

University-Industry Cooperation Policy in Korea: Implementation and Implication of the Enactment of Law of Industrial Education and University-Industry Cooperation, 2003-2011*

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Abstract

This article examines the evolution of university-industry relations which overviews the policy implementations in Korea since 2003. In Korea, the current policy perspective tends to tighten university-industry link in science and technology policy at national economic system. Moreover, policy stance aims to expand university-industry cooperation in regional level. We aim to reflect a university-industry policy implementation and exploit implications for policy and future research to enhance the contributions of university-based research for social innovation and economic performance. This paper overviews the trend of national university-industry cooperation policy during the 2003-2011 period in Korea using data on Survey on University-Industry Cooperation Activities in 2011 and The Law on Industrial Education and University-industry Cooperation of 2003. In our analysis, there was a fundamental change for each of infrastructure and organization, technology transfer, cooperative education and training, and exchange of human capital in relation between industry and university. We highlight that each is remarkable policy outcomes for building the foundation and institutionalization to achieve long term national policy goal. We hope this initial research provides an implication and agenda for policy makers and researchers in a variety of disciplinary and methodological perspectives in the field of university-industry cooperation.

Keywords: University-industry cooperation, University-industry cooperation policy, Law of Industrial Education and University-industry cooperation, Economic development

1. Introduction

This article examines university-industry relations to review the policy orientation, formulation, and implementation of university-industry cooperation policy since 2003. We aim to overview the evolution of university-industry policy and consider

implications of policy and future research to enhance the contributions of university-based research to national economic performance. Economic growth, employment and sustainable development are fundamental in national economic system. University-industry relation appears to be the most significant policy stance for national economic

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development and social innovation through scientific knowledge transfer and technology commercialization. Thus, the national university-industry policy attempts to promote university-industry linkages by using the various policy instruments, developing the numerous initiatives and stimulating collaborative activities.

Cohen, Nelson and Walsh (2002) emphasize the significance of industrial differences in the relation between university and industrial innovation by examining the effects of university research on industrial R&D and the mechanisms. They demonstrate that public research including university affects industrial R&D in manufacturing companies and knowledge flow. George, Shaker and Wood Jr. (2002) argue that university-industry cooperation may not directly influence the firm's success in innovation but it can affect their decision or management of research projects. Policy makers accept a theme that university researches affect private sector innovations and such innovations develop the national economy. They try to increase the national economic growth from proliferation of university research outcomes and diffusion of technological innovation. These efforts attempt to initiate various university-industry cooperation programs and create regional industries based on high-technology around universities. Faced with the growing role of universities, universities respond to demand for a national government. They perform various collaborative activities including research and development (R&D), technology transfer and commercialization and education programs.

In Korea, the public policy initiatives tend to tighten university-industry linkages for a national economic development and aim to expand university-industry cooperation in regional economy by strengthening university's role in industry relations. Many of these initiatives attempt to increase economic growth based on university research and education outcomes by supporting the creation of the university-industry cooperation foundations, business incubating centers,

and technology licensing offices in terms of organizational infrastructure and research program they operate in government funding. Other policy efforts are founded in a series of legislation and enactment of law. The Law on Industrial Education and University-industry Cooperation of 2003 is the most significant historical event in Korea because the enactment law plants the seed for university-industry cooperation and technology commercialization.

We argue that the complete revision of the Law on Industrial Education and University-industry Cooperation of 2003 is remarkable in evolution of university-industry cooperation policy in Korea. In this article, we highlight how the law affects the policy orientation, formation and implementation during the 2003-2011 period. Using data on Survey on University-Industry Cooperation Activities in 2012 (2003-2011) by Ministry of Education, Science and Technology and the National Research Foundation of Korea, we reviewed the trend of national university-industry cooperation policy during 9 years in Korea. Although we acknowledge that this paper has a limitation because we do not attempt empirical models, we aimed to focus on long term trend analysis because we assume it is preferentially important to analyze the long-term based outcomes.

Reflecting on evolution of university-industry cooperation, we expect that policy would invigorate the present level of cooperation and provide a descriptive foundation for researches on the topic across a variety of academic disciplines.

In this paper, we define the concept of relations between university and industry. Second, we overview the policy processes of orientation, formation and implementation of university-industry cooperation. Third, we assess the legislation based policy orientation and goal and its impact. Finally, we conclude with implications for policy and future research.

