
Overseas Research and Development Activities of Korean ICT Enterprises in Emerging Countries

Jeongseon Seo*

Abstract

With the globalisation of the world's economies and the increasing role of multinational corporations in the generation of knowledge, global research and development (R&D) activities in emerging countries are following a new trend. This paper describes case studies of two large companies and discussion of the motives (demand vs. supply) and tasks (demand-driven vs. supply-driven) of R&D activities outside their home country. This work is based on an analysis of four overseas R&D units of two Korean ICT companies – here, ICT refers to goods and services in the information technology and communication technology fields – in India and China. The research findings are as follows: (1) The overseas R&D activities of Korean ICT enterprises in emerging countries may be driven by a combination of demand and supply factors of host countries; and (2) Korean overseas R&D centres in emerging countries may need to carry out both demand- and supply-driven tasks in view of the overlap between demand and supply factors of the host countries. Based on the results of this research, the following policy implications can be drawn for encouraging more effective overseas R&D activities of Korean enterprises in emerging countries. First, the government needs to expand the support systems so that enterprises can manage local R&D centres more effectively and actively use the variety of local support systems and useful information. Second, the government needs to expand the support systems so that the overseas R&D centres of Korean enterprises revitalise collaborations with locally excellent universities and research institutions.

Keywords

R&D globalisation, demand vs. supply motives, demand- vs. supply-driven tasks, emerging countries

1. INTRODUCTION

With the globalisation of the world's economies and the increasing role of multinational corpora-

* Doctoral researcher, Science and Technology Policy Research (SPRU), University of Sussex, Science and Technology Policy Research (SPRU), Jubilee Building, University of Sussex, Falmer, Brighton, BN1 9SL, United Kingdom, js327@sussex.ac.uk

tions (MNCs) in the generation of knowledge, emerging countries such as China and India have come to occupy an increasingly important position in the world economy. Recently, global research and development (R&D) activities in emerging countries, which were principally conducted by United States and European firms, are following a new trend. As the importance of R&D increases because of rapid technological change and a shortening product lifecycle, many leading MNCs in the world have already established (or are in the process of establishing) R&D centres in emerging countries. Several studies have been carried out in relation to the global R&D activities of leading MNCs in developed countries; however, this field of investigation is now expanding into the emerging countries.

Most Korean companies have principally conducted their R&D activities at the home location, i.e., in Korea. However, Korean corporations, which in the past have been passive in setting up foreign R&D activities, are now expanding the geographical domain of their activities into the rest of the world, including developed countries as well as emerging countries, though only a small number of companies from Korea are conducting global R&D activities to date. In particular, Korean ICT companies – here, ICT refers to goods and services in the information technology and communication technology fields –, which enjoy strong competitiveness in the world market, are operating more foreign R&D centres compared with those in other sectors. Few studies have focused, however, on the global R&D activities conducted by Korean companies and their research in emerging countries. Therefore, further investigation on this topic is needed to provide both empirical evidence on the trends of the world's R&D and feedback regarding theoretical approaches to MNCs and to the internationalisation of innovation processes in emerging and catching-up countries.

Based on these propositions, the purpose of this study was to examine the R&D globalisation of Korean enterprises in locational terms between China and India and to draw policy implications for more effective overseas R&D activities of Korean enterprises from them. For this research objective, this study involved the following two questions: (1) What are the motives of overseas R&D activities of Korean ICT enterprises in emerging countries? and (2) What do the overseas R&D centres of Korean ICT enterprises carry out in the emerging countries?

2. LITERATURE REVIEW

2.1. Globalisation of R&D

The internationalisation of R&D is no longer a new phenomenon. The reason that the R&D activities of MNCs are decentralised could be as follows. First, to diversify their knowledge channels around the world, companies should set up subsidiaries to share and transfer new knowledge from local environments to headquarters (Kuemmerle, 1997). In particular, for large-sized firms, R&D is perhaps the best method to accumulate new knowledge and skills; thus, they conduct internationalisation of research for the internationalisation of technological activity (Cantwell, 1995). Second, with a highly competitive world market, firms should release and dispatch new products as soon as possible (Kuemmerle, 1997).

