable success is in

automobile parts. Because Kia Motors built a factory in the region, a large number of cooperative partner firms have grown and the industry has become a core of the regional economy. Design industry is as a strategic industry designated by city government and plays a significant role for the vision “the Hub city of Asian culture”. During the period of 2010-2013, electronics, computer, communication and audio/video equipment industries grew up by -3.25%, optics/precisions by 4.91% and automobile parts by -0.65% (KOSIS).

The research analyzed a hundred and twenty-seven companies in light and electronics, eco-car parts and design industries in Daegu. Twenty-six firms in light and electronics industry achieved 11.44% sales growth on average, ninety-two firms in eco-car parts 8.26% growth and design 15.19% growth. In eco-car parts industries, subsidized firms grew up faster than the average of the similar industry with 95% confidence level.

<Table 4.7 > Growth rate of Gwangju

	Light and Electronics	Eco-Car Parts	Design
Mean	11.44%	8.26	15.19%
95% CI	-1.72-24.60%	3.68-14.14%	-8.55-38.93%
Growth	▲	O	▲

Before regression analysis, correlation analysis is conducted among dependent, independent and control variables as in Table 4.8. There was positive correlation between ‘New Product’ and ‘R&D Manpower’, and ‘R&D Manpower’ and ‘R&D Investment’. VIFs less than 2 were also acquired during the regression analysis, which concludes we secured independence between variable.

<Table 4.8 > Correlation among variables in terms of Gwangju

		1	2	3	4	5	6
1	Sales Growth Rate	1	0.097	0.055	0.214	-0.192	-0.048
2	New Product	0.097	1	0.14	0.088	-0.127	0.136
3	R&D Manpower	0.055	0.14	1	0.102	0.006	0.105
4	R&D Investment	0.214	0.088	0.102	1	-0.121	-0.031
5	Firm History	-0.192	-0.127	0.006	-0.121	1	0.299
6	Firm Size	-0.048	0.136	0.105	-0.031	0.299	1

The research achieved meaningful analysis result in eco-car parts and design industry. R&D investment ratio effects positively to firm's performance in eco-car parts industry and new product ratios in design industry with 95% confidence level.

<Table 4.9 > Regression analysis in terms of Gwangju

		Entire Samples	Light and Electronics	Eco-Car Parts	Design
Constant	t	2.846	1.507	1.392	2.019
	p-value	.005	.147	.168	.137
New Product	t	.626	-.507	-1.246	***2.038***
	p-value	.533	.618	.216	.134
R&D Manpower	t	.327	.512	-.865	-1.348
	p-value	.745	.614	.390	.270
R&D Investment	t	***2.110***	-.304	***5.632***	-.646
	p-value	0.037	.765	.000	.564
Firm History	t	-1.723	-1.036	-.728	-1.956
	p-value	.087	.313	.468	.145
Firm Size	t	-.048	.591	-.456	.678
	p-value	.962	.561	.650	.546
R^2		0.078	.086	.306	.953
F		2.055	.377	7.594	12.043
N		127	26	92	9

4.4. Daejeon Metropolitan City

Daejeon has competent engineering schools, public and private laboratories, and central government agencies. For example, KAIST and ETRI are world-renowned for being capable of introducing new examples of high technology. The R&D infrastructure and qualified brains lead the electronics, chemicals, ICT and other high-technology-based industries in the region. Government support has focused on these areas for the sake of efficiency. During the period of 2010-2013 period, electronics, computer, communication equipment and audio/video equipment industries grew up by 6.13% and chemical materials by 10.72% and optics/precisions industries by 7.80% (KOSIS).

The research analyzed one hundred and eighty-five companies in light electronics, chemical material and mobile Communication industries in Daejeon. During the 2010-2013 period, fifty-three firms in light electronics industry achieved 14.33% growth on average, forty firms in chemical industry 15.13% and ninety-two firms in mobile communication 12.50%. In light electronics and mobile communication industries, subsidized firms have grown up faster than the average of the similar industry with 95% confidence level.

<Table 4.10 > Growth rate of Daejeon

	Light Electronic	Chemical Material	Mobile Comm.
Mean	14.33%	15.13%	12.5%
95% CI	6.29-22.39%	7.49-22.77%	7.14-17.86%*
Growth	O	▲	O

* 90% Confidence Interval

Correlation analysis is taken among dependent, independent and control variables as in Table 4.11. There was positive correlation between 'R&D Manpower' and 'R&D Investment' variables. VIFs less than 2 were also acquired during the regression analysis, which concludes we secured independence between variable.

<Table 4.11 > Correlation among variables in terms of Daejeon

		1	2	3	4	5	6	7
1	Sales Growth Rate	1.000	-.030	.221	.006	.234	-.076	-.014
2	Patents	-.030	1.000	.003	-.167	-.055	.115	.083
3	New Product	.221	.003	1.000	.066	.005	.008	-.046
4	R&D Manpower	.006	-.167	.066	1.000	.104	-.027	.114
5	R&D Investment	.234	-.055	.005	.104	1.000	-.073	-.132
6	Firm History	-.076	.115	.008	-.027	-.073	1.000	.315
7	Firm Size	-.014	.083	-.046	.114	-.132	.315	1.000

According to the R^2 and F value in Table 4.12, the research achieved meaningful result in light electronics and mobile communication industries. In terms of light electronics, new products ratio effects positively to the performance with 95% confidence level. In mobile communication industry, new products ratio and R&D investment rate influenced significantly on firm's revenue increase with 95% confidence level.

<Table 4.12 > Regression analysis in terms of Daejeon

		Entire Samples	Light Electronic	Chemical Material	Mobile Comm.
Constant	t	1.622	1.298	.397	.582
	p-value	.106	.201	.694	.562
Patents	T	-.297	.479	-.016	-.373
	p-value	.767	.634	.987	.710
New Product	t	***3.189***	***2.651***	.025	***2.229***
	p-value	.002	.011	.980	.028
R&D Manpower	t	-.634	1.188	.682	-2.046
	p-value	.527	.241	.500	.044
R&D Investment	t	***3.316***	.221	1.728	***2.639***
	p-value	.001	.826	.093	.010
Firm History	t	-1.045	-1.893	-.101	.027
	p-value	.297	.065	.920	.979
Firm Size	t	.780	1.477	-.432	.905
	p-value	.437	.146	.668	.368
R^2		.111	.312	.141	.144
F		3.713	3.481	.902	2.376
N		185	53	40	92

4.5. Ulsan Metropolitan City

During the period of 2010-2013, automobile parts industry grew up by 1.14%, shipbuilding by -16.56% and machine parts by 7.87% (KOSIS). The thesis analyzed three hundred and fifteen companies in automobile parts, shipbuilding and energy system parts industries in Ulsan. One hundred and fifty-five firms in automobile parts industry achieved 8.43% sales growth on average. In addition, one hundred and one firms in shipbuilding industry saw 13.00% growth and energy system parts realized -0.58% growth. In automobile parts and shipbuilding industries, subsidized firms grew up slower than the average of the similar industry, with this finding showing the 95% confidence level.

