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Spatial Demand Estimation for the Knowledge-Based Industries in the Capital Region of Korea*

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지식기반산업의 입지수요추정*

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Abstract : There is very high preference for the firms to locate in the Capital region, the City of Seoul and its surrounding areas, which inevitably meets diverse types of regulations to prevent over-concentration in Korea. In order to suggest an urgent need to reform these regulations, the demand for knowledge-based industries is estimated. A logit model is employed to estimate the demand of relocation of the current firms based on a survey conducted in 2001. A logistic curve is used to forecast the demand of new start-ups in Korea. The lands for industrial use only are estimated as many as 2.1 million~3.9 million pyung(1 pyung=3.3m^2) in nation-wide. Considering affiliate facilities and infrastructures, 3.1 million~5.9 million of industrial area should be developed in Korea for next five years. Since the rents are very high and the available land is short in the southern parts of Seoul, where most knowledge-based firms locate right now. Many firms have considered relocating on any other places where there exist a plenty of lands available and cheaper rents and cheaper wage rates, but still not far away from Seoul so that they could obtain new advanced information, skilled labors, venture capitals, and high quality of producer services. The Capital region, especially Gyeonggi and Incheon, is the only place to meet those conditions in Korea.

Key Words : knowledge-based industries, demand estimation, logit model, regulation on the Capital region

요약 : 수도권은 기업의 입지선호도가 높고 수요가 많아 중앙정부는 오랜 기간동안 수도권정비계획법 등 다양한 법규와 정책으로 수도권지역의 과밀억제를 방지하는 노력을 하고 있다. 이 논문은, 이론적 분석을 통해 지식기반산업의 발전을 위해서는 지식기반산업의 입지특성과 네트워크 형성의 성격에 맞는 입지수요의 충족이 필요하다고 제시했으며, 지식기반산업의 입지수요 추정모형을 제시하고, 사례조사를 통해 입지수요를 분석하였다. 2001년 후반기에 실시한 지식기반기업에 대한 입지이전과 신규입지에 대한 수요조사를 기초로하여 로짓모형을 설정하였다. 분석결과, 향후 5년동안의 우리나라 지식기반산업 입지수요는 약 310~590만평인데 반해, 국토 전체의 산업용지는 210~390만평밖에 되지 않는 것으로 드러났다. 특히 서울남부지역은 지식기반기업의 입지수요는 무척 높은데 비해 가용지가 많지 않고 지가가 너무 높아, 많은 기업들이 이전을 고려하고 있으나, 정보, 숙련 노동력, 모험자본, 고차 사업 서비스 등의 사업여건이 구비된 곳은 수도권뿐임이 드러났다. 이 연구에서는 분석결과를 토대로 정책적 시사점을 제시하였다.

주요어 : 지식기반산업, 수요추정, 로짓모형, 수도권규제

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1. Introduction

Industrial restructuring towards knowledge-based economy has much to do with spatial restructuring at the metropolitan level. The term "knowledge-based industries" usually refers to those industries which are relatively intensive in their inputs of technology and/or skills, *i.e.* human capital. There is generally a close correlation between R&D in an industry and investment in human capital. Usually, in addition to the commonly identified manufacturing industries, service activities such as finance, insurance and communications are included in the category of knowledge-based industries.

These industries have high propensity to formulate clusters and these clusters have even higher orientation toward locating in metropolitan areas. Knowledge-based industrial clusters, by creating atmosphere of innovation through dense networking between firms, research institutes, universities, and other intermediary institutions, further attract more firms in those areas.

There is a policy dilemma whether or not to allow by market principle all the firms concerned to locate where they prefer. In the Korean case, there is very high preference to the Capital region, the City of Seoul and its surrounding areas, which inevitably meets diverse types of regulations to prevent over-concentration in this region (Choo *et al.*, 2002).