With the growing number of MNC overseas R&D centres, many researchers have analysed the global R&D activities of MNCs. Most studies have identified the type of R&D as support-oriented R&D (demand-driven R&D) or knowledge sourcing (supply-driven R&D) and suggested factors affecting foreign R&D centres of MNCs (Zejan, 1990; Håkanson & Nobel, 1993b; Odagiri & Yasuda, 1996; Kumar, 1996, 2001; Iwasa & Odagiri, 2004; Shimizutani & Todo, 2008). For the former demand-driven case, influences are local market needs and size of the market, with the R&D centre focusing on market expansion; for the latter supply-driven case, influences are related to the quality, size, and specialisation of the knowledge base, with the R&D laboratory mostly located in places such as local universities or research parks (von Zedtwitz & Gassmann, 2002). Since the coexistence of the two types has been discovered, the quantity of global R&D centres and the complexity of foreign R&D activities have deepened, and some researchers have considered both types at the same time (Håkanson & Nobel, 1993b; Ito & Wakasugi, 2007). Other authors have also studied different factors amongst the leading reasons to carry out R&D activities abroad, such as non-technical considerations (e.g., monitoring the competition), political imperatives (e.g., government incentives and innovation-supporting tax), and policy reforms of intellectual property rights (IPRs) - here, IPRs mean exclusive rights by a company to have patents, copyrights and/or trademarks- (De Meyer, 1993; Jones & Davis, 2000; Ito & Wakasugi, 2007).

2.2. R&D Activities in Emerging Countries

With globalisation of the world economy and the fast-growing economies of emerging countries, MNCs' interest in the latter is increasing. Amongst these, China and India are locations where MNCs are already operating several R&D centres, yet studies that relate to them are rare (Asakawa & Som, 2008). These two countries offer many possibilities and opportunities but also simultaneously entail high risks. Studies addressing the selected countries have focused on obstacles to local R&D activities such as technology leakage and reproduction and protection of IPRs (Gassmann & Han, 2004; Zhao, 2006; von Zedtwitz et al., 2007; Yang & Jiang, 2007; Asakawa & Som, 2008). Some studies mention the motivation of local R&D operations and local R&D activities along with other issues, in particular targeting China (Li & Zhong, 2003; Gassmann & Han, 2004; Lu & Liu, 2004; von Zedtwitz, 2004; Li & Yue, 2005; Walsh, 2007). They consider the huge pool of human resources, large markets, and the government's favourable policy towards local R&D activities of MNCs as important drivers in the decision to undertake R&D activities in the host country.

3. RESEARCH AND METHODOLOGY AND DATA COLLECTION

This research employs in-depth case studies of the leading Korean ICT companies and their foreign R&D operations in emerging countries. Korean ICT firms lead the world's technical markets; in particular, Samsung Electronics and LG Electronics are heading this trend. In addition, of the total overseas R&D centres operated by the Korean ICT companies, most in the emerging countries are run by these selected firms. Based on this particular background, a methodology of in-depth case studies has been selected for this research. To gather such data, this study has adopted the following

three methods: a review of secondary materials, conducting a survey, and an interview programme. *Review of secondary materials:* The basic and broad trends of information are collected from secondary materials such as company annual reports and historical anniversary publications, newspapers, technical literature, and internet searches. In general, these secondary sources provide the background knowledge on the companies' global activities and their history and evolution processes related to technology issues, as well as information on the global trends and characteristics of the ICT sector.

Conducting the survey and interview programme: Detailed information is collected by a survey using a formal structured questionnaire and by in-depth interviews using a semi-structured questionnaire. Ahead of conducting both methods, a list of all known external R&D centres in China and India was developed and finalized after much work to confirm its validity. Next, the validity of the content of the questionnaires was confirmed through a pilot feasibility study and interviews with experts in this field. The aim of this activity was to ensure that the prospective respondents understood what questions were being asked in relation to the measurements specified, the general contents of the semi-structured questionnaire, and its composition. Through this process, improvements in the clarity of the wording and questionnaire formalities were applied to the final product. The survey questionnaires were sent by email to identified contacts. These were senior managers in the R&D centres, who are generally recognised as best able to provide suitable answers for the topics surveyed. For the purpose of securing head offices' viewpoints related to the global R&D activities, the interviews mostly involved personnel in the headquarters and domestic R&D centres. Basically, face-to-face interviews were conducted; however, they were performed by e-mail or telephone in different situations. If there were ambiguities in either case, a follow-up survey or interview was performed to resolve them. Collected data from both methods were cross-checked and integrated to produce a combination of quantitative and qualitative evidence.