2. Concept of Industry-University Cooperation

2.1. Defining university-industry cooperation

The concept of university-industry cooperation is focused on the interaction of university and firm including official and unofficial activities. Thus, the university-industry cooperation is defined as a strategic partnership between universities and firms that effectively respond the needs of the market through the interactions of human resources and scientific and technological knowledge (Park & Lee, 2012).

For most universities, university-industry cooperation is activity of scientific knowledge diffusion and technology transfer to industry, sponsored research and problem solving in product productions and manufacturing processes to expand the government funding and industrial investment and graduate employment (Smilor, 1993). Firms focus on industrial innovation to utilize university knowledge and technology and human resources with publications, conferences, consulting, formal and informal interaction with university researchers, patents and licensing. Lee (2012) emphasizes that open innovation is important and university-industry cooperation tends to expand broader by participating various actors in collaborative works. Park (2000) categorized university-industry cooperation into multilateral cooperation to maximize the national competitiveness and innovation based on the networks of all relevant actors, not relationship between the firm and the university. Government aims to increase the commercialization of academic research for industrial innovations and to facilitate the application of these research to improve national economic performance.

The Law on Industrial Education and University-industry Cooperation of 2003 defines that university-industry cooperation is to foster industrial education and training for a human resource

development and industrial competence, and formulate efficient R&D system and finally contribute to the national and regional economic performance through the exchange and training of human capitals, knowledge diffusion, technology advance and industrialization.

In short, university-industry cooperation is defined as multilateral, official and unofficial activities to enhance the social innovation and the national and regional economic performance.

2.2. Forming a typology

The term of university-industry cooperation and type of activities are inherently interdisciplinary and varied but are considered as an important policy field in the national economic system and thus defining and forming typology are important for research. A variety of government departments promote policies to achieve their own organizational goals. In 2011, we find that 26 policy programs are operated by Ministry of Education and Science & Technology, Ministry of Knowledge Economy, Small and Medium Business Administration. Technology advancement, education, technology transfer, sharing of equipment and infrastructure construction are the main policy goal respectively investing one trillion and 461.9 billion won (the Korean National Science and Technology Commission, 2012).

University-industry cooperation is categorized by actors, interaction between university and firm, policy orientation. First, university-industry cooperation is divided into bilateral and multilateral interaction. The form of university-industry cooperation is the bilateral cooperation. Thus university-industry expands multiple actors to participate in the national economic system. In university-industry relations, various actors appear to be in either independent or consortium type of interactions.

Table 1. Main actors

Actors	▪ Research university (including S&T university), national and regional university
	▪ Big and large company, small and medium enterprise, high-technology company
	▪ Government research institutes
	▪ Industry research institutes
	▪ National government
	▪ Regional government

Source: Ministry of Education, Science & Technology and the National Research Foundation of Korea. (2012). Survey on University-Industry Cooperation Activities in 2012

Second, university-industry cooperation takes official and unofficial cooperative forms. OECD (2002) divides the interaction between university and firm into official and unofficial cooperation in Table 2.

Table 2. Activities

Unofficial	Official
Publication, patent Conference Share of research facility Internship, co-op Informal interaction	Consulting Continuing education and training Contract or sponsored research Staff and executive exchange Spin-off, Joint Venture

Source: OECD (2002). Benchmarking industry-science relations

Third, the policy orientation are divided into infrastructure, R&D, education, technology transfer, product and process advances, and labor mobility to promote linkages between university and firm in Table 3.

Table 3. Policy goals

Purpose	Type
Infrastructure	The university-industry foundation, incubating center, Technology Licensing Office(TLO), Industrial Liaison Office(ILO) Research facility Coordinated support programs
Education and training	Co-op programs, internship, continuing education, executive development, industry customized programs, student scholarships and contract department with industry
Technology transfer and research relations	Technology transfer, joint venture, spin-off, access to research facility Contract research, cooperative R&D projects Incubating businesses
Knowledge and personal exchange	Industrial project by students, hiring research-oriented students Participation in conferences and seminars Industrial consulting by university faculty and staff Knowledge sharing through publication and research results by faculty

Source: Kwon S., Song, W., Lee, H. and Tae, S. (2011). Industry-Academy-Laboratory Cooperations Advanced Plan for promoting the open-innovation. The National Research Foundation of Korea.

