Economic Evaluation of the IT SoC Industry Infrastructure Progr

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Abstract

This paper evaluates the economic effect of the IT SoC Industrial Foundation Composition Project. The evaluation was done in three steps. The first step was to estimate the contribution effect of the fabless small and medium venture business' sales. The step includes interview with all the CEOs of the firms under the support of the Enterprise Incubation System, The second step was to apply input-output analysis and then estimate the production inducement effect. The last step was to compare the results of estimation with the costs of the project. We have concluded this project had achieved 6.3 times greater economic effect compared to the budget. The reason for the large economic effect is that the project provided various infrastructures to the small and medium venture businesses.

Keywords: IT SoC, economic effect, input-output analysis

I. Introduction

Since the late 1980s, as the interest on the economic effect of the public spending increases, the measuring of the effect, improvement of the effect and the Performance-based Management (PBM), which stresses the importance of the utilization of the effect information are proliferating.

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GPRA (Government Performance and Results Act), which was instituted in the United States in 1993, and PART (Program Assessment Rating Tool), which was adopted in the United Sates in 2002, are the representative examples of the application of the PBM on government institutions. The goal of GPRA was to legislate the aim of the progress and build a progress measurement system so that it can improve the efficiency of the governmental institutions and raise its obligatory characteristics. However, after GPRA was introduced, GPRA was criticized that its effect isn't powerful enough and that the application to the budget decision and the utilization of the resources from the result of the effect measurement were ineffective. As a result, to evaluate the public program in a more objective and consistent way and to strengthen the relationship between the effect and the budget, PART was additionally introduced.

In the end of year 2004, as we can see from the government passing the "law of the effect evaluation and the effect management of the national research and development project," PBM seems to be spreading out also in Korea. In accordance, domestically, it is expected that various effect measurements, effect improvements and utilization of the progress information would become regularized.

In this tendency of the PBM spreading out both at home and abroad, this paper is to analyze the effect of the infrastructure supporting project of the IT SoC industry. IT SoC industry was one of the 9 new strategies for the growth of IT announced by the Ministry of Information and Communication, Korea in 2003, and also it is the core component to dominate the competitive power of IT manufactured goods' future. SoC(System on a Chip) is a non-memory semi-conductor, an accumulation of several functions in a single chip, which enables mixed-functions, produces high efficiency and uses less electric power, thus it is now leading the IT industry's development trend of high efficiency and fusion of digital compliances. Especially, in the aspect of Korea's production of the semi-conductor industry being extremely concentrated to the manufacture of memory semi-conductors, the development of the IT SoC industry will greatly contribute for the domestic semi-conductor industry to become a higher value-added business.

Korean government is presenting various development strategies for the new growth of IT as well as IT SoC, but ever since the WTO was founded, the government funding for these industries are inevitably being limited. Therefore, just like other countries, the government's industrial policies should be focused on original development of the technology and the promotion of the infrastructure rather than the selective supports toward the specific firms. This is why our study is focusing on the infrastructure-supporting

project.

IT SoC industry's infrastructure support is mainly done by the Electronics and Telecommunications Research Institute (ETRI)'s IT SoC project team which is under the control of the Ministry of Information and Communication. Generally, infrastructure can be classified as hardware infrastructure, software infrastructure and human infrastructure. The main purpose of this study is to analyze the effect of Industrial Foundation Composition Project* which supports the hardware and the software infrastructure at the same time.

This research is composed as followed. Along with the Introduction, in Part II, we'll look into the present state of the IT SoC industry and the IT SoC Industrial Foundation Composition Project, and then in Part III, we'll show the result of this project's effect analysis. Part IV is the summary and conclusion.

This paper is organized as follows. In section II we'll look into the present state of the IT SoC industry and the IT SoC Industrial Foundation Composition Project. Section III introduces methodology for our analysis and shows the result of the project's effect. Section IV is the conclusion. and summary.

II. The present state of IT SoC industry and the IT SoC Industrial Foundation Composition Project

1. The present state of IT SoC industry

IT SoC is a single IC(Integrated Circuit) accumulated with MPU(Micro Processor Unit), DSP(Digital Signal Processor), memory, base-band chip, embedded software and etc. Compared to when each function was separately combined by individual chips, SoC shows greater performance, lower price, reduction in size of the system, and longer run time of batteries etc. Also, since the IT SoC accumulates the memory and the non-memory needed for the system in a single chip, the existing borders of the chip manufacturers' are to be broken down. Thus IT SoC is expected to bring a considerable ripple effect on the

* The project that the IT-SoC project team is working on in order to support the human infrastructure for the IT SoC industry is the Main Designer Training Project. IT SoC Industrial Foundation Composition Project and the IT SoC Main Designer Training Project greatly differs in the target to give support and the details of the support, thus in this research we exclude them from the target to be analyzed.

semi-conductor industry and throughout the whole IT industry*.