-<Table 4.13 > Growth rate of Ulsan

	Automobile Parts	Shipbuilding	Energy System Parts
Mean	8.43%	13.00%	-0.58%
95% CI	4.12-12.74%	4.85-21.14%	-6.22-5.06%
Growth	O	O	▲

Before regression analysis, correlation analysis is conducted among dependent, independent and control variables as in <Table 4.2>. R&D Manpower and R&D Investment has positive correlation in the table. However, VIFs less than 2 were acquired during the regression analysis, which concludes we secured independence between variable.

<Table 4.14 > Correlation among variables in terms of Ulsan

		1	2	3	4	5	6
1	Sales Growth Rate	1.000	.060	.018	.140	-.077	-.025
2	New Product	.060	1.000	.073	-.002	.077	-.005
3	R&D Manpower	.018	.073	1.000	.333	.257	.274
4	R&D Investment	.140	-.002	.333	1.000	.098	.044
5	Firm History	-.077	.077	.257	.098	1.000	.245
6	Firm Size	-.025	-.005	.274	.044	.245	1.000

<Table 4.15 > Regression analysis in terms of Ulsan

		Entire Samples	Automobile Parts	Shipbuilding	Energy System Parts
Constant	t	3.361	1.606	2.454	1.672
	p-value	.001	.110	.016	.100
New Product	t	1.221	.162	1.044	-.218
	p-value	.223	.872	.299	.828
R&D Manpower	t	-.205	-.886	-.397	.727
	p-value	.838	.388	.692	.470
R&D Investment	t	2.590	-.734	***6.110***	-1.548
	p-value	.010	.464	.000	.128
Firm History	t	-1.567	.691	-1.534	-1.731
	p-value	.118	.490	.128	.089
Firm Size	t	-.080	.049	-.114	-.048
	p-value	.937	.961	.909	.962
R^2		.033	.014	.345	.108
F		2.091	.424	9.996	1.285
N		315	155	101	59

According to the R^2 and F value in Table 4.15, the research shows causal relation in shipbuilding industry. R&D investment effects positively to the performance with 95% confidence level.

4.6. Chungcheongbuk-do (Chungbuk)

Being close to the Seoul metropolitan area, Chungbuk has attracted a number of technology-based firms. The local government of Chungbuk has a solid belief in the biomedical industry and supports it politically and financially with the national government. The governments designated a biomedical complex around the Osong area. In the secondary battery and cosmetics industries, major firms and their vendors are also located in Chungbuk. During 2010-2013 period, bio-medical and similar industry grew up by 1.5%, secondary battery and similar by -16.56% and machine parts by 6.67% (KOSIS).

The thesis analyzed one hundred and seventy-eight companies in bio-medical, secondary battery and cosmetic products in Chungbuk. Thirty-three firms in bio-medical industry achieved 3.99% sales growth on average. Moreover, fifty-nine firms in secondary battery industry gained 9.16% growth and eighty-six firms in cosmetic products industry saw 14.51% growth. In cosmetic products industries, subsidized firms grew up slower than the average of the similar industry with 95% confidence level.

<Table 4.16 > Growth rate of Chungbuk

	Bio-Medical	Secondary Battery	Cosmetic Product
Mean	3.99	9.16%	14.51%
95% CI	-0.78-8.76%	4.48-14.84%	6.62-22.41%*
Growth	▲	▲	O

* 90% Confidence Interval

Before regression analysis, correlation analysis is run among dependent,

independent and control variables as in Table 4.17. Patents, R&D Manpower and R&D Investment has positive correlation with each other. However, VIFs less than 2 concludes we secured independence between variable.

<Table 4.17> Correlation among variables in terms of Chungbuk

		1	2	3	4	5	6	7
1	Sales Growth Rate	1.000	.022	-.009	.105	.136	-.143	-.045
2	Patents	.022	1.000	.180	.298	.308	.011	.143
3	New Product	-.009	.180	1.000	.130	.098	.034	-.024
4	R&D Manpower	.105	.298	.130	1.000	.355	.080	.270
5	R&D Investment	.136	.308	.098	.355	1.000	-.086	-.054
6	Firm History	-.143	.011	.034	.080	-.086	1.000	.426
7	Firm Size	-.045	.143	-.024	.270	-.054	.426	1.000

<Table 4.18> Regression analysis in terms of Chungbuk

		Entire Samples	Bio-Medical	Secondary Battery	Cosmetic Product
Constant	t	2.879	.776	2.346	1.815
	p-value	.005	.445	.023	.073
Patents	T	-.380	-.207	1.951	-.605
	p-value	.704	.837	.056	.547
New Product	t	-.270	.082	.425	-1.160
	p-value	.788	.936	.673	.250
R&D Manpower	t	1.067	-.381	.045	1.236
	p-value	.288	.706	.964	.220
R&D Investment	t	1.231	.425	-1.807	***2.641***
	p-value	.220	.675	.077	.010
Firm History	t	-1.677	-.574	.108	-2.043
	p-value	.095	.571	.915	.044
Firm Size	t	-.014	.713	-1.799	.817
	p-value	.989	.482	.078	.416
R^2		.043	.025	.118	.203
F		1.281	.109	1.160	3.350
N		178	33	59	86

According to the R^2 and F value in Table 4.18, the research shows causal relation in cosmetic industry. R&D investment effects positively to the performance with 95% confidence level.

4.7. Chungcheongnam-do (Chungnam)

The representative industries of Chungnam would be automobile parts and the display and machine parts industries. Given the new regulations around the Seoul metropolitan area, firms have migrated to Chungnam province, and Chungnam is now recognized as a main pillar of the Korean economy.

In Chungnam area, automobile parts industry grew by 8.83%. Moreover, display grew by -5.68% and machine parts grew by 4.69% (KOSIS) during 2010-2013 period. According to the local government's plan (2014), electronic and automobile parts industries in the province have grown faster than the national average and have led the economic development of Chungnam, Additionally, the local government of Chungnam (2014) insists that more than four thousand jobs have been created and around three billion US dollars of revenue has been improved.

The thesis analyzed four hundred and fifty-five companies in automobile parts, display and machine parts industries in Chungnam. As shown in <Table 4.19>, two hundred and thirty-eight firms in automobile parts industry achieved 11.61% sales growth on average. Fifty-eight firms in display industry grew by

8.15%. Finally, one hundred and fifty-nine firms in machine parts saw 9.82% growth. Subsidized firms in display and machine parts industries grew up faster than the average of the similar industry with 95% confidence level and firms in automobile parts industry with 90% confidence level.