4. DISCUSSION OF FOUR CASES

The four cases selected are from the overseas R&D centres of Samsung Electronics (hereafter SEC) and LG Electronics (hereafter LGEC) (Table 1). SEC, which manufactures and sells both complete products and components, is one of the leading companies in the global electronics market. The main business areas are home appliances, home entertainment products, telecommunication products, semiconductors, and LCDs. SEC had a total of 14 foreign R&D centres all over the world as of the end of 2011. Amongst these, the company operates eight laboratories in emerging countries such as Russia, India, China, and Poland. Of those centres, the numbers of R&D units in India and China are two and four, respectively (SEC, 2012).

LGEC is also one of the largest electronics companies in the world market. It mainly focuses on home entertainment products, home appliances, and telecommunication products. Of 20 foreign R&D centres excepting four design centres, 12 laboratories are located in emerging countries including Brazil, Russia, India, and China as of the end of 2011. Amongst these, six centres are in China and two laboratories are in India (LGEC, 2012).

TABLE 1. Description of cases

Item	Unit	A	B	C	D
Parent company		Samsung Electronics	LG Electronics	Samsung Electronics	LG Electronics
Year of establishment		1996	1996	2000	2000
Host location		Bangalore, India	Bangalore, India	Beijing, China	Tianjin, China
Entry mode		Greenfield	Greenfield	Greenfield	Greenfield
Main R&D activities		Software for mobile, semiconductors, and digital printing	Software for mobile phones	Telecommunication	Digital appliances
R&D employees as of 2009		2100+	700+ (as of 2008)	530+	130*+

Note: The number of R&D employees of LGEC in Tianjin was around 600 as of 2008, if the engineers working in the laboratories in production facilities are included.

4.1. Units A and B in India

Established in 1996 in Bangalore, India, SEC's software centre (hereafter Unit A) and LGEC's software centre (hereafter Unit B) were the first foreign software centres respectively established by the two companies. Both R&D centres started operating with small numbers of engineers; however, they developed into the largest foreign R&D centres respectively in each company. Unit A was set up to develop application software for products of the headquarters in some specific fields (e.g., information systems, semiconductors, multimedia products, and computers), while Unit B aimed to carry on the software business, targeting the world market, as well as to provide support for the headquarters.

There are, however, many similarities in the decision-making processes for establishing the software centres of two such different companies. Procuring cheap but talented engineers and using them to develop software technology were the main motives for both units. Owing to the efforts of the Indian government to promote the software industry, India has advanced technology and human resources in the selected field, and Bangalore is one of the most specialised zones for software in the host country. For this reason, both companies selected Bangalore as the location for their software centres despite the poor industrial infrastructure of India. The former president of SEC, South West Asia, Mr. H.B. Lee explained that "India is a country to provide advanced technology and human resources after the United States" (Money Today, 19 February 2008). Then-president Mr. J.G. Kang also expected that SEC would benefit from the cheap but talented engineers of the host country in their R&D activities on software technology, an important consideration in the decision to establish an R&D unit in India (SEC, 2009a). Similarly, a former vice president of Unit B, Mr. H.J. Choi, said that "the establishment purpose [of Unit B] is to challenge the world market using Indian software engineers who are the strength of India" (Busan Ilbo, 7 December 2001).

Along with the supply factors, the demand factors were an important driving force to set up both Units A and B (Table 2). A former head of Unit A, Mr. J.Y. Kim, said when established that "our [Unit A's] ultimate goal is to develop low-cost software that is appropriate for local markets [in the world]" (Press release of Samsung Group, 26 February 1996), and Mr. H.J. Choi said at the beginning that "it [Unit B] put about 70 percent of the whole works into targeting the global market such as the American and European markets" (Busan Ilbo, 7 December 2001). In this way, undertaking

software development projects for the global market was an important task from the outset for the R&D units of the two companies; however, this does not mean that the size and growth potential of the Indian market were not important driving factors in the decisions of the two companies (Survey, Units A and B).

At the time, India had more serious concerns with economic standards and social infrastructure than it now has; however, the host country was showing a 15 percent annual increase in the extant electronics market, which was expected to be valued at some \$US 27 billion by 2005. In addition, the penetration rates of electronics products and mobile phones were low¹ despite a population of more than one billion, so that India was regarded as a market with growth potential as high as China's. In these circumstances, SEC established a plan for a large-scale investment in India, which consisted of three stages, to be one of the three major companies in the host country. Amongst these, establishing a software centre was included in the first stage (Press release of Samsung Group, 26 February 1996). The situation was very much the same with LGEC. With the expectation of market growth, the company established a project team for the Indian market invasion, a group of eight talented staff from several fields including planning, marketing, and R&D in 1995, and founded a local subsidiary over two years (LGEC, 2008).