Presently, according to each market research teams, the range of semi-conductors included in the IT SoC differs. When IT SoC is defined comprehensively as it is done by the IDC, embedded micro logics such as MPU, MCU or DSP are to be included**. According to the IDC, the memory market is expected to show an average annual growth rate of 9.1% from 2003 to 2010, but the IT SoC market is expected to show an average annual growth rate of 10.9%. Followed by this, the proportion of which the IT SoC holds in the world semi-conductor market seems to increase from 61.8% in 2004 to 67.2% in 2010.

Recently the world semi-conductor industry has changed from an era of traditional mass production to an era of small quantity batch production. That means you can't survive no longer by mass production of generally used semi-conductors such as MPUs and DRAMs. Now, accurate reading and appropriate reaction to the diverse needs of the consumers are required. Accordingly, a big change is in process among the business model. In the early 1970s, comprehensive semi-conductor enterprise of a vertical structure took care of IP (Intellectual Property) designing, manufacturing, testing and fabricating all at once, but starting from the early 1990s, Foundry, Fabless and professional testing/fabricating enterprises had appeared so that the existing vertical structure be changed to a horizontal structure.

Followed by this, world semi-conductor market today is composed of comprehensive semi-conductor enterprises called IDM (Integrated Device Manufacturer), professional entrusted manufacturing enterprise called Foundry, professional designing enterprise called Fabless and professional testing/fabricating Back-end enterprises. Presently this specialized form of enterprises is typically shown in the IT SoC industry, and as to appropriately react to the special application of each customer, IT SoC industry is lead by the Fabless enterprises.

The world's SoC industry is lead by the United States. In 2004 the United Sates held 74.7% of the whole sales of the top 25 IT SoC enterprises, followed by Taiwan 12.6%,

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* Recently IT SoC is being utilized by the mobile communication industry which its function is becoming more multifarious. IT SoC is to be applied more widely in the DTV and DMB, Telematics, RFID, Home Networking, Robot etc., thus resulting in the market's rapid growth. About this, more information is provided in IT-SoC association – Ministry of Information and Communication (2005b).

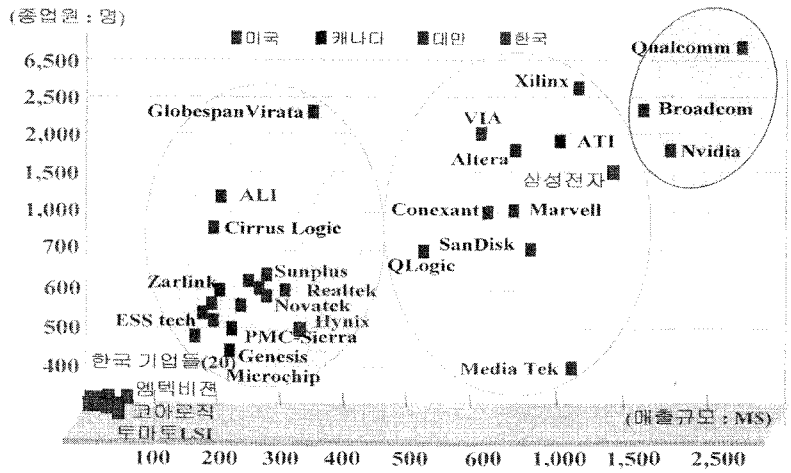
** IDC defines the semi-conductors excluding memory semi-conductors and the one-item optical semi-conductor as IT SoC. Thus, according to the definition of IT SoC made by the IDC, IT SoC is almost same as non-memory semi-conductors.

Canada 10.0% and Korea 2.7%. The world semi-conductor market is growing based on the IT SoC, nevertheless, Korea is concentrating on the memory, so our IT SoC industry is very weak. In 2002 domestic memory production was 12 billion dollars, ranking the first place in the world. But SoC manufacturing ranked only 10th place in the world, by 2.5 billion dollars. Accordingly, in the domestic market, 80% of the SoC is from abroad.