<Table 4.19> Growth rate of Chungnam

	Automobile Parts	Display	Machine Parts
Mean	11.61%	8.15%	9.82%
95% CI	9.09-14.12%*	0.73-15.57%	6.21-13.44%
Growth	O	O	O

* 90% Confidence Interval

Before regression analysis, correlation analysis is conducted among dependent, independent and control variables as in Table 4.20. Patens, R&D Manpower and R&D Investment has positive correlation with each other. However, VIFs less than 2 were acquired during the regression analysis, which concludes we secured independence between variable.

<Table 4.20> Correlation among variables in terms of Chungnam

		1	2	3	4	5	6
1	Sales Growth Rate	1.000	-.032	.070	.194	-.211	-.072
2	Patents	-.032	1.000	.044	.110	.082	.510
3	R&D Manpower	.070	.044	1.000	.255	.015	-.019
4	R&D Investment	.194	.110	.255	1.000	-.089	.022
5	Firm History	-.211	.082	.015	-.089	1.000	.198
6	Firm Size	-.072	.510	-.019	.022	.198	1.000

According to the R^2 and F value in Table 4.21, the research shows causal relation in automobile part and machine part industries. R&D investment effects

positively to the performance of firms with 95% confidence level.

<Table 4.21> Regression analysis in terms of Chungnam

		Entire Samples	Automobile Parts	Display	Machine Parts
Constant	t	6.750	6.130	1.286	2.797
	p-value	.000	.000	.204	.006
Patents	t	-.444	-.093	.127	-1.692
	p-value	.657	.926	.899	.093
R&D Manpower	t	.617	.430	-1.056	1.605
	p-value	.538	.668	.296	.111
R&D Investment	t	3.657	***3.450***	.773	***2.874***
	p-value	.000	***.001***	.443	***.005***
Firm History	t	-4.054	-4.021	-.200	-2.301
	p-value	.000	.000	.843	.023
Firm Size	t	-.489	.748	-1.062	1.761
	p-value	.625	.455	.293	.080
R^2		.078	.118	.054	.144
F		7.601	6.206	.593	5.163
N		455	238	58	159

4.8. Jeollabuk-do (Jeonbuk)

Health functional food, eco-automobile parts and biological material industries are representative industries of Jeonbuk. From 2006 to 2013, Jeonbuk provided subsidies of 15 billion US dollars to the automobile parts, food and machinery industries to establish infrastructure, to boost research and development and to enhance the industrial eco-system (Jeollabuk-do, 2014). The local government also holds that the number of medium-sized companies has increased by 27%, with large-sized firms increasing by 30%. The numbers of employers in the representative industries have also increased continuously.

The thesis analyzed two hundred and forty-nine companies in health functional food, eco-automobile parts and biological material industries in Jeonbuk. Seventy-three firms in health functional food industry achieved 17.21% sales growth on average. One hundred and thirty-four firms in eco-automobile parts industry realized 6.90% growth. Additionally, forty-two firms in biological material industry acquired 13.58% growth. During the same time span, health functional food industry realized 8.83% of annual growth rate, eco-automobile industry achieved -4.76% growth, and biological material saw 13.58% (KOSIS).

Subsidized firms in health functional food and eco-automobile parts industries grew up faster than the average of the similar industry with 95% confidence level and biological material industry also developed faster with 90% confidence level.

<Table 4.22 > Growth rate of Jeonbuk

	Health Functional Food	Eco-Automobile Parts	Biological Material
Mean	17.21%	6.90%	13.58%
95% CI	10.20-24.22%	2.61-11.19%	4.59-22.57%*
Growth	O	O	O

* 90% Confidence Interval

Before regression analysis, correlation analysis was conducted among dependent, independent and control variables as in Table 4.23. Every independent variable has positive correlation with each other. However, VIFs were verified to be less than 2 during the regression analysis, which concludes this research secured independence between variables.

<Table 4.23 > Correlation among variables in terms of Jeonbuk

		1	2	3	4	5	6	7
1	Sales Growth Rate	1.000	.040	.136	.023	.150	-.221	-.091
2	Patents	.040	1.000	.234	.221	.327	.036	.060
3	New Product	.136	.234	1.000	.249	.526	-.096	-.108
4	R&D Manpower	.023	.221	.249	1.000	.296	-.005	.018
5	R&D Investment	.150	.327	.526	.296	1.000	-.094	-.130
6	Firm History	-.221	.036	-.096	-.005	-.094	1.000	.367
7	Firm Size	-.091	.060	-.108	.018	-.130	.367	1.000

<Table 4.24> Regression analysis in terms of Jeonbuk

		Entire Samples	Health Functional Food	Eco-Automobile Parts	Biological Material
Constant	t	5.362	3.709	3.457	2.816
	p-value	.000	.000	.001	.008
Patents	T	.057	-1.486	.111	***2.515***
	p-value	.955	.142	.912	.017
New Product	t	.941	.732	.021	-.685
	p-value	.348	.467	.983	.498
R&D Manpower	t	-.403	1.116	-.292	***-2.648***
	p-value	.687	.268	.771	.012
R&D Investment	t	1.318	.431	1.452	-.143
	p-value	.189	.668	.149	.887
Firm History	t	-3.102	-1.878	-2.413	-.715
	p-value	.002	.065	.017	.479
Firm Size	t	.097	.093	.005	-.379
	p-value	.923	.926	.996	.707
R^2		.069	.177	.079	.255
F		3.006	2.362	1.897	1.992
N		249	73	134	42

According to the R^2 and F value in Table 4.24, the research shows causal relation in biological material industries. ‘Patents’ and ‘R&D investment’ effect positively to the performance of firms with 95% confidence level.

4.9. Jeollanam-do (Jeonnam)

Biological material, petrochemical material and energy system parts industries seem to be representative industries of the province. The provincial government explains that the numbers of firms and employees in the biological industry decreased from 2008 to 2012, but the value-added amounts associated with these industries increased by 4.8% (Jeollanam-do, 2014). Jeollanam-do (2014) also insists the number of firms in petrochemical industry decreased, but the number of employees and the value-added increased by 1.8% and 6.6%.

This study analyzed one hundred and forty-seven companies in biological material, petrochemical material and energy system parts industries in Jeonnam. Seventy-nine firms in biological material industry achieved 14.95% sales growth on average. Thirty-six firms in petrochemical acquired 47.93% growth. Moreover, thirty two firms in energy system parts got 29.97% growth. During the same period, the average growth rate of food manufacturing industry was 6.88%, drink manufacturing -3.09%, petrochemical material manufacturing 10.86% and electric equipment manufacturing 2.70%.