What matters, however, is that there is high demand for some specific areas as the destinations of knowledge-based industrial firms and we need some information on that. Regulations should, if any, be applied according to firms' demand and sometimes differently to the characteristics of the demand. How to estimate this demand is the focus of the study.

1) Development of Knowledge-based Industries and Their Clusters

Knowledge-based industries are buzzwords in this rapidly changing world. Theorists argue that knowledge transmission and learning process in innovative milieu can be working with high skilled workers, high-tech provisions, institutional thickness, and networking, just list a few. As Park (1996) and Park and Markusen (1995) argue, however, all the industrial clusters do not always follow the Marshallian type developmental path, based on 'flexibly specialized', indigenous, high-tech, innovative small firms. In another setting, especially East-Asian economies, both the central and local governments policies, large, multinational firms, local boosters, and locational advantages are important in the cluster-building process (Coe and Townsend, 1998; Maskell, 2001; Santos, 2000).

Industrial clusters are usually defined as 'a critical mass of firms in a region of the same, closely related or complementary sectors (Rosenfeld, 1997)'. Such clusters typically consist of very similar types of firms selling similar consumer or household design-intensive products. Italian industry clusters often consist of commodity or raw material inputs that are transformed by cooperating producers employing similar production technologies and cooperative cultures (Altenburg and Meyer-Stamer, 2000; Braczyk, Cooke, and Heidenreich, 1998; Capello, 1999; Jones, 1998). As Porter(1988) pointed out, traditional advantages of industrial agglomeration based on urbanization economies such as cost minimization due to proximity to inputs or markets have been undercut by the economic globalization process, and the nature of economies of agglomeration has shifted toward the cluster level and away from either narrower industries or urban areas *per se*.

The most well known knowledge-based industrial clusters of the world are Silicon Valley, Route 128, and Silicon Alley. All of them are based on the spontaneous cross-fertilization between local universities and research laboratories and established high technology companies through dominant practices such as subcontracting non-core business activities, partnering in research and product development, intra-networking, entrepreneurship, and practicing

knowledge diffusion by the creation of spin-offs. They are especially interested in the growth and development potential of local and regional economies and the possible positive effects on employment (Maskell and Malmberg, 1999; Martin and Sunley, 2003; OECD, 2001; Swann, Prevezer, and Stout, 1998).

These experiences and lessons of the known knowledge-based industrial clusters suggest that policy makers should aim at maintaining a high level of information flow for positive feedback from innovation process. Government's effort to facilitate dynamic synergy can be differentiated according to the evolutionary phase of industrial clusters. For the simple industrial agglomeration and industrial park, physical infrastructure, business support functions such as management, marketing, information, administration, legal supports, and market information are needed in order to link local firms. These kinds of direct support or hardware provision of government should be transformed to indirect or software provision for the development of a successful industrial clusters. Various types of informal associations, meetings, and forums among industries, universities, and local chamber of commerce are essential for dynamic collective learning process and institutionalization of social capital (Park and Nahm, 2000). Moreover, government's intermediate effort for collaborative alliance among research institutions, universities and industries and social policy such as venture incubators, training/retraining programs, and techno mart for technology transfers is also quintessential for successful cluster development (Cooke, 2001; Feser, 1998; Gordon and McCann, 2000; Porter, and Ackerman, 2001; Santos, 2000; Van Klink and De Langen, 2001).

In this sense, one of the prerequisite for the development of knowledge-based industrial clusters is the business demands to locate the specific space and then efforts to facilitate dynamic synergy among the businesses and associated institutions of the cluster, both for public and private sectors, in order to form a kind of 'sticky place' not a 'slippery space'

2) Purpose of the Study

The main purpose of this study is to estimate the demand of knowledge-based industries in the Capital region in Korea in order to understand the urgent needs to reform a strict regulation of prohibition of new industrial sites in this region. Surveys are conducted to examine the characteristics of the firms and to estimate the demand for relocations from July 21 to August 14 in 2001. 194 firms have responded to the questionnaires. A logit model is applied to estimate the relocation demand based on the characteristics of firm' s location and development stage of firm. A simple logistic curve is developed to forecast the demand of new start-ups. The total demands of new industrial sites are the summation of two separate results.