Domestic IT SoC industry has comprehensive semi-conductor enterprises, professional Foundry enterprises, professional Fabless enterprises and professional testing/fabricating enterprises. As the comprehensive semi-conductor enterprises, there exists Samsung Electronics and Magna-chip Semi-conductor, and as a professional Foundry enterprise, there only exists Dongbu-Anam semi-conductor. Also, as professional testing/fabricating enterprises, there exists Testana, TESNA etc.

Meanwhile, domestic professional Fabless enterprises are mostly composed of small and medium sized venture businesses, and among them are several enterprises in rapid growth by success in new technology development. MtekVision and CORE LOGIC enabled CCP(Camera Control Processor), which is used in cellular phone cameras, to be used commonly, thus achieving more than 100 billion Won in sales in 2004. Moreover, TOMATO LSI and Leadis Technology made rapid increase in sales by making LCD IC and LDI for cellular phones. However, these are still very small businesses compared to foreign professional Fabless enterprises.

<Figure 1> Home and Foreign IT SoC enterprise's sales and size of employees



Source: Korea IT Industry Promotion Agency's IT SoC project team(2005) "Present state of the IT SoC project"

2. The present state of the IT SoC Industrial Foundation Composition Project

In 2003 the Ministry of Information and Communication selected IT SoC as one of the top 9 new growth strategies, and set up goals to develop a core chip for mobile communication that consumes less electric power until the year 2005, and to make a spurt to become one of the top 3 developed country on the IT SoC until the year 2007. The Ministry of Information and Communication is estimating that until 2010 there will be about 10 enterprises professionally taking care of the designing of which the sales reach up to 100 billion won, thus stepping forward to the world market of 230 billion dollars in size. And the base of this support plan is the IT SoC Industrial Foundation Composition Project.

By the Ministry of Information and Communication's funding, the purpose of the IT SoC Industrial Foundation Composition Project, which Korea IT Industry Promotion Agency's IT-SoC project team is in charge of, is to provide infrastructure support to the Fabless enterprises, which also are small and medium venture businesses, to establish the basis on which to have the ability to grow by itself. The IT SoC Industrial Foundation Composition Project, which was started since 1997, was at first started in a small scale to support the domestic ASIC enterprise, but gradually the scale and range began to expand thus to be executed as shown in <Table 1>.

<Table 1> The main contents of the IT SoC Industrial Foundation Composition Project

No.	The main content of the project
1	Support to the SoC Designing Environment
2	Support to the SoC H/W Experimental Environment and equipment
3	Support to the EnterpriseIncubation
4	Support to the initial product manufacturing
5	Support to the SoC testing
6	Support to the establishment of IP designing environment and technology
7	Industrial-enterprise business training of SoC
8	establishment of cooperation network both at home and abroad by funding the IT-SoC Association

Source: Ministry of Information and Communication (2004), 「IT SoC Industrial Foundation Composition Project」

There are nine main contents in the project; support to the SoC Designing Environment, SoC H/W Experimental Environment and equipment, SoC testing, establishment of IP designing environment and technology etc. are for the Fabless enterprises, which are insufficient in capital and equipments, to support the hardware infrastructure. And the industrial-enterprise's business training of SoC, establishment of cooperation network both at home and abroad by funding the IT-SoC Association is for supporting the software-al infrastructure for the Fabless enterprises that have recently established a new firm.

II. Economic effect of the IT SoC Industrial Foundation Composition Project

1. The methodology

To analyze the economic effect of the IT SoC Industrial Foundation Composition Project, this study is done according to 3 steps. The first step is by estimating the contribution effect on the sales of the firms by this project. Most of the researches that analyzed the effect of diverse projects made by domestic researchers until now had only used the industry information or had only relied upon the intuition of the minority experts and researchers to derive the contribution effect on the sales of the firms which forms the basis for the economic effect. But this research estimates the contribution effect on the sales of the firms by a survey made on the firms, in order to enhance the objectivity of the economic effect analysis. Firm survey is not only regarded as an objective method to derive the contribution effect on the sales of the firms but also as a good method to understand the present state of the project in a deeper sense. This research executes an in-depth interview with the CEO as the concrete method of the firm survey.

The second step is to use an input-output analysis in order to estimate the nationwide economic spillover effect of the project. The input-output analysis is based on the Input-output table of the country, which has all the business relations on all of the goods and services produced in a country systematically written down. By using the Input-output table, we can actually measure the effect of an expansion of the industry's production and value-added on the national economy.