<Table 4.25> Growth rate of Jeonnam

	Biological Material	Petrochemical Material	Energy System Part
Mean	14.95%	47.93%	29.97%
95% CI	6.84-23.05*	-13.27-109.12%	10.16-49.79%
Growth	O	▲	O

* 90% Confidence Interval

Subsidized firms in biological material and energy system parts industries grew up faster than the average of the similar industry with 95% confidence level and subsidized firms in petrochemical industry did not show significant difference from non-subsidized business.

Through correlation analysis as in Table 4.26. R&D Manpower and R&D Investment has positive correlation with each other. However, VIFs less than 2 were acquired during the regression analysis, which concludes we secured independence between variable.

From Table 4.27, the research shows causal relation in petrochemical material industries. 'R&D investment' effects positively to the performance of firms with 95% confidence level.

<Table 4.26> Correlation among variables in terms of Jeonnam

		1	2	3	4	5
1	Sales Growth Rate	1.000	.054	.502	.096	.145
2	R&D Manpower	.054	1.000	.374	-.051	.010
3	R&D Investment	.502	.374	1.000	.018	.100
4	Firm History	.096	-.051	.018	1.000	.261
5	Firm Size	.145	.010	.100	.261	1.000

<Table 4.27> Regression analysis in terms of Jeonnam

		Entire Samples	Biological Material	Petrochemical Material	Energy System Parts
Constant	t	-.083	2.446	-1.275	1.514
	p-value	.934	.017	.212	.142
R&D Manpower	t	-1.943	.290	-.588	-1.231
	p-value	.054	.773	.561	.229
R&D Investment	t	7.127	.729	***6.627***	1.157
	p-value	.000	.468	***.000***	.257
Firm History	t	.795	-1.287	1.335	-.442
	p-value	.428	.202	.192	.662
Firm Size	t	1.035	-.219	-.371	1.461
	p-value	.303	.827	.713	.156
R^2		.284	.049	.633	.120
F		14.080	.963	13.395	.917
N		147	79	36	32

4.10. Gyeongsangbuk-do (Gyeongbuk)

This research assumes that the automobile parts, machine parts and mobile electronics industries represent the industrial economy of Gyeongbuk. The electronics industry complex around Gumi has led the economic development of Gyeongbuk, and vendors of Hyundai-Kia motors have grown near Ulsan and contributed to the growth of the local economy there.

During the period of 2010 to 2013, automobile parts, machine parts, electronic Industry have grown by 17.25%, 5.81% and -2.05% on average (KOSIS) and subsidized local firms in each industry have grown by 7.88%, 11.40% and 8.51% on average during the same period. Subsidized firms in

mobile electronic industry grew up faster than the average of the similar industry with 95% confidence level and subsidized firms in machine parts industry did not show significant difference from non-subsidized business. However, subsidized firm in automobile parts industry recorded inferior growth rate compared to the non-subsidized firms.

<Table 4.28> Growth rate of Gyeongbuk

	Automobile Parts	Machine Parts	Mobile Electronics
Mean	7.88%	11.40%	8.51%
95% CI	4.62-11.14%	-3.73-26.53%	0.88-16.14%
Growth	X	▲	O

Before regression analysis, correlation analysis is taken among dependent, independent and control variables as in Table 4.29. New Product, R&D Manpower and R&D Investment shows correlation with each other. However, the research verified that VIFs were less than 2 during the regression analysis, which concludes we secured independence between variable.

<Table 4.29> Correlation among variables in terms of Gyeongbuk

		1	2	3	4	5	6
1	Sales Growth Rate	1.000	.020	-.006	.262	-.135	-.005
2	New Product	.020	1.000	.102	.187	-.050	.096
3	R&D Manpower	-.006	.102	1.000	.367	.047	.194
4	R&D Investment	.262	.187	.367	1.000	-.024	.133
5	Firm History	-.135	-.050	.047	-.024	1.000	.300
6	Firm Size	-.005	.096	.194	.133	.300	1.000

From Table 4.30, the research shows causal relation. 'New Product' promoted the firms' performance in automobile parts industry and 'R&D investment' effects positively to the performance of firms with 95% confidence level in machine parts and mobile electronic industries. However, this research found that 'R&D Manpower' had negative impact on the performance in machine parts industry.

<Table 4.30> Regression analysis in terms of Gyeongbuk

		Entire Samples	Automobile Parts	Machine Parts	Mobile Electronics
Constant	t	2.958	2.529	1.167	3.095
	p-value	.003	.013	.248	.003
New Product	t	-.549	***3.303***	-.247	-1.400
	p-value	.583	.001	.805	.166
R&D Manpower	t	-1.682	.773	***-2.121***	-1.414
	p-value	.094	.441	.038	.162
R&D Investment	t	4.587	-.205	***4.042***	***3.719***
	p-value	.000	.838	.000	.000
Firm History	t	-2.040	-1.173	-1.035	-3.208
	p-value	.042	.243	.305	.002
Firm Size	t	.279	.414	.587	1.254
	p-value	.781	.680	.559	.214
R^2		.097	.123	.248	.230
F		5.292	2.853	4.017	4.291
N		253	108	67	78

4.11. Jeju-do

The representative industries of Jeju-do is water, cosmetic product and health functional food industries. According to the KOSIS from 2010~2013, beverage industry, cosmetic product manufacturing and food manufacturing grew up by 13.67%, 19.05% and 3.16% on annual average.

Through the research, only seventy-seven subsidized firms in Jeju Island was analyzed. Twenty-five firms in water industry recorded 5.13% sales growth on average, ten firms in cosmetics product showed 28.74% growth, and forty-two companies in health functional food acquired 22.31% growth. Subsidized firms in water industry recorded inferior growth rate compared to the non-subsidized firms. There was not significant difference between subsidized and non-subsidized firms in terms of cosmetic product. Subsidized firms in health functional food grew up faster that the average of the similar industry with 95% confidence level.

<Table 4.31> Growth rate of Jeju

	Water Industry	Cosmetic Product	Health Functional Food
Mean	5.13%	28.74%	22.31%
95% CI	-1.74-12.00%	6.46-51.02%	8.53-36.14%
Growth	X	▲	O

Before regression analysis, correlation analysis is taken among dependent, independent and control variables as in Table 4.35. R&D Manpower and R&D Investment has positive correlation with each other in the table. However, VIFs

less than 2 were acquired during the regression analysis, which concludes we secured independence between variable.

<Table 4.32> Correlation among variables in terms of Jeju

		1	2	3	4	5
1	Sales Growth Rate	1.000	-.183	.051	-.235	-.054
2	R&D Manpower	-.183	1.000	.342	.085	.040
3	R&D Investment	.051	.342	1.000	-.136	.002
4	Firm History	-.235	.085	-.136	1.000	.162
5	Firm Size	-.054	.040	.002	.162	1.000

According to the R^2 and F value in Table 4.36, the research could not find meaningful regression analysis result in any industry.