Unit A focuses on software development for mobile technology, digital printing, and memory solutions. In particular, the mobile team, which is one of the oldest and biggest teams at Unit A, carries out the various software development projects for mobile devices from low-level tasks such as commercialisation for local markets including the Indian market (known as 'localisation') to the high-level tasks of developing the platform and operating system (OS). Similarly, Unit B concentrates on software development for mobile devices at the various levels.

TABLE 2. Factors considered important when establishing Units A and B

Factors	Items	Values for Unit A	Values for Unit B
Supply factors	Excellent information and communication systems	Very important	Somewhat important
	Locally excellent technology	Very important	Fairly important
	Locally excellent human resources	Very important	Very important
	Locally moderate costs of R&D	Very important	Extremely important
Demand factors	Market size and potential for growth	Very important	Extremely important
	Lack of competition in local market	Not applicable	Fairly important
	Expectation as foothold for surrounding areas	Not applicable	Fairly important

Notes: Data were measured using a five-point Likert scale. In data columns, "Extremely important" = 5, "Very important" = 4, "Fairly important" = 3, "Somewhat important" = 2, "Not at all important" = 1, and "Not applicable" = 0.

¹ In India, the distribution rate of mobile phones was just 4 percent as of 2004. Because of the large population, however, the number of subscribers exceeded 45 million; moreover, 30,000 people daily and 1.6 million people each month were becoming new members (Yonhap News, 5 December 2004).

4.2. Unit C in China

In 2000, Unit C of SEC was founded in Zhongguancun, Beijing, China, to develop CDMA (Code Division Multiple Access)-based 3G mobile technology for the Chinese market. Because by then the number of Chinese mobile phone subscribers surpassed 60 million, the host country rapidly rose to become the world's second-largest market, after the United States (Press release of Samsung Group, 15 September 2000). The Chinese CDMA-based market where SEC provided telecommunication equipment was also expected to grow. The market size and potential for growth in the telecommunication industry were important drivers for Unit C (Survey, Unit C; Table 3). Such demand factors, however, were not the only reasons to establish Unit C. The pool of available high-quality engineers was also a major consideration (Survey, Unit C) because Zhongguancun is a leading technology hub in China. In other words, there were both market and supply factors involved in the decision to set up Unit C.

Fostering next-generation telecommunication technologies for the Chinese market and developing key technologies and products needed in China by local engineers were the primary motives for Unit C. SEC first transferred the synchronous IMT-2000² and mobile handset technologies to Unit C and started the development project for CDMA-based 3G technology for the Chinese market. Since then, it has focused on the standardisation and commercialisation of telecommunication technology and products for the Chinese market. In particular, Unit C developed the world's first TD-SCDMA (Time Division-Synchronous Code Division Multiple Access) mobile phone through collaboration with headquarters in 2004. The wireless telecommunication technology that Unit C developed was adopted as China's wireless standard by the China Wireless Telecommunication Standards, which defeated Qualcomm's and Bell's research centres (Seoul Shinmun, 23 July 2004). Because Unit A was designated as an operating organisation of a postdoctoral programme, it cultivates people of talent as well as participating in Chinese national projects for the next-generation telecommunication technologies with outstanding local universities and research institutes.

TABLE 3. Factors considered important when establishing Unit C

Factors	Items	Values for Unit C
Supply factors	Excellent information and communication systems	Fairly important
	Locally excellent technology	Fairly important
	Locally excellent human resources	Very important
	Locally moderate costs of R&D	Fairly important
Demands factors	Market size and potential for growth	Very important
	Lack of competition in local market	Not at all important
	Expectation as foothold for surrounding areas	Fairly important

Notes: As for Table 2.

² IMT (International Mobile Telecommunication)-2000 refers to mobile multimedia telecommunication systems to allow communication with anyone at anytime and anywhere using various media over the existing 'CDMA-One' in 1997, which was organised by four major North American telecommunication companies, Lucent Technologies, Motorola, Nortel, and Qualcomm to standardise IMT-2000. Through this activity, SEC secured fundamental technologies and key components first by the end of 1998 (SEC, 2009b).