In other words, to measure the economic effect of the IT SoC Industrial Foundation

Composition Project, this research first estimates the contribution effect on the sales of the firms, and then, by using the Input-output table, we estimates the national economic production inducement effect. This 2-stage analysis was already used in researches made by Baek and Oh(2004).

The third step performs an cost-benefit analysis. In the project's cost, not only the project's net expenditure but also the project's management cost is included. This paper presents the project's cost and the progress in monetary value so that the progress compared to the cost can be understood quantitatively.

In this research, the subject of the firm survey are the 168 domestic Fabless small and medium venture businesses selected by the IT-SoC project team on August 31, 2005.

2. Economic effect analysis on the project

Of the 3 steps to analyze the economic effect, the first step is to estimate this project's contribution effect on the firms' sales. To do this, beforehand, we estimate the economic effect of the firms under the support of the Enterprise Incubation System, since one of the main context of the IT SoC Industrial Foundation Composition Project is the support to the Enterprise Incubation. Next, we estimate the economic effect of firms that were provided with supports of other kinds although they weren't given the support from the Enterprise Incubation System.

Lastly, we calculate the production induction effect, value added induction effect etc. made to the overall national economy from the economic effect caused by the IT SoC industry itself, through the input-output analysis, thus estimating the overall economic effect.

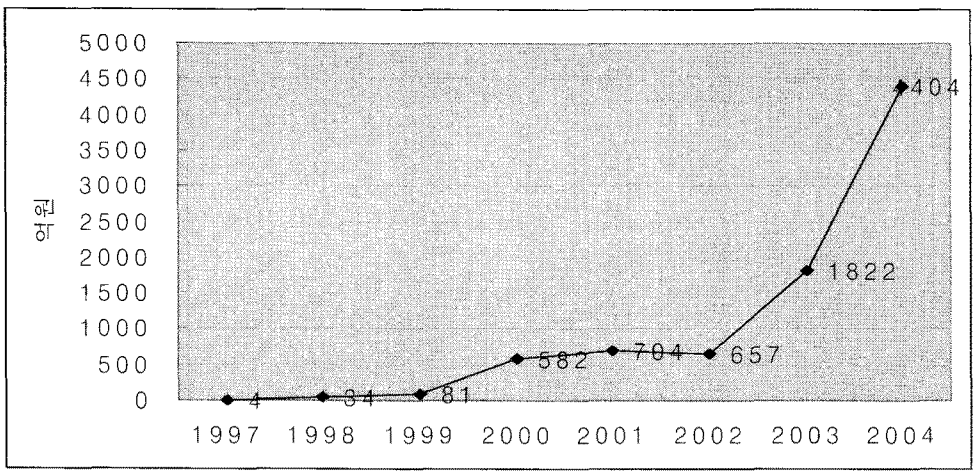
1) The economic effect in the aspect of the firms under the support of the Enterprise Incubation System

Among the 168 Fabless small and medium venture businesses that are recognized by the IT-SoC project team, the firms which graduated from the Enterprise Incubation class sums up to 54. To estimate the economic effect in the aspect of the firms under the support of the Enterprise Incubation System, we made an overall in-depth interview with all the CEOs of the firms under the support of the Enterprise Incubation System. Among the 54 Enterprise Incubation firms, 25 firms were excluded because of reasons such as

discontinuance of business, the switchover of the type of industry or disability to visit by the refusal on the interview caused by non-occurrence of sales, resulting only 29 subject to be left to interview. By the in-depth interview of the CEOs of the firms under the support of the Enterprise Incubation System, we collected information on matters such as the change in sales, contribution effect of the project, main product, competitiveness and etc.

Through 1997~2004, the sales of the firms under the support of the Enterprise Incubation System were 856.4 billion won in total. In <Figure 2>, you can see the change in the sales of the firms under the support of the Enterprise Incubation System. Here you can realize that between 1997~1999 it shows sales of 300 million won, 2.9 billion won and 6.9 billion won accordingly, as of being the quickening period. The sales goes through a stagnation during 2000~2002 and then starting from 2003 it makes great strides as to reach 175.8 billion won in 2003 and 440.4 billion won in 2004. This was able to be accomplished, thanks to the successful enterprises such as MtekVision and CORE LOGIC.