<Table 4.33> Regression analysis in terms of Jeju

		Entire Samples	Water Industry	Cosmetic Product	Health Functional Food
Constant	t	3.927	.882	2.095	2.124
	p-value	.000	.388	.090	.040
R&D Manpower	t	-1.626	-1.449	.111	-.602
	p-value	.106	.163	.916	.551
R&D Investment	t	.748	.965	-1.086	.693
	p-value	.457	.346	.327	.493
Firm History	t	-1.756	-.047	-.398	-1.355
	p-value	.083	.963	.707	.184
Firm Size	t	-.117	.024	-.476	.258
	p-value	.907	.981	.654	.798
R^2		.089	.101	.380	.082
F		1.767	.562	.765	.830
N		77	25	10	42

4.12. Analysis Result

The results for thirty-three industries from the eleven provinces are shown in the third column of Table 4.40. Because dataset for the three province was not sufficient, the analysis could not be performed. Eighteen industries showed significant growth potential compared to similar industries in the same area with a 95% significance level. In particular, the shipbuilding industry of Ulsan, a display of Chungnam, health functional food of Jeonbuk, and electronic components industries of Gyeongbuk showed high growth rate with more than ninety nine significance level.

For eleven industries, it was difficult to compare the growth rates, and four industries were characterized as having a lower growth potential compared to similar industries. The textile and automobile parts industries of Daegu, the automobile parts industry of Gyeongbuk and the water industry of Jeju showed lower growth rates than similar industries in the same province. This research acquired somewhat different analysis results from prior research on local industries in Daegu and Gyeongbuk.

The results of the regression analysis are also summarized in Table 4.40. The results of each of the 33 independent analyses conducted to examine the impact of the independent variables on the sales growth rate are shown. First, there were significant results in fourteen industries based on the R2 and F values. This research categorized the results of the regression analysis into three levels - positive, negative and neutral - based on the degree by which the

dependent variable was affected. The R&D investment rate has a positive significant effect on the dependent variable in ten industries. Next, the ratio of new products exists in a causal relationship with the annual growth rate in five cases and with the quality of R&D manpower two cases. For the biological material industry of Jeonbuk, the higher R&D manpower rate suggests a lower growth rate.

The study also conducted a qualitative survey of the difficulties and expectations of local firms. Local businesses assume funding issues and a lack of manpower as major difficulties. If the government, through a regional industrial policy, can support the investment and infrastructure needed for the R&D of private companies, their growth rates would likely accelerate. This is why the government should continue with its regional industrial policy.

The number of sample population was not enough to verify the causal effect of government program in a few provinces. In such provinces, analysis was almost impossible for insufficient dataset. For Jeju, analysis is barely possible but small and biased economy is a hindrance for statistical significance. Grey areas in <Table 4.40> mean that there is no dataset for the relevant independent variables.

<Table 4.34> Analysis result

Province	Industry	T-test	Regression Analysis			
		Policy Effect	Patents	New Product	R&D Manpower	R&D Invest.
Busan	Machine Parts	O				
	Digital Contents	▲				+
	Metal Processing	O				
Daegu	IT	▲				
	Textile	X				
	Automobile Parts	X				
Gwangju	Light and Electronics	▲				
	Eco-Car Parts	O				+
	Design	▲		+		
Daejeon	Light Electronic	O		+		
	Chemical Material	▲				
	Mobile Comm.	O		+		+
Ulsan	Automobile Parts	O				
	Shipbuilding	O				+
	Energy System Parts	▲				
Chungbuk	Bio-Medical	▲				
	Secondary Battery	▲				
	Cosmetic Product	O				+

Chungnam	Automobile Parts	O				+
	Display	O				
	Machine Part	O				+
Jeonbuk	Health Food	O				
	Eco-Automobile Part	O				
	Biological Material	O		+	−	
Jeonnam	Biological Material	O				
	Petrochemical Material	▲				+
	Energy System Part	O				
Gyeongbuk	Automobile Parts	X		+		
	Machine Parts	▲			+	+
	Mobile Electronics	O				+
Jeju	Water Industry	X				
	Cosmetic Product	▲				
	Health Food	O				

5. Conclusion

5.1. Research Result

Awareness of the regional imbalances has been raised for a long time, Korean government's regional policy did not deviate from the suppression on the overcrowding Seoul metropolitan area. Korea has pursued regional policy as a reward for the shortsighted political and economic effects rather than raise the competitiveness of underdeveloped regions. In the 1990s, the government established a policy goal to strengthen the competitiveness of companies and to create an environment where businesses could grow constantly, and has been promoting the regional industrial policies according to the goal. Government has designed a variety of programs and invested more than 10 billion US dollars for the expansion of the infrastructure for the industry in non-metropolitan areas. Moreover, the government has continued supporting businesses and led efforts to address the difficulties of the local enterprise. As a result of the policy, new industries began to appear and has driven economic growth of the region, also it made a steady growth of related companies.

This report begins by expressing worries about whether the regional industry policy has made any contribution to the growth of local economies. The core of the study is an analysis of the discriminative growth of local companies belonging to representative industries, and the relationship between innovation and growth. First, this research selected three representative

industries for every thirteen provinces. The selected industries were those that had led the local economy or that had had an opportunity to be a growth engine.

The report compared the growth rate of subsidized firms with the growth rate of industry average. The significance level was 95%. It observed a high growth potential of supported firms compared to the overall industry average in many industries. The government may continue on regional industrial development policy on the authority of this causal relation.

The study defined and measured the innovation activities of local companies and attempted to understand the relationship between the performance of an enterprise and its innovation activities. First, the study set up four variables to measure the innovation of local companies. The ratio of R&D investment in R&D to total sales, the percentage of master's and doctoral degree holders in terms of R&D personnel, the number of patent applications and registrations, and the ratio of brand-new products to total sales were utilized in previous studies. The report also determined that these four innovation indicators could represent the innovation activities of local firms.

The report analyzed the impact of the four innovation activities on the growth rates of companies. Each company's growth rate was defined as its average annual growth rate from 2009 to 2013. The study concluded that R&D investments have a causal effect on the company's growth rate in ten industries out of thirty-three. In other words, if the government can provide financial

support and establish the infrastructure needed for the R&D activities of companies through a regional industrial policy, the growth rates of local companies would increase.

5.2. Policy Implication

Central and local governments have established a system by which to design and implement policies through mutual collaboration. The central government has expanded the participation of local governments in the process of establishing regional industry policies. Local governments have established a system to create a regional industrial development plan and to assess the detailed tasks of the relevant regions. The municipalities also support the development of local businesses by contributing their own funds to the budget of the central government. The Korean government attempts to ensure the autonomy of local regions during the policy process, undertaking coordination activities between municipalities, comprehensive consultations, inter-regional assessments, and management and supervision duties. However, many experts have insisted that central and local governments need to clarify and share roles.