2.3. University-industry cooperation as Public Policy: *The nature and policy orientation*

Why does Korean government promote the cooperation between university and firm? The

importance of university-industry cooperation is a major policy instruments for government to affect both of management of university and industrial innovation to increase the national and regional economic performance. Another importance is the

scale of government investment on university, firm, government research institute, and local and regional government. Multiple government ministries of Ministry of Science, ICT and Future Planning (MSIP), Ministry of Education (MOE), Ministry of Trade, Industry and Energy (MITIE), Small and Medium Business Administration (SMBA) adopt university-industry cooperation as policy instruments to achieve their organizational goals and national funding of 193 billion won is distributed in projects and programs.

Why government policies focus more on university in cooperation between university and firm? The role of universities in technological advance and industrial innovation is significant (Pavit, 1984; Etzkowitz & Leydesdorff, 1997; Eom & Lee, 2009). Thus, universities emerge as the key component of the national economic growth (Freeman, 1987; Lundvall, 1992). Global competition and technological change significantly increase firm's links to university for not only knowledge but also its industrialization. Another reason is that economic structure has been dominated by big firms and government, and a relatively weak role by universities and the SMEs (Kim, 1993; Lim, 2006). In 2005, 39.7% of researchers and 52.2% of Ph.D. researchers work for the top 20 firms (Eom & Lee, 2009). Large firms have dominated the in house R&D since mid 1980 and acquire technology sources and human resources from developed countries (Eom & Lee, 2009).

Thus, Korean government tried to promote national R&D capacity by legislating law and initiating programs. Law and related institutionalization stimulate the reformation for education-oriented universities and the creation of outcome for research-oriented universities to contribute the industrial innovation and economic development as social sources. In other words, Korean government induces universities to play major role in creating new industry and new jobs. Most government R&D investments and research infrastructure projects are related to university-industry cooperation directly and indirectly. Many government administrations

and branches fulfill similar functions in cooperation between university and industry. Each has different policy goals and strategies to achieve. SMBA focuses on technological advance in manufacturing process and product development and human resource development and employment of Small and medium enterprise. MITIE develops technological breakthrough by collaborating with businesses and university researches to promote new industry growth and economic performance. MOE focuses on reform of university structure and educational system and program by promoting cooperation between colleges and firms. Ministry of employment and labor focuses on reeducation and strengthening of ability through college programs. MSIP has policy goal to enhance the role of university in industrial innovation, technology commercialization and new growth engine through cooperation between university and firm and government research institute and industry.

3. How Government Policies Affect the Relations between University and Firm? Towards Policy Overview

3.1. Origins of law

Toward the evaluation of policies, we review the policy process of initiation, formulation, implementation and assessment. We focus on the period after the Law on industrial education and university-industry cooperation of 2003. How this law affects the linkages between university and firm? We argue that the Law on industrial education and university-industry cooperation is remarkable in policy initiatives.

To promote the university-industry relations, universities started to establish the university-industry cooperation foundation after the enactment of the Law on industrial education and university-industry cooperation of 2003. This law aims to respond to industrial demands for hiring talented graduates, human resource development and technological innovations based on university education and research. It aims

to build effective R&D system and industrial advance by promoting creation, transfer, diffusion and commercialization of knowledge and technology.

The main components of law are related to institutionalization of university-industry cooperation by designing and initiating effective system. Establishment of university-industry cooperation foundation, technology transfer office, acquisition and management of intellectual property rights, continuing education, corporate scholarship and contracted department with firms, collaborative R&D, technology transfer, business development and commercialization aim to be invigorated under law.

The most important of policy initiative is the establishment of university-industry cooperation foundation. Before the enactment of law, university has no legal rights and law enacts a provision including university-industry cooperation foundation has legal right and obligation as a contractor with firms. The Law on industrial education and university-industry cooperation also enact a provision which university-industry cooperation foundation acquires intellectual property rights. With this law, university-industry cooperation foundation manages independent accounting system from universities. It operates profitable business based university outcomes and includes overhead costs based on the university-industry contracts in their operation revenue to secure the financial base which can be

operated. In education and training, the establishment of the contract department with industries aims to leverage the research and education by responding the industrial demand for human resources.

3.2. The effects of the Law

The Law of industrial education and university-industry cooperation is evaluated as the legal foundation for university operating system shift and collaborative programs and activities of university-industry cooperation. Promotion of the university-industry cooperation gains momentum as universities start to establish the university-industry cooperation foundation after the enactment of the Law on industrial education and university-industry cooperation of 2003.