<Figure 2> the change of sales of the firms under the support of the Enterprise Incubation System



The calculation method for the derivation of the contribution of the Industrial Foundation Composition Project to the sales of the firms under the support of the Enterprise Incubation System can be put into two big categories: the BOTTOM-UP method and the TOP-DOWN method. The BOTTOM-UP method calculates, as each item, the

savings from the rent of the building during the Enterprise Incubation, SoC initial product development supporting effect , reduced cost in using the EDA tool etc. By the in-depth interview with the CEOs of the firms under the support of the Enterprise Incubation System, this study adopted the TOP-DOWN method, which you inquire what the percentage of the contribution of the project is if the sales accumulated until the year 2004 is set as 100. The advantage of this method is that it is the evaluation made upon the firms that have survived in the market, so that it reflects the function of the market; the disadvantage is that it is based on subjective responses.

As these responses are analyzed, the contribution of the project to the firm was low if the firm had graduated from the Enterprise Incubation class a long time ago or if the sales were huge. However, the firms that graduated recently and had few sales showed relatively high contribution from the project. This shows that, although there were limitations from the fact that these responses were subjective ones, the CEOs' responses were quite accurate. For CEOs who previously made extreme responses, we provided chances to respond to our additional inquiries, compare their responses, and then make possible changes to their response. Especially, assuming that the CEO is pretty sure of the whole aspect of the firm, since the firms are mostly small and medium venture businesses, we come to a conclusion that there won't be a problem to use this result directly.

As we take a look into the result of the responses, the project's contribution to the sales was at least 3%, at most 70%, simple average being 22.5%. We multiplied the sales of firms with the contribution of the project so that we can derive the amount of money contributed to the firms' sales, and then for all the firms, added up the numbers in order to get the contribution effect to the firms of the project. The total contribution n sales were calculated as 144.1 billion won. Eventually, the rate of the project's contributive effect to sales compared to the total sales of the firms under the support of the Enterprise Incubation System was 18.0% (contributive amount 144.1 billion won divided by sales 802 billion won).

2) The Economic effect on the Other Firms

Other firms, which are firms not under the support of the Enterprise Incubation System, are 114 among the 168 domestic Fabless small and medium businesses. Among these, the sales of 50 enterprises between 2002~2004 was identified by the original material of the IT-SoC project team and investigations from the firm's web pages, and 20 of the firms'

sales between 2002~2004 were identified by visiting the firms. As a result, these 70 firms' sales were, in 2002 282.8 billion won, in 2003 561.7 billion won and in 2004 974.8 billion won. Between 1997~2004, total sales of "other firms" was 2 trillion 395.2 billion won. However, of the sales of 70 investigated firms, there were some sales included which were those of non-IT SoC products. Meanwhile, this study couldn't investigate the sales of 65 "other firms." Therefore, this research was done by estimating the sales of 70 firms, which also includes some non-IT SoC products' sales, to be the total 135 Other Firms' sales.

The Estimation of the contributive amount of IT SoC Industrial Foundation Composition Project on the sales of the Other firms was calculated based on the investigation made during the in-depth interview of the CEOs. First, we divided the business affairs into 4 stages* from planning to merchandising, to recognize each importance in details, and then we recognized in which stage of the business affairs did they have the support from the Industrial Foundation Composition Project, and then we asked the percentage of the contribution made to each stage. This investigation was made upon not only the Other Firms' CEOs but also to all of the CEOs of the firms under the support of the Enterprise Incubation System.

The simple average of the result is as shown in <Table 2>. As for the Other Firms, when 10.8%, the rate of contribution of the project on overall business affairs, is applied, the project's sales contribution effect is 258.2 billion won in total.

<Table 2> The amount of contribution of Business affairs divided in details

No.	Stage Divisions	Percentage of importance(%)	The contribution rate of IT SoC Industrial Foundation Composition Project(%)
1	Planning	16	0.0
2	Job Assignment	11	0.2
3	Development	46	10.1
4	Business operation, marketing, Promotion (including the activity of the IT-SoC Association)	27	0.6
sum		100	10.8

* Such division of the IT SoC business affairs is based on the opinion of IT SoC experts such as CEOs etc.

3) Nationwide economic effect: input-output analysis

We used the 2000 input-output table to calculate the production inducement effect and the value-added inducement effect. Originally, the input-output analysis is which you subdivide the national economy according to each industry, so that you can utilize the input-output table which is accumulated with dealings of the goods and services of each industry. By this table, we figure out the spillover effect to each industry's production caused by the final change in demand of things such as consumption, investment, export etc. in actual numbers. However, in this research, we used the input-output table to recognize the effect by the IT SoC Industrial Foundation Composition Project to each of the domestic industrial sectors' production.