4.3. Unit D in China

To develop digital appliances for the Chinese market, Unit D of LGEC was sited in Tianjin, China, where LGEC established its production corporation and operates the production complex for digital appliances³(LGEC, 2008). The primary motives of Unit D are promoting technology and human resources in home appliances and developing new technology and products for the Chinese market. As in the case of Unit C, both market and supply factors were important considerations in the decision to set up Unit D (Survey, Unit D; Table 4). Developing low- and middle-priced goods that compete with products of local companies is one of the main activities of Unit D. The tasks of technology exploitation such as improvement of existing product technology, however, are not everything. Unit D is actively engaged in work on technology exploration such as development of new product technology, e.g., for a power-saving air-conditioning system with two refrigerant compressors (Twin Power Cooling System).

As a result of focusing on the development of future home appliances for the Chinese market, Unit D applied for around 3,000 patents between 2001 and 2003, and the number of applications had already reached over 5,000 in 2004. Owing to these R&D activities, Unit D was selected as a ‘company with national technology’ in 2004, which was the first foreign-funded enterprise to be put in this category. It was also designated as a training institute for post-doctoral researchers in 2006. In addition, to secure outstanding engineers and to take Unit D (which has relatively low-level R&D capability) to a level of headquarters excellence, LGEC singles out approximately 100 engineers from Unit D and laboratories in production facilities and sends them to headquarters for a two-year training programme. Because of the efforts of LGEC, Unit D is also engaged in developing global premium products through close collaboration with engineers dispatched from headquarters.

TABLE 4. Factors considered important when establishing Unit D

Factors	Items	Values for Unit D
Supply factors	Excellent information and communication systems	Fairly important
	Locally excellent technology	Very important
	Locally excellent human resources	Very important
	Locally moderate costs of R&D	Fairly important
Demand factors	Market size and potential for growth	Extremely important
	Lack of competition in local market	Fairly important
	Expectation as foothold for surrounding areas	Very important

Notes: As for Table 2.

² The Tianjin production complex for home appliances was founded in Tianjin, China, in 1995, which is the sixth production corporation of LGEC in China. It aimed to accelerate entry into the Chinese market and thus build up the foundations for global production systems. The Tianjin production complex started to manufacture air conditioners and microwave equipment from 1996. It expanded the production facilities and diversified products in 1997. As a result, it produced electric motors and air-conditioner compressors from 1997 and 1998, respectively. As its production scale largely expanded in 2000, it became the greatest production facility located in the north of China. The Tianjin production complex additionally set up a new plant for microwaves and manufactured magnetrons in 2002 (LGEC, 2008).

5. ANALYSIS OF THE CASES

In terms of the two aspects of globalisation of R&D, this section analyses the four cases in the emerging countries: demand vs. supply motives and demand-driven vs. supply-driven tasks.

5.1. Demand vs. Supply Motives

In this study, there were demand factors amongst the motives of overseas R&D activities of Korean ICT companies in emerging countries, though the two host countries showed them to varying degrees. The market size and potential for growth of the host country were the most important factors in the decision to establish the R&D centres in emerging countries. China, where Units C and D were founded, is a big but fiercely competitive market where dozens of global major companies and local firms clash. Both units mainly carried out the R&D activities for the Chinese market from the beginning while Units A and B were not focused on the Indian market in software development initially. However, the Korean companies expected when they decided to establish R&D units that the market in a certain field in the host countries was going to expand in accordance with underlying economic growth. Those units have thus also been conducting technical activities for local markets in terms of the market growth in the host country.

With the demand factors, supply factors were also found amongst the influences on foreign R&D activities of two companies in emerging countries. For all R&D units, the excellent local technology and human resources were primary factors for undertaking R&D activities in both host countries. Korean ICT companies highly appreciated Indian engineers' technology capabilities and, importantly, considered those advantages (cheap, talented, and English-speaking) from a long-term point of view when they decided to establish foreign software centres (Units A and B) in the host country, though the local engineers were not engaged in the development projects for advanced software technology from the beginning. Established in China, both Units C and D were founded to develop technology and products for the local market using local engineers at the host location. The pool of high-quality engineers is one of the strengths of the host country. To use local technology capabilities, these R&D units are located in places that allow continuing easy access to universities and/or research institutes for technology acquisition and exchange.