As of 2011, 369 universities established university-industry cooperation foundations. In 2003, the number of university-industry cooperation was only 25 and increased to 369 in 2011. The number of employees in university-industry cooperation foundations was 1,558 people in 2005, but it was increased to 6,291 in 2011. The operating revenues was 161 billion in 2005, but increased to 5 trillion won in 2011 (Ministry of Education, Science & Technology and National Research Foundation of Korea, 2012).

Table 4. Current status of the university-industry cooperation foundation

Year	Number of foundation	The number of Employees	Operating revenues (unit: one million won)
2003	25	N/A	N/A
2004	299	N/A	N/A
2005	319	1,558	161,464
2006	333	2,002	321,423
2007	339	2,355	321,262
2008	344	3,300	4,415,104
2009	349	4,204	5,225,185
2010	354	6,012	4,677,256
2011	369	6,291	5,576,026

Source: Ministry of Education, Science & Technology and the National Research Foundation of Korea (2012). Survey on University-Industry Cooperation Activities in 2012

Under this law, as of 2011, 100 universities established Technology Licensing Offices (TLOs). The intellectual property rights of research outcomes of university professors began to belong formally to universities. In the past individual professors tended to file patents to have them as their personal ownership. After the enactment of law, there has been a significant growth in the field of securing intellectual property rights and technology transfer during the 2003-2011 period. In 2011, the number of technology transfer increased from 210 cases in

2003 to 1,990 cases. Income from technology transfer increased about 47.9 billion in 2011 from about 1.9 billion won in 2003. In regard to overseas patent, 564 cases in 2003 increased to three times and 1,627 in 2011. 2,758 domestic cases in 2003 grew to seven times and 20,205 cases in 2011.

Intellectual property rights and industrial products exchanges has increased 318.6% and the registration of intellectual property rights has increased to 91%. It has increased 203% for technology transfer, and it has increased 454% for loyalty fee income.

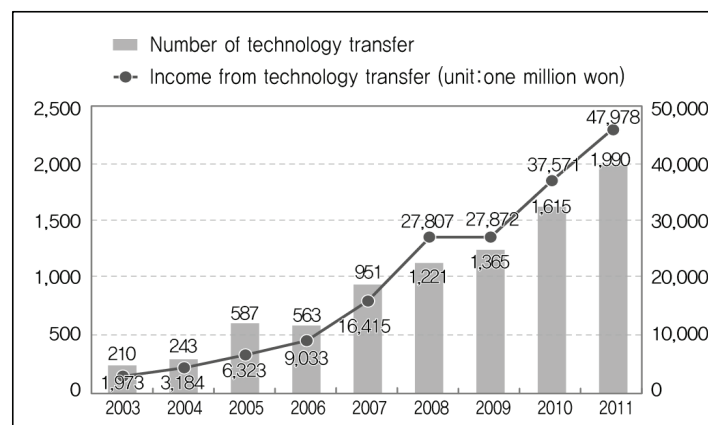


Figure 1. Current number of technology transfer and income from technology transfer, 2003-2011

Source: Ministry of Education, Science & Technology and the National Research Foundation of Korea (2012). Survey on University-Industry Cooperation Activities in 2011

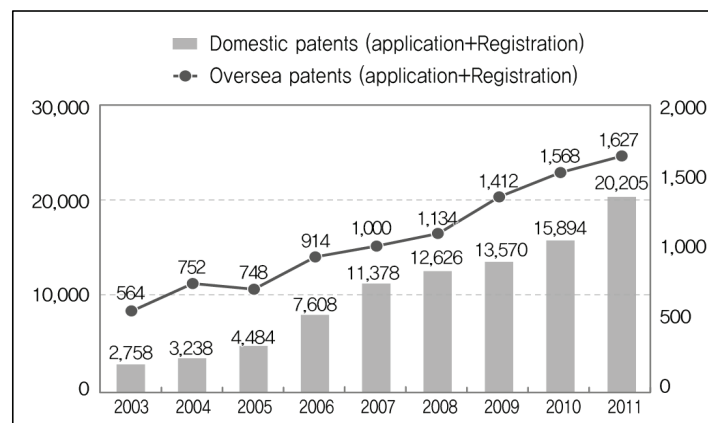


Figure 2. Current status of registration and patent applications at home and abroad, 2003-2011

Source: Ministry of Education, Science & Technology and the National Research Foundation of Korea (2012). Survey on University-Industry Cooperation Activities in 2011

From the point of view of university-industry cooperative education, contract department with industry expands. In department, student population

grew to 2 times than in 2008 by providing cooperative education and training course in specific sector and product.