To measure the inter-industry production effect, we utilized the input-output table analysis. We need to estimate both the indirect and total production effect together when there is a production change in certain industry h. Transform of a standard input-output table into an appropriate form should precede the estimation of the second stage. Table 3 exogenizes the particular sector h from other endogenous sectors.

<Table 3> Input-Output Table with Exogenized hthSector

	Intermediate Demand (Endogenous Sectors) h^{th}sectorexcluded	Exogenous Sector		Import	Aggregate Output
		h^{th}sector Int. Demand	Final Demand		
Domestic Int. Input (Endogenous sectors, hthsectorexcluded) (d)	$X_{11}^{d}X_{12}^{d}\cdots X_{1n}^{d}$ $X_{21}^{d}X_{22}^{d}\cdots X_{2n}^{d}$. $X_{n1}^{d}X_{n2}^{d}\cdots X_{nn}^{d}$	X_{1h}^{d} X_{2h}^{d} . X_{nh}^{d}	F_1^{d} F_2^{d} . F_n^{d}		X_1 X_2 . X_n
Domestic Int. Input hthsector	X_{h1} $X_{h2}\cdots$ X_{hn}	X_{hh}	F_h^{d}		X_h
Imports (m)	$X_{11}^{m}X_{12}^{m}\cdots X_{1n}^{m}$ $X_{21}^{m}X_{22}^{m}\cdots X_{2n}^{m}$. $X_{n1}^{m}X_{n2}^{m}\cdots X_{nn}^{m}$	X_{1h}^{m} X_{2h}^{m} . X_{nh}^{m}	F_1^{m} F_2^{m} . F_n^{m}	M_1 M_2 . M_n	
Value Added (v)	$X_1^{v}X_2^{v}\cdots$ X_n^{v}	X_h^{v}			
Aggregate Input	X_1 $X_2\cdots$ X_n	X_h			

X_i both in the last column and the last row denotes gross output or gross input of sector i, X_{ij} is sector i input used for production of sector j output, F_i is final demand for sector i, and M_i is import of sector i. Using the superscript 'd' for domestic and 'm' for import, we write input-output equation for some industry i as follows.

$$a_{i1}^{d} X_1 + a_{i2}^{d} X_2 + \ \ldots \ + a_{in}^{d} X_n + a_{ih}^{d} X_h + F_i^{d} = X_i \quad (6)$$

With the matrix notions A_h^d (domestic input matrix coefficients of the h^{th} sector), X((n-1) gross input or output vector excluding the hth sector) and F^d ((n-1) final demand vector excluding the h^{th} sector) the above equation system is written as

$$A^d X + A_h^d X_h + F^d = X \quad (7)$$

If all terms of X is arranged in the left hand side, then

$$X = (I - A^d)^{-1}(A_h^d X_h + F^d) \quad (8)$$

where $(I - A^d)^{-1}$ is the inverse domestic input matrix that excludes the h^{th} sector.

Now we are ready for estimating the indirect inter-industrial production effect. From equation (8), it is

$$\Sigma[(I - A^d)^{-1} A_h^d \ \triangle X_h] \quad (9)$$

where 'Σ' denotes the sum of all elements of the column vector. Therefore, the total production effect of the intra-industry and inter-industry production effect of sector h, $\triangle X_h$, becomes

$$\Sigma[(I - A^d)^{-1} A_h^d \ \triangle X_h] + \triangle X_h \quad (10)$$

Similarly, the total induced value added effect and the induced import effect is

$$A^v (I - A^d)^{-1} A_h^d \ \triangle X_h + A_h^v \ \triangle X_h \quad (11)$$

Where superscript 'v' denotes 'value-added'.