In the next section, theory and foreign experiences of demand estimation are introduced, followed by data description and presentation of the model. The demands of new start-ups and relocations are estimated. Conclusions and policy implications are presented in the last section.

2. Demand for the Knowledge-Based Industries

It is a worldwide trend that knowledge-based industries are clustered in specific areas in each country. These clusters range from a small district with less than fifty companies to a huge area as big as a city. A review of the theory and examples of the demand estimation gives us some clues about the size and locational characteristics of highly demanded areas for the knowledge-based industries.

The demand for land is derived from the demand for land itself as well as the demand for the goods or services produced by using a piece of land as an input. In a microeconomic theory, the optimal amount of land for a firm is determined when the

value of marginal product is equal to the land price. The market demand for land is the summation of the demand of each individual firm. The notion of the value of marginal product, however, is complex in the real world. Instead of the estimation of a real demand curve for land, the concept of elasticity is employed. A price elasticity of demand or an income elasticity of demand for land is often measured. A price elasticity of demand means that how the demand for land changes in response to a percentage change in land price. An income elasticity of demand records the relationship between income changes and quantity of land changes.

Another way to estimate demand for land is to formulate a regression equation from the past trends of consumption on land. The amount of land consumption is dependent variable and various socio-economic variables are independent variables. Socio-economic variables include growth domestic product, population, the number of new firms, industrial mix of the country or region, and so on. This method can be used if we know the actual amount of land consumption. The forecasting is based on the past trend. If the trend is, however, distorted because of a big shock, this method is not applicable. In that case, a survey is commonly used for a research. By the interviews with CEO of a firm, the willingness to pay for land or how many areas the firm needs, and whether the firm relocates or expands its site are surveyed. In order to quantify these survey results, a logit model can be applied. The logit model is commonly used when the dependent variable is a binary-type, that is, 1 (yes) or 0 (no). For example, Schmenner (1991) used a probit model to explain the character of the Sunbelt plant location decision. The probit model represented the relationship between the location decision in the Sunbelt area and the regional characteristics such as unionized, plant independence, percent of plant's supplies bought from other company plants, degree of product innovation, room for expansion, more breadth to product line in last decade. A logit model is to estimate a probability of a decision-making. In the case whether a firm relocate or expand its site, hence, a logit model can be employed.

3. Model and Analysis

1) The Spatial Characteristics of the Observed Firms

A survey had been conducted for three weeks in 2001 in order to examine the characteristics and the spatial behaviors of knowledge-based firms in Korea. About 200 firms are selected randomly among the knowledge-based firms located on Seoul, Capital region and others. The questions included firms' locational factors, obstacles of economic activities, and actual demands for relocation. Total of 194 data were collected through direct interviews or mailing. 104 firms (53.6%) locate in Seoul, 42 firms (21.6%) in Gyeonggi or Incheon, and 48 firms (24.7%) in the other regions, respectively. 75% of 194 firms had established after the year of 1996, when the new economic development plan began in Korea. By industry, 28% of the analyzed firms are related to software. 25.9% firms belong to electronics and Information machinery. Others are information services (14%), bio-tech industry (3.6%), new materials (3.1%), chemicals (3.6%), Environmental industry (3.1%), and culture-related firms (2.1%). The average number of employees is 43 per each firm, and the average sales' volume of a firm is 8.9 billion won (about $6.8 million) (see Table 1).