The government asks stakeholders to participate in the policy making process and listens to their opinions through a variety of pathways. Many residents of the affected areas remain uninformed about these government actions. The outcomes of economic development in each region are shared by

its inhabitants; therefore, it is important to ensure the voluntary participation of local residents. The government needs to strengthen the participation of local residents as well as local organizations such as businesses and universities. The government should also consider policy options that provide powerful incentives to increase the participation of residents and stakeholders.

Through continuous support, the government can promote enterprises such that they can reach a stable position from which they can invest in the R&D process themselves. Though the importance of investment in R&D is widely accepted, many companies are hesitant to make investment decisions without the experience of successful R&D. A proper regional industry development policy can encourage firms to feel the positive effect of R&D on their performance and to decide upon supplementary investments, which would in turn boost the industrial eco-system.

In a few cases, variables such as ‘R&D manpower’ and ‘new products’ also had a positive impact on business growth. Recruitment is one of the major problems facing local firms at present. The local workforce wants to find jobs around the Seoul metropolitan area, while local firms suffer a shortage of applicants for job positions. The problem is severe when it comes to highly educated personnel. If a company has a sufficiently advanced R&D staff, it would have more of an opportunity to develop new items and convert these developments into sales.

The R&D tax credit program in the US gives tax exemptions for additional R&D. 'Additional R&D' here refers to R&D investments that would have not occurred in the absence of government support. Federal and state governments in the US restrict the R&D policy only to additional R&D. In Korea, the government does not limit the client of the R&D programs, and non-additional R&D by private firms can be supported by the policy. In this manner, the R&D programs in the US are very different from those in Korea. If the R&D policy only supports clients after assessing their R&D plans in advance, it cannot enhance additional R&D. Instead, private companies will attempt to achieve policy support for non-additional R&D which they have already decided to carry out regardless of the subsidy from the government. Such an outcome may be disappointing for a government expecting to generate externalities through R&D innovations.

The government can change its R&D policy to allow companies to take risks. It can introduce a tax credit scheme and/or prefer a project with a low probability of success but significant positive externalities at the national level. R&D policies should focus on stimulating the economy and creating jobs.

5.3. Limitations and Tasks Ahead

Many studies have proven the effectiveness of these policies and analyzed the relationship between innovation and corporate performance only

in specific industries or specific regions. There is not much research reviewing whether there is any relationship between innovation and corporate performance on an entire province. Those works investigated whether the policy design process was reasonable, the implementation process was transparent, and/or whether the feedback was sufficient. The analysis of the government tended to be presented only in terms of results, such as sales, incomes, and employment policies. From the viewpoint of business management, studies usually focus on what factors create corporate performance.

This study strongly embraced a wide range of prior studies and carried out an analysis based on individual firms according to their provinces and industries. The study sought to identify the core innovative competencies of local companies required to achieve growth. This study is meaningful because it uses the latest statistics on the representative industries and provides a foundation on which additional work can contribute to the policy making process in the near future. This study, by analyzing the impact of regional industry policies, derived implications for the development of local industries. However, the study still has several limitations.

When an individual firm that has the experience of receiving a subsidy shows prominent growth, some extent of the growth may not have been caused by the government program. Although we can note the external or internal growth of firms, it remains difficult to measure how much a government policy

influences a firm. It is desirable to compare subsidized with non-subsidized firms rather than all firms in the same or similar industries. In this case, the subsidized companies are considered to be superior to non-subsidized ones regardless of the effectiveness of the policy support, as subsidized firms passed the assessment process during which the performance and potentials of the firms were evaluated.

The research introduced four independent variables to find the relationship between innovation processes and business performance. Four variables are not enough to represent business innovation activities, complicating any diagnosis of the innovation process. Moreover, openness is an essential part of innovation activities, but this study did not consider or review this. Local enterprises have accumulated tacit knowledge, human networks and technological know-how while communicating with other firms, research institutes and universities within close distances. If the study had analyzed these open innovation processes, the results could have been more concrete.

The sole dependent variable, the annual growth rate, does not explain the performance of each firm, even if it can represent most. In general, experts comprehensively determine the financial performance of a company after measuring changes in sales, margins and assets. For example, by adding margin changes as the dependent variable, future studies may be able to obtain more meaningful results.

Bibliography

Allen, T. J., Lee, Denis M. S., & Tushman, M. L. (1980). R&D performance as a function of internal communication, project management, and the nature of the work. *Engineering Management*, 27(1), 2 – 12.

Breschi, S. & Lissoni, F. (2001). Knowledge Spillovers and Local Innovation Systems: A Critical Survey. *Industrial and Corporate Change*, 10(4), 975-1005.

Chang, Sun-Mi (2013). Effects of Innovation and Openness on Firms Productivity: Using Company Innovation Index. *International Commerce and Information Review,* 15(3), 225~243.

Chesbrough, H. W. (2003). Open Innovation: The new imperative for creating and profiting from technology. *Harvard Business School Press*, Boston.

Chungcheongnam-do (2014). *Regional Industry Development Plan of Chungcheongnam-do*. Chungcheongnam-do.

Cooke, Philip & Leydesdorff, Loet (2006). Regional Development in the Knowledge-based Economy. *The Journal of Technology Transfer*, 31(1), 5-15.

Czarnitzki, D., Ebersberger, B. & Fier, A. (2007). The relationship between R&D collaboration, subsidies and R&D performance: Empirical evidence from Finland and Germany. *Journal of Applied Econometrics,* 22(7), 1347-1366.

Daegu Digital Industry Promotion Agency (2013). Daegu IT/SW Industry Investigation, *Daegu Digital Industry Promotion Agency*, Daegu.

DeVol, R., Harris, K., & Ratnatunga, M. (2015). California's Innovation-Based Economy: Policies to Maintain and Enhance It. *Milken Institute*, 45-61. Retrieved from http://assets1c.milkeninstitute.org/assets/Publication/ ResearchReport/PDF/California-Innovation-Economy3.pdf

Florida, R., Mellander, C. & Stolarick, K. (2008). Inside the black box of regional development — human capital, the creative class and tolerance. *Journal of Economic Geography*, 8(5), 615-649.

Gray, M. (1997). Evidence-based health care: How to make healthy policy and management decisions, *Churchill Livingstone*, New York & London.

Gomez, M. A. & Sequeira, T. N. (2014). Should the US increase subsidies to R&D? Lessons from an endogenous growth theory. *Oxford Economic Papers-new series,* 66(1), 254-282.

Higgins, B. & Savoie, D. (1997). *Regional Development Theories and Their Application*, *Transaction Publishers*, New Jersey.