<Table 4> Formula for inducement effect

Production inducement effect(n-1)×1	$X = (I - A^{d}_{-h})^{-1} A^{d}_{h} \triangle X_h$
Value-added inducement effect (n-1)×1	$V = A^{v}_{-h} (I - A^{d}_{-h})^{-1} A^{d}_{h} \triangle X_h + A^{v}_{-h} \triangle X_h$

input coefficient matrix A = $[a_{ij}]$, $a_{ij}=X_{ij}/X_j$
value-added coefficient matrix $A^v=[a_{vj}]$, $a_{vj}=V_j/X_j$

To derive the production inducement effect, we adopted the formula shown in <Table 4> to calculate the coefficient of the production inducement. In <Table 5> the coefficient of the production inducement for each industry is shown. Excluding the Other Industries, the industry which has the largest coefficient of the production inducement is Printing, publishing and reproduction of recorded media (2.000412) followed by Construction. And then the next is the Furniture and other manufacturing products as of being 1.953056. Electronic and other electric equipment's coefficient of the production inducement, 1.474248 isn't so high even thought it includes a lot of the information and communication industry. We assume that it is the result of the Integrated Circuit which is 22.3 % of the Electronic and other electric equipment's amount of monetary output (31745074 million won), is because it is inclined to the IT SoC industry. And the coefficient of the production inducement of IT SoC is the lowest, being 1.214711. The reason for this result is because other industries are of 28 largely assorted groups, whereas IT SoC is one of the basic sectors composed of 404 subdivisions, thus the actual size is very small.

The project's production inducement effect on the national economy is derived by the equation "the increase in sales of Fabless small and medium venture businesses by the project"+"sales of front-and-rear related-industries(firms)", and we come up with a calculation of IT SoC industry's coefficient of the production inducement to be 1.214711 × 402.3 billion won(= business foundation 144.1 billion won + others 258.2 billion won) = 488.6 billion won.

The project's value-added production inducement effect is calculated in the same way as we did with the production inducement effect. In other words, the project's value-added production inducement effect = the increased amount of money of value-added of Fabless small and medium venture businesses by the project + the increased amount of money of value-added of front-and-rear related-industries(firms) = 0.472205(IT SoC coefficient of value-added inducement)* × 402.3 billion won (= business foundation 144.1 billion won +

others 258.2 billion won) = 189.9 billion won.

<Table 5> Coefficient of production inducement for each industry

No.	Name of Sector	Production inducement of each industry	Production inducement of other industry	Total sum
1	Agriculture, forestry, and fisheries	1.000000	0.505717	1.505717
2	Mining and quarrying	1.000000	0.587476	1.587476
3	Food, beverages and tobacco	1.000000	0.821574	1.821574
4	Textile products and leather products	1.000000	0.556346	1.556346
5	Wood and paper products	1.000000	0.432836	1.432836
6	Printing, publishing and reproduction of recorded media	1.000000	1.000412	2.000412
7	Petroleum and coal products	1.000000	0.104108	1.104108
8	Chemicals and allied products	1.000000	0.402314	1.402314
9	Nonmetallic mineral products	1.000000	0.699719	1.699719
10	Primary metal products	1.000000	0.287966	1.287966
11	Fabricated metal products	1.000000	0.926247	1.926247
12	General machinery and equipment	1.000000	0.771984	1.771984
13	Electronic and other electric equipment	1.000000	0.474282	1.474282
14	Precision instruments	1.000000	0.856735	1.856735
15	Transportation equipment	1.000000	0.725692	1.725692
16	Furniture and other manufacturing products	1.000000	0.953056	1.953056
17	Electric, gas, and water services	1.000000	0.324549	1.324549
18	Construction	1.000000	0.980344	1.980344
19	Wholesale and retail trade	1.000000	0.515243	1.515243
20	Eating and drinking places, and hotels and other lodging places	1.000000	0.959444	1.959444
21	Transportation and warehousing	1.000000	0.429775	1.429775
22	Communications and broadcasting	1.000000	0.421361	1.421361
23	Finance and insurance	1.000000	0.283334	1.283334
24	Real estate and business service	1.000000	0.365597	1.365597
25	Public administration and defense	1.000000	0.523615	1.523615
26	Educational and health service	1.000000	0.529274	1.529274
27	Social and other services	1.000000	0.821124	1.821124
28	Dummy sector	1.000000	1.500372	2.500372
29	IT SoC	1.000000	0.214711	1.214711

4) Cost-Benefit analysis

The economic effect can be estimated by the achievement ratio per input budget. First, in the aspect of the budget of the IT SoC Industrial Foundation Composition Project, the total amount of money invested to the IT SoC Industrial Foundation Composition Project as its budget from 1997~2004 is 72.75 billion won. Budget details of each minor field are

* Report on the coefficient of the value-added inducement for each industry is omitted. If wanted, it is possible to be provided by the author.

shown in <Table 6>. Since this research was performed during the year 2005, the final sales of 2005 were impossible to get, thus we excluded the data. And IT SoC the Task of Training Professional Designers was run as an individual project from 2000~2003, (during the period the budget was 3.16 billion won, and starting from 2004 it was expanded as a Main Human Resource Training Project) thus we excluded the data.