The firms prefer to locate on the Capital region, for more specific, in the southern parts of Seoul. Over 75% of the firms (146 firms) had started their businesses in the Capital region. 50% of observed firms (97 firms) had started their businesses in the southern parts of Seoul, whereas only 9.3% (18 firms) in the northern parts of Seoul. Currently, 95 firms (48.0%) locate on the southern parts of Seoul, and 42 firms locate on Gyeonggi or Incheon. 6 firms

Table 1. Start-up locations and current locations of observed firms

(number, %)

Stage of development	Start-up locations	Current locations				
		Northern part of Seoul	Southern part of Seoul	Gyeonggi/ Incheon	Others	Total
Phase I: Start-up	South of Seoul	-	7(100)	-	-	7
	Gyeonggi/Incheon	-	-	1(100)	-	1
	Others	-	1(33.3)	1(33.3)	1(33.3)	3
	Subtotal	-	8(72.2)	2(18.2)	1(9.1)	11
Phase II: R & D	North of Seoul	4(57.1)	1(14.3)	2(28.6)	-	7
	South of Seoul	-	13(76.5)	3(17.6)	1(5.9)	17
	Gyeonggi/Incheon	-	-	6(100)	-	6
	Others	1(4.8)	-	-	20(95.2)	21
	Subtotal	5(9.8)	14(27.5)	11(21.6)	21(41.2)	51
Phase III: Business Expanding	North of Seoul	4(36.4)	5(45.5)	2(18.2)	-	11
	South of Seoul	-	60(90.9)	5(7.6)	1(1.5)	66
	Gyeonggi/Incheon	-	-	18(100)	-	18
	Others	-	2(7.4)	2(7.4)	23(85.2)	27
	Subtotal	4(3.3)	67(54.9)	27(22.1)	24(19.7)	122
Phase IV: Matured Stage	South of Seoul	-	6(85.7)	1(14.3)	-	7
	Gyeonggi/Incheon	-	-	1(100)	-	1
	Others	-	-	-	1(100)	1
	Subtotal	-	6(66.7)	2(22.2)	1(11.1)	9
Other	Others	-	-	-	1(100)	1
Total		9	95	42	48	194

Source: Ministry of Information and Communication, 2001.

Table 2. Demanding lot sizes by location of firms

(number, %)

Locations / Lot sizes (pyung($3.3m^2$))	Northern parts of Seoul	Southern parts of Seoul	Gyeonggi / Incheon	Others	Total
Below 50	2(25.0)	27(36.5)	7(19.4)	19(41.3)	55
51-100	2(25.0)	19(25.7)	11(30.6)	15(32.6)	47
101-200	3(37.5)	13(17.6)	10(27.8)	4 (8.7)	30
201-300	0(0.0)	0(0.0)	6(16.7)	3(6.5)	9
Above 301	1(12.5)	15(20.3)	2(5.6)	5(10.9)	23
Total	8(100)	74(100)	36(100)	46(100)	164

Source: Ministry of Information and Communication, 2001.

had relocated from the northern parts of Seoul to the southern parts of Seoul. 4 firms had moved from the northern parts of Seoul to Gyeonggi or Incheon. 9 firms had moved from the southern parts of Seoul to Gyeonggi or Incheon. The most favorable location for the knowledge-based industry is, thus, the southern parts of Seoul. The firms start their business in the locations where the rent is relatively cheaper. Then, firms move to the large market areas in order to commercialize or to the Gyeonggi/ Incheon, where are the cheaper rents for manufacturing (see Table 2).

The most of all firms agreed on the necessity of the development of new industrial sites in the Capital

region. Only 8 firms (3 firms in the southern parts of Seoul and 5 firms in Gyeonggi or Incheon) disagreed on more development in the Capital region. By stages of development, the firms of phrase II and III, that is R&D and business expanding, have concern more seriously on the necessity of the new development in the Capital region, since they have plans to relocate or expand their sites near future. A firm asked 205.2 pyung (678 square meters) in average. 62.2% of the firms asked below 100 pyung (330 square meters). The total of demanding lot sizes are 16% larger than the sizes they occupy now.