Finding 1. The overseas R&D activities of Korean ICT enterprises in emerging countries may be driven by a combination of demand and supply factors of host countries.

Demand-driven (technology exploitation) vs. supply-driven (technology exploration) tasks

In these cases, there was a demand-driven motive in the intention to undertake the R&D activities in emerging countries. Unlike Units C and D, Units A and B focus on software development, in many cases to support technically the products in specific fields. These R&D units do not directly develop products, but they supply specialised support services for specific markets based on customer demands such as localisation of products. Their technical activities were mainly to obtain an increasing market share in large global markets initially while they also undertake R&D activities for Indian customer demands at present. All R&D units target the improvement of existing product

technology. In particular, Unit A is engaged in localisation tasks of core R&D conducted by the headquarters.

On the other hand, Units C and D were positioned to develop technology and products for the Chinese market in the telecommunication and home appliances areas, respectively. SEC transferred advanced telecommunication technologies to Unit C; this R&D centre exploited them to develop technology and products for the Chinese market. Unit D undertakes the improvement tasks of existing product technology for the Chinese market as well as collaborating with engineers dispatched from the headquarters of LGEC. Both R&D units also localise the core R&D conducted by the headquarters.

In all R&D units, however, a dual motive driven by demand and supply factors is found. These R&D centres are involved in improving local technology capabilities as well as generating new technology and products. Units A and B undertake low-level tasks for local markets in software development projects; however, they are also engaged in high-level tasks, e.g., developing the platform and operating system. Similarly, Units C and D apply for many patents while they develop new technology and products for the Chinese market. They also operate a training programme for local technical professionals and collaborate with local knowledge organisations.

Finding 2. Korean overseas R&D centres in emerging countries may need to carry out both demand- and supply-driven tasks in view of the overlap between demand and supply factors of the host countries.

6. CONCLUSIONS AND IMPLICATIONS

This study examined the overseas R&D activities of Korean ICT companies in emerging countries in terms of motives (market vs. supply) and tasks (demand-driven vs. supply-driven) of R&D activities abroad. This research is based on four overseas R&D units of two Korean ICT companies in India and China. The research findings are as follows: (1) The overseas R&D activities of Korean ICT enterprises in emerging countries may be driven by a combination of demand and supply factors of host countries; and (2) Korean overseas R&D centres in emerging countries may need to carry out both demand- and supply-driven tasks in view of the overlap between demand and supply factors of the host countries.

Based on the results of this research, the following policy implications can be drawn for encouraging more effective overseas R&D activities of Korean enterprises in emerging countries. First, the government needs to expand support systems so that enterprises can manage local R&D centres more effectively and actively use the variety of local support systems and useful information. One of the difficulties that Korean enterprises encounter when operating global R&D centres is that sharing useful information about the R&D is not easy. This facilitation is needed especially by followers that do not actively conduct overseas R&D activities in areas like pharmaceuticals, where it

becomes most important to share information on local government policies, regulations, and procedures and incentives for R&D.

Second, the government needs to expand the support systems so that the overseas R&D centres of Korean enterprises revitalise collaborations with locally excellent universities and research institutions. Even though the number of overseas R&D centres of Korean enterprises is gradually increasing, the number of their collaborations with such local research institutions is still small. Many factors might explain this paucity, such as the possibility of leaking core technologies or cultural differences between organizations, including intellectual property piracy; however, it is necessary to expand the existing systems so that Korean enterprises can more effectively conduct overseas R&D activities through using locally excellent professionals and technologies for solving these problems.

On the other hand, this research focuses on motives and tasks of global R&D units of Korean ICT enterprises in emerging countries and thus suggests a rough policy direction for overseas R&D but does not delineate specific policy issues. This study has concentrated only on finding implications based on an understanding of the research results. Therefore, it reserves for follow-up studies more specific and practical policy suggestions and improvements to support the foreign R&D activities of companies and the great ripple effects expected from them.