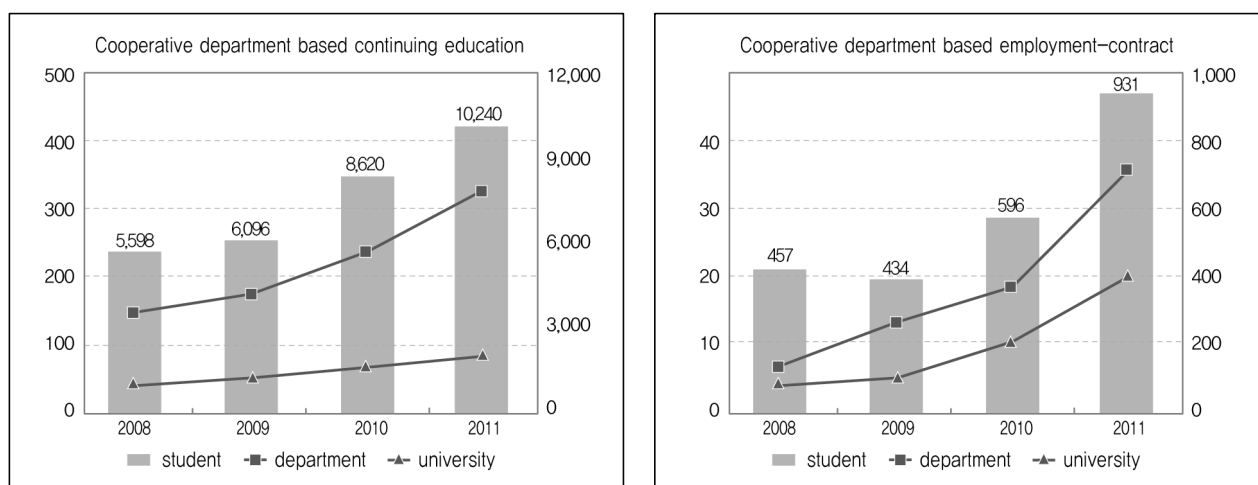


Figure 3. Current status of cooperative education and training in university

Source: Ministry of Education, Science & Technology, the National Research Foundation of Korea (2012). Survey on University-Industry Cooperation Activities in 2011

Another dramatic shift in university-industry cooperation is human capital exchange and faculty consulting in Table 5. The growth in both human

capital exchange and faculty consulting are prevalent in university-industry cooperation.

Table 5. Human capital exchange

Year	Faculty secondments in industry	Industry secondments in university	Number of faculty consulting
2004	1,106	2,480	516
2005	1,485	3,621	828
2006	1,719	4,266	1,344
2007	3,900	5,955	1,661
2008	2,924	4,397	2,160
total	11,134	20,719	6,509

Source: Ryu, J., Kim, J., Park, S. Baek, S., An, K., Cho, J., et al. (2010). Program Evaluation of New University for Regional Innovation (NURI) project. The National Research Foundation of Korea.

4. Conclusions and Discussion

We reviewed the orientation and impact of public policy issues and processes and the Law on industrial education and university-industry cooperation in 2003: how it promotes the institutionalization of the collaborative infrastructure and how it builds foundation rapidly qualitatively in field of university-industry cooperation in Korea. In trend during the 2003-2011 period, there was a fundamental change for each of infrastructure and organization, technology transfer, cooperative education and training, and exchange of human capital in relation between industry and university. We highlight that each is remarkable policy outcomes for building the foundation and institutionalization to achieve long term national policy goal.

Although this paper provides some evidence about university-industry relation patterns, we acknowledge much work remains to be done. This paper provides some initial insight and implications for future research in descriptive way to define, form a typology of university-industry cooperation and demonstrate the development pattern and trend. However it also has a limitation because we do not attempt empirical models and quantitative analyses. The results do not address how policies affect the firm level performance. We leave these issues for future researches.

This article reveals several important findings and questions in evolution of university-industry relations during 2003-2011 period. First, in university-industry cooperation, the enactment of law and policy do not connote different goal and purpose for collaborative activities between firms and universities because policy focuses more on institutionalization and university system (Lee & Koh, 2007). We assume that firm size and industrial sector would be related to behaviors in university-industry cooperation. For instance, large companies (64.3%) experienced the cooperation than small and

medium enterprises (42.2%) (Jeong & Lee, 2008). How collaboration expands to small and medium enterprises (SMEs) and technology ventures? Second, government support the public funding for university infrastructure and operation, but competence and sustainability of university-industry cooperation foundations are not yet independent to make profitable activities. In foundations, only 29.9% work for university-industry cooperation related tasks and 68.1% of employers are less than two years in related work experiences, and professionals are only 9.2% as of 2011 (the National Research Foundation of Korea, 2012). What organizational restructure with professional staffs and management will need to enhance the performance? Third, finding and question is how national governmental support sustains to enhance cooperation between university and firm? Will national government departments play a role in a catalyst or regional government should play an innovative and active role in this policy field?