According to survey, the appropriate rent for a new site is about 21,000 won per month. Most firms want to pay cheaper monthly rent, about 70% of current rent level. The most favorable locations for new industrial clusters are Gyeonggi or Incheon and the southern parts of Seoul. In Gyeonggi, Pankyo and Koyang are the most favorable cities for the new industrial clusters.

2) The Method of Demand Estimation

The demand of new industrial clusters is estimated by two different ways. One is a relocation demand based on survey analysis. The other is a demand of new start-ups. The former is estimated with two different logit models (Model A and Model B). The latter is forecasted with a logistic formulation concerning previous trends of new start-ups in Korea. Model A represents the demand of relocation concerning the stage of firm's development. Model B represents the demand of relocation concerning the locations of firm. The firm wants to move mostly its location because of the lack of land available at the current site, much expensive rents at this moment. At the stage of R & D, the firm does not require

Table 3. Ratios of demanding lot sizes vs. current lot sizes

Current lot sizes (pyung)	Below 50	51-100	101-200	201-300	Above 301	Average
Demanding lot sizes	1.1223	1.2466	1.2303	1.1429	1.0069	1.1599

Table 4. Favorable locations for industrial clusters by current locations

		Current locations				
		North of Seoul	South of Seoul	Gyeonggi/Incheon	Others	Total
Locations For clusters	North of Seoul	7(10.1%)	50(72.5%)	5(7.2%)	7(10.1%)	69(100%)
	South of Seoul	2(2.4%)	34(41.0%)	33(39.8%)	14(16.9%)	83(100%)
	Gyeonggi/Incheon	0(0%)	1(5.6%)	2(11.1%)	15(83.3%)	18(100%)
	Others	0(0%)	0(0%)	0(0%)	5(100.0%)	5(100%)
	Total	9(5.1%)	85(48.6%)	40(22.9%)	41(23.4%)	175(100%)

Source: Ministry of Information and Communication, 2001.

Table 5. Favorable locations for industrial clusters by firm's stage of development

		Stages of development				
		Phase I	Phase II	Phase III	Phase IV	Total
Locations For clusters	North of Seoul	5(7.2%)	18(26.1%)	42(60.9%)	4(5.8%)	69(100%)
	South of Seoul	4(4.8%)	20(24.1%)	56(67.5%)	3(3.6%)	83(100%)
	Gyeonggi/Incheon	0(0%)	7(38.9%)	10(55.6%)	1(5.6%)	18(100%)
	Others	0(0%)	3(60.0%)	2(40.0%)	0(0%)	5(100%)
	Total	9(5.1%)	48(27.4%)	110(62.9%)	8(4.6%)	175(100%)

Source: Ministry of Information and Communication, 2001.