REFERENCES

- Asakawa, K., & Som, A. (2008). Internationalization of R&D in China and India: Conventional wisdom versus reality. *Asia Pacific Journal of Management*, 25(3), 375-394.
- Busan Ilbo. (2001, December 7) Various issues. Retrieved from <http://www.busan.com> (in Korean)
- Cantwell, J. (1995). The globalisation of technology: what remains of the product cycle model? *Cambridge Journal of Economics*, 19, 155-174.
- De Meyer, A. (1993). Management of an international network of industrial R&D laboratories. *R&D Management*, 23(2), 109-120.
- Gassmann, O., & Han, Z. (2004). Motivations and barriers of foreign R&D activities in China. *R&D Management*, 34(4), 423-437.
- Håkanson, L., & Nobel, R. (1993a). Foreign research and development in Swedish multinationals. *Research Policy*, 22, 373-396.
- _____. (1993b). Determinants of foreign R&D in Swedish multinationals. *Research Policy*, 22, 397-411.
- Ito, B., & Wakasugi, R. (2007). What factors determine the mode of overseas R&D by multinationals? Empirical evidence. *Research Policy*, 36, 1275-1287.
- Iwasa, T., & Odagiri, H. (2004). Overseas R&D, knowledge sourcing, and patenting: an empirical study of Japanese R&D investment in the US. *Research Policy*, 33, 807-828.
- Jones, G., & Davis, H. (2000). National culture and innovation: implications for locating global R&D operations. *Management International Review*, 40, 11-39.
- Kuemmerle, W. (1997, March-April). Building effective R&D capabilities abroad. *Harvard Business Review*, 61-70.
- Kumar, N. (1996). Intellectual property protection, market orientation and location of overseas R&D activities by multinational enterprises. *World Development*, 24(4), 673-688.
- _____. (2001). Determinants of location of overseas R&D activity of multinational enterprises: the case of US and Japanese corporations. *Research Policy*, 30, 159-174.
- LG Electronics. (2008). *Samsung Electronics 50 – year history* (Vol. 1). Seoul, Korea.
- _____. (2012). *2011 Annual report*. Seoul, Korea.
- Li, J., & Yue, D. R. (2005). Managing global research and development in China: Patterns of R&D configuration and evolution. *Technology Analysis and Strategic Management*, 17(3), 317-337.
- Li, J., & Zhong, J. (2003). Explaining the growth of international R&D alliances in China. *Managerial and Decision Economics*, 24(Special Issue), 101-105.
- Lu, L., & Liu, J. (2004). R&D in China: An empirical study of Taiwanese IT companies. *R&D Management*, 34(4), 453-465.
- Money Today. (2008, February 19) Various issues. Retrieved from <http://www.mt.co.kr> (in Korean)
- Odagiri, H., & Yasuda, H. (1996). The determinants of overseas R&D by Japanese firms: And empirical study at the industry and company levels. *Research Policy*, 25, 1058-1079.
- Samsung Electronics. (2009a). *Samsung Electronics 40 – year history* (Vol. 1). Seoul, Korea.
- _____. (2009b). *Samsung Electronics 40 – year history* (Vol. 2). Seoul, Korea.
- _____. (2012). *2011 Annual report*. Seoul, Korea.

- Samsung Group. Various issues. Retrieved from <http://www.samsung.co.kr> (in Korean)
- Seoul Shinmun. (2004, July 23) Various issues. Retrieved from <http://www.seoul.co.kr> (in Korean)
- Shimizutani, S., & Todo, Y. (2008). What determines overseas R&D activities? The case of Japanese multinational firms. *Research Policy*, 37, 530-544.
- von Zedtwitz, M. (2004). Managing foreign R&D labs in China. *R&D Management*, 34(4), 439-452.
- von Zedtwitz, M., & Gassmann, O. (2002). Market versus technology drive in R&D internationalization: Four different patterns of managing research and development. *Research Policy*, 31, 569-588.
- von Zedtwitz, M., Ikeda, T., Gong, L., Carpenter, R., & Hamalainen, S. (2007). Managing foreign R&D in China. *Research Technology Management*, 50(3), 19-27.
- Walsh, K. (2007). China R&D: A high-tech field of dreams. *Asia Pacific Business Review*, 13(3), 311-319.
- Yang, Q., & Jiang, C. X. (2007). Location advantages and subsidiaries' R&D activities in emerging economies: Exploring the effect of employee mobility. *Asia Pacific Journal of Management*, 24(3), 341-358.
- Yonhap News. (2004, December 5). Various issues. Retrieved from <http://www.yonhapnews.co.kr> (in Korean)
- Zejan, M. C. (1990). R&D activities in affiliates of Swedish multinational enterprises. *Scandinavian Journal of Economics*, 92(3), 487-500.
- Zhao, M. (2006). Conducting R&D in countries with weak intellectual property rights protection. *Management Science*, 52(8), 1185-1199.