<Table 6> IT SoC Industrial Foundation Composition Project annual budgets

(unit : hundred million won)

classification		'97	'98	'99	'00	'01	'02	'03	'04
A. Running the industrial center	support to the designing environment					48	38.0	27.0	20.2
	support to the business foundation and growing					7	7.0	5.0	2.3
	management of the business (rental fee of buildings etc.)					17	-	14.0	9.5
B. IP Designing Environment Construction and support to the technology		-	-	-	17	19	15.0	13.5	10.0
C. support to the SoC Initial product manufacturing		-	-	-	-	40	40	21	16.0
D. support to the IT SoC testing		-	-	-		45	5.0	6.0	6.0
E. construction of the IT SoC testing environment		-	-	-	-	-	-	6.5	4.0
F. construction of the home and abroad network of SoC industry			-	-	-	-	5.0	5.0	4.5
G. Improvement on the ETRI Foundry (*done by ETRI)		-	-	-	-	47	-	-	-
sum		54	51	35	84	223	110	98	72.5

※ B. support to the IP technology was done by the ETRI until 2003

※ E. construction of the IT SoC testing environment was done by ICU until 2004

※ F. construction of the home and abroad network of SoC industry was done by the IT-SoC Association

From 1997 to 2004 the IT SoC Industrial Foundation Composition Project's budget was 72.75 billion won in total, therefore the ratio of the contributive effect of the firms under the support of the Enterprise Incubation System, as being 14.41 billion won, 2.0 to 1. Also, the contributive effect on sales of the Other firms excluding the firms under the support of the Enterprise Incubation System is 258.2 billion won, so the ratio per budget is 3.5 to 1. Finally, as you can see from the sum of the two previously mentioned figures, the overall effect on the whole IT SoC enterprise is 402.2 billion won, thus

bringing an effect of 5.5 to 1 in ratio. And the whole economic effect measured by the production inducement effect is 488.6 billion won, being 6.7 times greater of the project cost of 72.75 billion won.

<Table 7> Summary of the project's economic effect

Details	amount of money (million won)	achievement ratio per input budget
Industrial Foundation Composition Project's total budget(1997-2004)	72,750	
Sales of firms under the support of the Enterprise Incubation System	801,969	
Sales contribution effect of firms under the support of the Enterprise Incubation System	144,075	2.0
Sales of Fabless enterprises excluding the firms under the support of the Enterprise Incubation System	2,395,197	
Contributive effect on sales of Fabless enterprises excluding the firms under the support of the Enterprise Incubation System	258,182	3.5
Sum of contribution on sales(3+5)	402,257	5.5
National economic Ripple effect	488,626	6.7

As you realize, IT SoC Industrial Foundation Composition Project's Overall benefit per cost is, compared to other projects, shows a high figure. For example, according to Park(2005), the expected benefit per cost of the constructing project of the National Technical Information Service(NTIS), of which the Ministry of Science and Technology is in charge of, is approximately 6.1 to 1 in ratio. And according to Chun and Kim (2004), Alternative Energy's Technology Development Supporting project's Social benefit per investment is, for each energy source, approximately 2.6 to 1 (wastes)~ 14.5 to 1(bio) in ratio.

IV. Summary and conclusion

We performed the analysis of economic effect in the IT SoC Industrial Foundation Composition Project, which is the representative IT SoC infrastructure-supporting project. By the 2 stage method using the contribution effect of Sales of the firms under the

support of the Enterprise Incubation System and the contribution effect of the other Fabless small and medium venture businesses' sales along with the estimation of the national economic spillover effect based on the input-output analysis, the result was 488.6 billion won, thus only measured by the economic effect, it brought great effect of 6.7 to 1 in ratio.

The reason to this result is because IT SoC Industrial Foundation Composition Project is presently very weak, but since it's the domestic IT SoC industry's infrastructure supporting project, of which will be the next generation's growth, so relatively the benefit per cost is derived rather high.

However, the evaluation can vary greatly by which method you use to analyze it. Therefore this research has a characteristic to be provisional. Thus, the methodology and the steps used in this research are to be supplemented by theoretic and corroborative development.

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