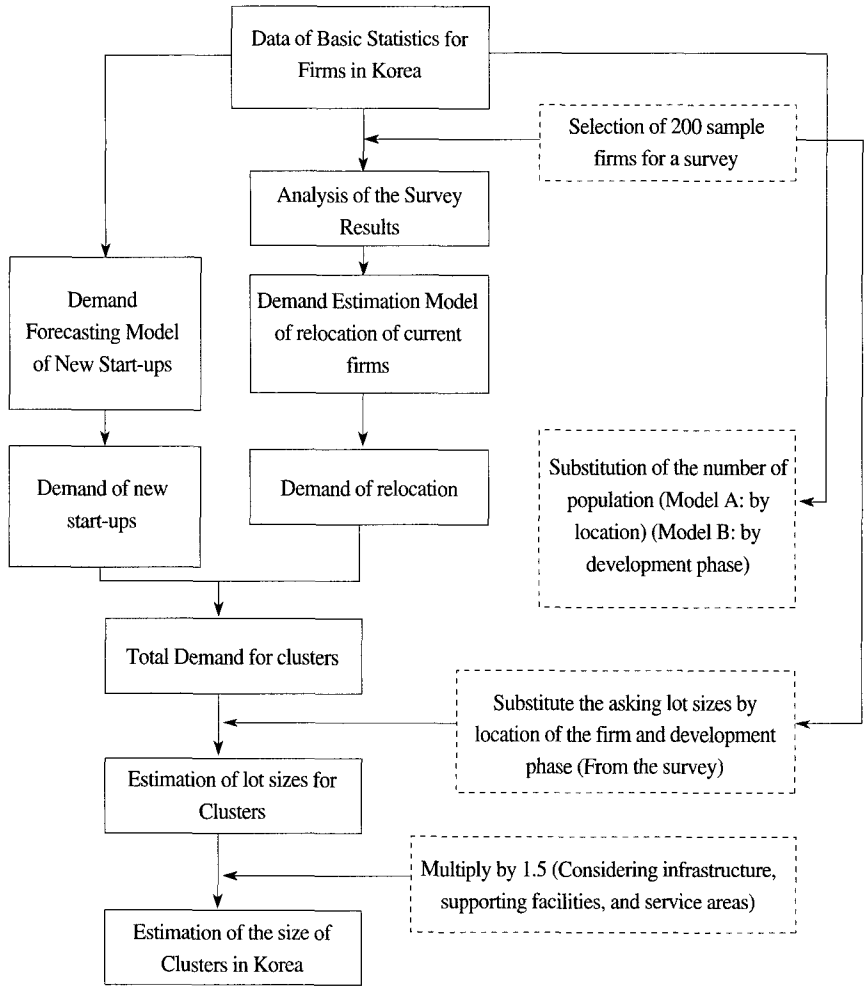

Figure 1. Process of demand estimation for industrial clusters in Korea

many lands for its job. The firm, however, should expand its facility in order to produce some products. Consider the rent per a piece of land is too high so that it is very hard to expand its facility at the current location. Then, the firm seeks a new place to locate. The total lot sizes are obtained by the multiplication of demand of relocation and average asking lot size from the survey. The results of a logistic curve for new start-ups are distributed into local demands by using a multiple regression. The lot sizes for new industrial clusters are finally obtained 1.5 times of the demanding lot sizes since the lots for infrastructures and supporting facilities should be considered for industrial clusters.

3) Demand Estimation of Relocation

The logit model is commonly used when the dependent variable is a binary-type, that is, 1 (yes) or 0 (no). When a survey conducted, a firm is asked whether it has an intention to move if a new industrial cluster develops. A firm answered yes or no. A logit model could represent apparently the relocation demand in this case. The typical polynominal logit model is represented as (eq. 1).

$$\log = \frac{p(y=1|x_1, \cdots, x_p)}{1-p(y=1|x_1, \cdots, x_p)} = \alpha + \beta_1 x_1 + \cdots + \beta_p x_p \quad \text{(eq. 1)}$$

The posteria probability is obtained from the coefficients, a, b_1, ..., b_p as (eq. 2).

$$\hat{P}(y=1|x_1, \cdots, x_p) = \frac{\exp(a+b_1x_1+\cdots+b_px_p)}{1+\exp(a+b_1x_1+\cdots+b_px_p)} \quad \text{(eq. 2)}$$

Two different models, Model A and Model B, are established since the results could be varied with the characteristics of independent variables. The independent variables for Model A are the current location of firms. Those for Model B are the stages of development, that is start-ups, R&D, business expanding, and matured stage.

The number of firms wants to move is estimated as 4,596 by Model A and 3,727 by Model B, respectively. The next question is to determine where the firm wants to move. From the survey, the information about the locations where the observed firms want to relocate and how many firms would move are obtained. It is assumed that the distribution of firms' relocation is just identical to the survey result. It is also assumed that the asking lot size is identical to the observed firms' asking lot sizes by location and by stages of firm's development. The demand for relocation of current firms by locations and by stages of development is obtained as Table 7.