Jeollabuk-do (2014). *Regional Industry Development Plan of Jeollabuk-do.* Jeollabuk-do

Jeollanam-do (2014). *Regional Industry Development Plan of Jeollanam-do*. Jeollanam-do

Kang, Kyung-Nam & Park, Hayoung (2011). Influence of government R&D support and inter-firm collaborations on innovation in Korean biotechnology SMEs. *Technovation*, 32(1), 68-78.

Kim, M. S., Kim, S. J. & Nam, K. H. (2012). The Empirical Study on Relation between R&D Innovation Capability and Performance in Knowledge-Based Service Firms. *The Korean Society for Quality Management Journal*, 40(4), 631-640

Kirkham, C. (2014, August 24). California vs. Texas in fight to attract and retain businesses. *LA Times,* Retrieved from http://www.latimes.com/business/la-fi-california-vs-texas-economy-20140824-story.html

Kogut, B. (1988). Joint ventures: Theoretical and empirical perspectives. *Strategic Management Journal*, 9, 319-332.

Lach, S. (2002). Do R&D subsidies stimulate or displace private R&D? Evidence from Israel. *Journal of Industrial Economics,* 50(4). 369-390.

Laursen, K. & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2), 131-150.

Leahy, D., & Neary, J. P. (1999). R&D spillovers and the case for industrial policy in an open economy. *Oxford Economic Papers*, 51(1), 40-59. Retrieved from www.jstor.org/stable/3488591.

Lee, Dongsuk & Chung, Lakchae (2008). A study for the impact of the key Evaluation Indexes on the Business Performance in Korean Inno-Biz. *The Journal of Business and Economics,* 24(2), 122~143.

Lee, E. Y. & Cin, B. C. (2010). The effect of risk-sharing government subsidy on corporate R&D investment: Empirical evidence from Korea. *Technological Forecasting and Social Change,* 77(6), 881-890.

Ministry of Strategy and Finance (2010), Dictionary of Current Economic Terms. *Ministry of Strategy and Finance of Korea*, Sejong, Retrieved from http://terms.naver.com/entry.nhn?docId=299854 &cid=43665&categoryId=43665

Ministry of Trade, Industry and Energy of Korea (2014). Master Plan for Regional Industry Development. *Ministry of Trade, Industry and Energy of Korea*, Sejong.

Ministry of Trade, Industry and Energy (2014). The Result of Firm Characteristic Investigation. *Ministry of Trade, Industry and Energy of Korea*, Sejong.

Organization for Economic Cooperation and Development [OECD] & EUROSTAT (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data. Pairs: *OECD Publishing.*

Organization for Economic Cooperation and Development [OECD] (2011). Regions and Innovation Policy. Paris: *OECD Publishing*.

Segerstrom, P. S. (2000). The long-run growth effects of R&D subsidies. Journal of Economic Growth, 5(3), 277-305.

Shin, J. K. & Jo, J. I. (2011). The Relationship between Innovation Capability of R&D and the Firm's Performance: Comparing Regional Strategy Industry with Non-Regional Strategy Industry in Daegu. *Daehan Academy of Management Information Systems Journal*, 30(2), 211-235

Tsai, K. H. & Wang, J. C. (2004). The R&D performance in Taiwan's electronics industry: a longitudinal examination. *R&D Management*, 34(2), 179-189.

Tödtling, F. & Trippl M. Regional innovation systems in Cooke, P., Asheim, B., Boschma, R., Martin, R., Schwartz, D., & Tödtling, F. (Eds.). (2011). Handbook of regional innovation and growth. Cheltenham: *Edward Elgar Publishing.*

World Bank & Organization for Economic Cooperation and Development [OECD] (2013). What is the role of regions in innovation policy? *Innovation Policy Platform*. Retrieved from https://www.innovationpolicyplatform.org/content/what-role-regions-innovation-policy

Yum, M. K. (2005). Direction and Problem of Regional Innovation System Construction. *Korean Regional Sociology*, 6(2), 22

초 록

우리나라는 수출주도형 성장모델을 적용하여 경제를 성장시켰다. 경제성장에 치우친 나머지 지역균형발전과 같은 형평성 중심의 가치들을 소홀히 한 측면도 있었다. 한국 정부가 수출주도형 경제발전을 위해 필요한 산업들을 수도권과 동남권에 집중적으로 배치시키면서, 다른 지역들의 경제발전 속도는 상대적으로 느렸다. 지역 간 불균형에 대한 인식과 그에 따른 정부의 지역정책이 오래 전부터 시작되었지만, 한동안 과밀화된 수도권 억제정책의 또 다른 단면으로서만 존재했었다. 1990년대 이전의 한국 정부는 낙후된 지역의 경쟁력을 키우기보다는 당장의 정치적, 경제적 효과를 위한 보상정책 중심으로 지역정책을 추진해 왔다.

1990년대 이후 우리 정부는 기업의 경쟁력을 강화하고 지속적으로 성장할 수 있도록 하겠다는 목표를 갖고 지역산업육성정책을 추진하고 있다. 정부는 10조원 이상의 예산을 투입하여 수도권 이외의 지역에서 산업육성을 위한 인프라를 확충하고, 다양한 기업지원 프로그램을 설계하여 기업들의 애로를 해소하기 위해 노력하고 있다. 그 결과 지역의 특색이 반영된 산업, 지역 성장을 견인하는 새로운 산업들이 뿌리를 내렸고, 관련 기업들의 성장도 꾸준히 이루어지고 있다.

그 과정에서 중앙정부와 지방정부가 협업을 통해 정책을 수립하고

집행하는 시스템이 자리를 잡고 있다. 지방자치단체가 지역의 이해관계자들과 함께 지역에 한정된 산업발전계획을 자율적으로 수립하고, 지역별 세부과제를 평가하는 시스템을 도입하였다. 정부는 지방자치단체별로 추진성과와 계획을 평가하여 예산을 차등 배분하고 있다. 지방자치단체도 정부의 지원예산에 자체 예산을 매칭하여 지역 내 기업들의 발전을 지원한다. 중앙정부는 지방자치단체 간 조율, 종합적 의견 수렴, 지역 간 평가, 관리 및 감독 등을 수행하면서 지역의 자율성을 보장하기 위해 노력하고 있다. 하지만, 중앙정부와 지방정부 간 보다 명확한 역할분담이 필요한 상황이다.

이 보고서는 우리나라의 지역산업육성정책이 지역기업의 성장에 어떠한 기여를 했는지에 고민에서 출발했다. 지역별 대표산업 관련 기업들의 성장성, 그리고 혁신활동과 성장성의 관계를 분석하는 것이 연구의 핵심이다. 먼저 국내 연구를 위해 지역산업육성사업의 공간적 대상인 비수도권 광역자치단체별로 3개의 대표산업을 선정하였다. 지역전략산업육성, 광역선도산업육성, 지역특화산업육성 등 그간의 지역정책을 통해 지원해 온 산업들 중 지역경제를 견인해 왔거나 미래의 성장동력이 될 수 있는 세 개의 산업을 선정하였다. 당초 서울특별시, 인천광역시, 경기도 그리고 세종특별자치시를 제외한 비수도권 13개 광역자치단체를 분석 대상으로 하였으나, 관련 자료가 부족했던 경상남도와 강원도는 분석에서 제외하였다.