Taken altogether, there are still many opportunities and limitations in the policy-making process to promote an industrial innovation in the private sector and social innovation and ultimately national development while technology commercialization is a key fundamental in university-industry cooperation, and is most profitable activities in entrepreneurial university. Thus many research opportunities on this topic remain.

In conclusion, we defined the various concepts of university-industry relations, form a typology and overview national university-industry cooperation policy and law during the 2003-2011 periods. We hope this initial research provides an implication and agenda for policy makers and researchers in a variety of disciplinary and methodological perspectives in the field of university-industry cooperation. As this paper demonstrate the formation and development of institutionalization of law and policy, many research opportunities and issues will continue to pursue interdisciplinary approaches and empirical analysis to this research field.

References

- Cohen, W. M, Nelson, R. R. and Walsh, P.J. (2002). Links and Impacts: Survey Results on the Influence of Public Research on Industrial R&D. *Management Science*, 48(1), 1-23.
- Eom, B and Lee, K. (2009). Determinants of Industry-Academy Linkages and Their Impacts on Firm Performance: The Case of Korea as a Late-comer in Knowledge Industrialization. *Research Policy*, 39(5), 625-639.
- Etzkowitz, H. and Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research Policy*, 29(2), 109-123.
- Freeman, C. (1987). *Technology Policy and Economic Performance: the lessons from Japan*. London: Printer Publishers.
- Gerard, G., Shaker A. Z. and Wood, Jr, D. R. (2002). The Effects of Business-University Alliances on Innovative Output and Financial Performance: A Study of Publicly Traded Biotechnology Companies. *Journal of Business Venturing*, Vol. 17(6), 577-609.
- Jeong, H. and Lee, J. (2008). Report on Survey Findings of Firm's relations with university and public institute. Korea Industrial Technology Association.
- Kim, L. (1993). *National System of Industrial Innovation: Dynamics of Capability Building In Korea*. Korea University: Business Management Research Center.
- Kwon S., Song, W., Lee, H. and Tae, S. (2011). Industry-Academy-Laboratory Cooperations Advanced Plan for promoting the open-innovation. National Research Foundation of Korea
- Lee, D.H. (2012). Korea's Corporate RTI Support System: Current Status and Policy Issues. Korea Institute of S&T Evaluation and Planning
- Lee, Y. and Koh, S. (2007). A study on Policy Evaluation Index to promote industry-academy linkage. Korean Technology Foundation.
- Lim, C. (2006). Research Issues Derived from the Study of National Systems of Innovation (NSI) of Small Advanced Nation: Analysis of the International Research Project on the NSIs of 10 Small Advanced Nations. Science & Technology Policy Institute.
- Lundvall, B. A. (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London & New York: Anthem Press.
- Ministry of Education, Science & Technology and National Research Foundation of Korea. (2012). Survey on University-Industry Cooperation Activities in 2011
- National Science and Technology Commission of Korea. (2012). Comprehensive Plan to promote integration of Industry, Academia, Public institute for National R&D projects.
- OECD (2002). Benchmarking industry-science relationships.
- Park, M and Lee, H. H. (2012). Factor Analysis on the Impact of Technical Cooperation Between Large firms and SMEs in South Korea. *Journal of Information Technology Architecture*, Vol.9 (2), 199-207.
- Park, J., Um, C., Lee, J. and Hwang, W. (2000). Reflection and Perspective of University Industry linkage in Korea. Institute of Industry Academy Management Technology
- Pavitt, K. (1984). Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory. *Research Policy*, 13 (6), 343-373.
- Ryu, J., Kim, J., Park, S. Baek, S., An, K., Cho, J., et al. (2010). Program Evaluation of New University for Regional Innovation (NURI) project. National Research Foundation of Korea.
- Smilor, R. W., Gibson, D.V. & Dietrich, G. B. (1993). The Entrepreneurial University: The Role of Higher Education in the United States in Technology Commercialization and Economic Development, *International Social Science Journal*, 45(1).