Table 6. Results for Model A and Model B

		The number of firms*	Parameter B	Significance Level	Exp(B)	Probability of relocation	Demand of relocation
Model A (Locations)	North of Seoul	1,101	0.646	0.378	1.908	0.55552	612
	South of Seoul	4,065	-0.037	0.920	0.964	0.38699	1,573
	Gyeonggi/ Incheon	2,925	-0.063	0.885	0.939	0.38084	1,114
	Others	3,278	-0.423	0.125	0.655	0.39580	1,297
	Total	11,369					4,596
Model B (Stages of development)	Phase I	3,136	-1.042	0.429	0.353	0.09154	287
	Phase II	3,632	0.815	0.339	2.258	0.39222	1,426
	Phase III	4,601	1.004	0.222	2.728	0.43807	2,016
	Phase IV	0	-1.253	0.118	0.286	0.22218	0
	Total	11,369					3,729

* National Statistical Office, 2001.

Table 7. Demand for relocation by region

		Relocation Places				
		Seoul*	Gyeonggi/ Incheon	Others	Anywhere	Total
Current Locations of the firms	North of Seoul	476	136	0	0	612
	South of Seoul	925	629	19	0	1,573
	Gyeonggi/ Incheon	139	919	56	0	1,114
	Others	222	442	475	158	1,297
	Total	1,762	2,126	549	158	4,596
Stages of Development	Phase I	160	127	0	0	287
	Phase II	534	594	208	90	1,426
	Phase III	770	1,026	183	36	2,016
	Phase IV	0	0	0	0	0
	Total	1,464	1,748	391	126	3,729

* The summation of the Northern and Southern parts of Seoul.

It is estimated 1,762 firms would relocate in Seoul, 2,126 firms in Gyeonggi or Incheon, and 475 firms in other regions, respectively from Model A. In the above section, it is found that the demanding lot sizes are different from one another corresponding to firm's location and stages of development. The required lot sizes for knowledge-based firms are 238,527 pyung (787,139 square meters) in Seoul, 284,192 pyung (937, 834 square meters) in Gyeonggi or Incheon, and 20,117 pyung (66,386 square meters) in the other regions according to Model A. The new lots for knowledge-based industries, otherwise, should be provided as many as 177,255 pyung (584,942 square meters) in Seoul, 216,272 pyung (713,698 square meters), and 46,476 pyung (153,370 square meters) from Model B.

4) Demand estimation of new start-ups

For the purpose of forecasting the number of new start-ups for next five years, a simple logistic curve is employed in the analysis. The information of new start-ups is provided by the Bureau of Statistics periodically. A logistic curve is drawn from the pattern of new start-ups during the periods of 1992-2001. Then, the total number of new firms is distributed by region and by industry. The developed logistic curve is represented as (eq. 3). The multiple regression model for distribution of the total number of firms is represented as (eq. 4)

$$TF = \frac{1}{1/1000 + e^{-5.34928 + (-0.34353) \times (year - 1992)}} \quad \text{(eq. 3)}$$

(adj-R^2: 0.9494)

where, TF: the total number of new start-ups in some year

$$X_{ij} = 1.66 \times 10^{-5} T_i^{0.71} T_j^{0.87} \quad \text{(eq. 4)}$$

where, X_{ij} : the number of firms in industry j in region i

T_i : the number of firms in region i

T_j : the number of firms in industry j

It is estimated that 28,071 new firms would have start for next five years in total. By region, 12,057 firms would start new business within next 5 years in Seoul. That means more than 1,441,533 pyung (4,757,059 square meters) should be provided for knowledge-based industries in Seoul. In Gyeonggi or Incheon area, 7,870 new firms would need more lands for their business as many as 940,758 pyung (3,104,500 square meters). In other regions, 973,489 pyung (3,212,514 square meters) should be prepared for 8,144 new firms in next five years. Hence, the total required lot sizes for new start-ups for 5 years is 3,355,781 pyung (11,074,077 square meters) in Korea.