먼저, 시.도별로 지역산업육성사업의 지원을 받아온 기업과 동일하거나 유사한 산업군 전체의 성장성을 유의수준 95%에서 비교하였다. 33개 분석 대상 산업 중 18개 산업에서 수혜기업들이 관련 산업 전체에 비해 높은 성장성을 보이는 것으로 나타났다. 향후 정부가 지역산업육성 정책을 지속적으로 추진하는 근거로 삼을 수 있을 것이다.

이 보고서는 지역기업의 혁신활동을 정의하고 측정 및 분석하였으며, 혁신활동과 기업의 성과 간 관계를 파악하기 위해 노력했다. 먼저, 지역기업의 혁신활동을 측정하기 위해 4가지 지표를 설정하였다. 총 매출액 대비 R&D 투자비율, R&D 인력 중 석사 및 박사학위 소지자 비율, 특허 출원 및 등록 건수, 총 매출액 대비 신제품 매출액 비율 등은 선행연구에서 인정되어 왔다. 본보고서는 4가지 지표가 대표성을 갖는다고 판단했다.

시.도의 산업별로 4가지 혁신활동이 기업의 성장속도에 미치는 영향을 분석하였다. 기업의 성장속도는 2009년부터 2013년까지 기업의 연평균 성장률로 정의하였다. 33개 산업 중 10개의 산업에서 R&D 투자가 많을수록 기업의 성장속도가 빠르다는 결론을 얻을 수 있었다. 즉, 정부가 지역산업정책을 통해 R&D에 필요한 기업의 투자를 보조하고 기반시설을 공급할 수 있다면 지역기업의 성장속도는 빨라질 가능성이 크다. 정부가 지역산업정책을 꾸준히 추진해야 하는 이유이기도 하다.

당장의 성과보다는 꾸준한 지원을 통해 기업들이 스스로 R&D에 투자할 수 있는 위치에 도달하도록 노력해야 한다. R&D투자의 중요성은 널리 알려져 있고, 많은 기업들이 이를 인식하고 있지만, R&D투자의 효과를 직접 경험하지 못한 기업 입장에서는 선뜻 투자결정을 내리기가 쉽지 않다. 이런 상황에서 정부가 나서서 기업들이 투자의 효과를 경험하고 추가로 투자결정을 내릴 수 있도록 도와주는 정책이 효과를 낼 수 있다.

‘R&D 인력의 수준’이나 ‘매출액 중 신상품 비율’과 같은 독립변수들도 기업의 성장 속도에 긍정적인 영향을 미치는 경우가 있었다. ‘R&D 인력의 수준’은 한 가지 산업에서 긍정적인 효과가 있었고, ‘신상품 비율’은 다섯 가지 산업에서 긍정적인 효과가 있었다. 인력수급문제는 지역의 기업들이 어려움을 호소하는 중요한 문제 중 하나이다. 지역기업이 원하는 인력들이 수도권으로 몰리면서 지역은 인력난을 겪고 있다. 학위 소유자의 경우 수도권 쏠림 현상이 더욱 심하다. 지역기업이 고급 R&D 인력을 보유할수록 창의적인 신제품을 개발하고 이를 매출과 순이익으로 연결시킬 수 있는 개연성이 커질 수 있다.

주요어: 지역산업육성정책, 지역기업, R&D 혁신활동, R&D 투자, R&D 지원정책

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Abstract

Korea has achieved economic development through export-led growth model, but the values emphasizing equity were neglected while focusing on economic development. The government placed the necessary industry for export-led economic development in the metropolitan area and southeastern, and economic development of the region excluded from the policy was relatively slow. Awareness of the regional imbalances has been raised for a long time, the government's regional policy did not deviate from the suppression on the overcrowding Seoul metropolitan area. Korea has pursued regional policy as a reward for the shortsighted political and economic effects rather than raise the competitiveness of underdeveloped regions.

In the 1990s, the government established a policy goal to strengthen the competitiveness of companies and to create an environment where businesses could grow constantly, and has been promoting the regional industrial policies according to the goal. Government has designed a variety of programs and invested for the expansion of the infrastructure for the industry. Moreover, the government has continued supporting businesses and led efforts to address the difficulties of the local enterprise. As a result, new industries began to appear and has driven economic growth of the region, also it made a steady growth of local companies.

This report begins by expressing worries about whether the regional industry

policy has made any contribution to the growth of local economies. The core of the study is an analysis of the discriminative growth of local companies belonging to representative industries, and the relationship between innovation and growth. First, this research selected three representative industries for every thirteen provinces. The selected industries were those that had led the local economy or that had had an opportunity to be a growth engine.

The report compared the growth rate of subsidized firms with the growth rate of industry average. The significance level was 95%. It observed a high growth potential of supported firms compared to the overall industry average in eighteen industries. The government may continue on regional industrial development policy on the authority of this causal relation.

The study defined and measured the innovation activities of local companies and attempted to understand the relationship between the performance of an enterprise and its innovation activities. First, the study set up four variables to measure the innovation of local companies. The ratio of R&D investment in R&D to total sales, the percentage of master's and doctoral degree holders in terms of R&D personnel, the number of patent applications and registrations, and the ratio of brand-new products to total sales were utilized in previous studies. The report also determined that these four innovation indicators could represent the innovation activities of local firms.

The report analyzed the impact of the four innovation activities on the growth

rates of companies. Each company's growth rate was defined as its average annual growth rate from 2009 to 2013. The study concluded that R&D investments have a causal effect on the company's growth rate in ten industries out of thirty-three. In other words, if the government can provide financial support and establish the infrastructure needed for the R&D activities of companies through a regional industrial policy, the growth rates of local companies would increase.

The government can promote enterprises such that they can reach a stable position from which they can invest in the R&D process themselves. Though the importance of investment in R&D is widely accepted, many companies are hesitant to make investment decisions without the experience of successful R&D. A proper regional industry development policy can encourage firms to feel the positive effect of R&D on their performance and to decide upon supplementary investments, which would in turn boost the industrial eco-system.

In a few cases, variables such as ‘R&D manpower’ and ‘new products’ also had a positive impact on business growth. Recruitment is one of the major problems facing local firms at present. The problem is severe when it comes to highly educated personnel. If a company has a advanced R&D staff, it would have more of an opportunity to develop new items and convert these developments into sales.

Keywords: Regional Industry Promotion Policy, Local Industry,
R&D Innovation Activity,R&D Investment, R&D Policy