5) Demand for new lots for knowledge-based industries

The summation of both demands of relocation and new start-ups represents the total demand for knowledge-based industries. The amount of 882,000 pyung, at least, should be prepared for the knowledge-based industries in Seoul for next five years. The first column in table 7 shows two different figures because two models, *i.e.*, Model A and Model B were established to estimate the demand for relocation. The new lots for industrial use only are estimated as many as 6.9 million - 13.1 million square meters in total. As mentioned earlier, industrial clusters consist of similar firms, supporting business services such as insurance, legal, account, research institute, training center, and university, and appropriate infrastructures. In the case of development of a traditional industrial complex, 1.5 is used as a multiplier in order to consider spaces for affiliate facilities. In the same manner, the total spaces for industrial clusters are obtained. It is, however, underestimated since industrial complex is larger concept compared to traditional industrial complex. As a result, in nation-wide, the new industrial clusters should be provided as many as 10.3 million - 19.6 million square meters in order to accommodate new firms and firms to alter their locations.

Table 8. Demand for new lots for knowledge-based industries (unit: m^2)

		Seoul	Gyeonggi/ Incheon	Others	Anywhere	Total
For Industrial Use only	Minimum	2,909,058	2,230,747	1,723,227	46,147.2	6,909,177
	Maximum	5,544,201	4,042,338	3,407,689	66,386.1	13,060,611
For Clusters	Minimum	4,363,359	3,346,121	2,584,841	69,220.8	10,363,766
	Maximum	8,316,304	6,063,509	5,111,535	99,580.8	19,590,919

Nowadays, a new development for industrial clusters will be built at Pankyo in Gyeonggi province. The designated size for industrial use is only 2.0 million square meters. Therefore, more than 0.2 million - 2.0 million square meters of land for industrial use should be prepared in Gyeonggi province in order to induce new investments from knowledge-based industries.

4. Conclusions

A survey conducted in order to examine the characteristics and the spatial behaviors of knowledge-based firms in Korea. Several findings are as follows: At first, 75% of the observed firms had established after the year of 1996, when the new economic development plan, i.e., government's leading venture capital and giving a favor to venture firms, began in Korea. At second, the average number of employees is 43 per a firm, and the average sales' volume of a firm is 8.9 billion won. At third, the firms prefer to locate on the Capital region, specifically, in the southern parts of Seoul. At fourth, the firms start their business in the locations where the rent is relatively cheaper, then, move to the place where the advanced technology and venture capital is available to obtain. After they succeed to develop a new technology, they move to the place where they can find plenty of lands and labors alike Gyeonggi or Incheon.

The demand for new lots for knowledge-based industries is estimated by two different ways. One is a relocation demand, and the other is a demand of new start-ups. A logit model is applied to estimate a relocation demand. The demand of new start-ups is forecasted with a logistic function and distributed into regions based on a multiple regression model. Finally, the lands for industrial use only are estimated as many as 6.9 million - 13.1 million square meters in nation-wide. Considering affiliate facilities and infrastructures, 10.3 million - 19.6 million square meters of industrial areas should be developed in Korea for next five years. In the Capital region, 3.3 million - 6.1 million square meters of industrial areas should be provided. In order to provide more industrial lands in the Capital region, the severe control policy of the Capital region should be released in the very short run. Specially, the lands for the firms want to expand their lots should be produced in cheaper places in order to activate their business. Since the rents are very high and the available land is short in the southern parts of Seoul, where most knowledge-based firms locate right now. Many firms have considered relocating on any other places where there exist a plenty of lands available and cheaper rents and cheaper wage rates, but still not far away from Seoul so that they could obtain new advanced information, skilled labors, venture capitals, and high quality of producer services. The Capital region, especially Gyeonggi and Incheon, is the only place to meet those conditions in Korea.

The estimation method employing in this work is totally based on the questionnaire survey, which may accompany over - or under- estimation and over-generalization fallacies. The macro economic variables, government policies, and other qualitative variables can be added to refine the model, which is the further research avenue for the future study in this area.

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