Available online at www.sciencedirect.com
SCIENCE DIRECT®
Technological Forecasting & Social Change 73 (2006) 377–389
Technological Forecasting and Social Change

Infrastructure of the digital economy: Some empirical findings with the case of Korea

Junmo Kim*

Kon Kuk University, Seoul, Korea

Received 4 March 2004; received in revised form 6 April 2004; accepted 1 September 2004

Abstract

While different conceptions of the digital economy exist, there is a common ground where discussion on digital economy can be fostered. Taking the notion that digital economy as a continuum from the existing old economy, this paper regards the manufacturing sector of the digital equipment as the digital infrastructure. Upon this, this research attempts to analyze the supply and demand side development patterns of the infrastructure of the digital economy in Korea between 1989 and 2000 with the Bank of Korea's data in order to present the dynamic that brought the growth of digital economy. Research findings show that there has been an unique mechanism in the development of IT sector in Korea, while policy measures have been broadly identical to the promotion of other sectors.

Keywords: Digital economy; Supply and demand; Infrastructure

1. Introduction

Digital economy is a new key word describing a new facet of our economy as opposed to the existing traditional image of the economy [1,2]. While different conceptions of the digital economy exist, it is fair to discuss the boundary of the digital economy that forms a common ground. First, the term digital

* Present address. Dept. of Public Admin., Kon Kuk University, Hwa Yang Dong 1, Seoul 143-701, Korea. Tel.: +82 17 713 1406; fax: +82 2 450 3579.
E-mail addresses: junmokim@empal.com, junmokim@unitel.co.kr.

0040-1625/$ - see front matter © 2004 Elsevier Inc. All rights reserved.
doi:10.1016/j.techfore.2004.09.003

economy is used to describe both equipment—manufacturing sectors and service sectors that utilize the digital equipment. Second, it is also reasonable to argue that digital economy cannot be conceived as a discontinuity from the existing old economy, composed of manufacturing and service sectors [3].

This paper, with the backdrop, takes a position to understand the digital economy as the economy in which economic transactions are performed with digital technology [4,5], by which position manufacturing sector of digital equipment is regarded as the "infrastructure" that sustains the digital economy from supply side; in comparison, household consumption can be regarded as the component of demand side "infrastructure". With this conception, this paper attempts to analyze the supply and demand side development patterns of the infrastructure of the digital economy in Korea between 1989 and 2000 with the Bank of Korea's data in order to present the dynamic that brought the growth of digital economy with an eventual aim to draw some implications.

2. Growth of digital economy in Korea

2.1. Policy measures for installing the digital infrastructure

Among diverse groups in business and academia, it may be a common thinking that there exist separate and distinctive policy measures suited for the IT sector. Against this easily perceived idea, there is no specifically designated policy measure for the sector when one approaches the core mechanisms of policy measures.

As presented in Table 1, policy measures for industrial promotion can be divided into two groups, incentives and regulation, which can be applied to virtually every industrial sector for all governments. Among incentive policies, it is possible to distinguish between policies of monetary incentives and those

Table 1
Tools of industrial policy

Incentive policies
1. Monetary Incentive Policy
Tax holidays
Financial incentives (low interest rate, long term credit)
Demand creation policies
Social Infrastructure provision
2. Nonmonetary policy
Vision statement policy
Competition policy
Consortium policy
Regulation policies
1. Monetary regulation
Credit line control
Tariffs
2. Market entry policy
Permission
Antimonopoly and oligopoly policy (antitrust policy)

with nonmonetary incentives. Policies of monetary incentives are, in fact, known to take the lion's share when one discusses the contents of industrial policy in many countries. Inside the umbrella of industrial policy of monetary incentives, there is a quite wide spectrum of policies, ranging from tax credits, finance to demand creation, and infrastructure building including social infrastructure [6]. Among them, tax incentives and finance measures are regarded as controversial in the sense that these policies may distort the economy with the "visible hands of government" [3,7]. Separate from the theoretical debate on its harmful effects, this type of policies has been in practice in many developing countries including Korea [3,8]. It is also a common finding that as an economy develops in its size and mode of governance from government-led to private sector-led, direct measures of industrial policy are reduced in relative terms [9,10]. Regarding IT sector promotion, if a country's policy is linked to annual investment of the country, it would be fair to understand that the country's policies include incentive policies of monetary nature.

In comparison, policies of demand creation and social infrastructure building are clearly less market distorting than the other type of incentive policy. One thing to note, however, is that in utilizing demand creation policy, financial capacity and mechanism of a country determine the extent of the policy in that country. For example, limits of credit lines allowable to firms and households are examples that demand policy can be operated within. In promoting IT sector in Korea, the Korean government has wisely utilized the demand creation policy. An earlier example of this policy is found in the case of personal computer industry promotion in the early 1980s, at which time the Korean industry was in its infant stage. The way the policy worked was that the demand creation was made by making educational needs of students. At this time, a policy example was to host computer skills contest for elementary schools students whose parents were forced to expend on PCs. After the initial promotion, IBM-compatible PCs were in great demand for teenagers through the 1990s.

Nonmonetary incentive policies include "vision statement policy" [7], building cooperative networks [11], and promotion of competition. The vision statement policy is valid in the sense that private sector receives the direction of the government in the way the government will manage the economy in the future. Building cooperative networks have been widely in use, as exemplified in SEMATECH and numerous consortium schemes in Japan [11,12]. In the promotion of IT sector, this type of policies was also in great "demand".

In regulation policies, market entrance regulation has been a very strong policy tool of government including the Korean case. As was the case in other sectoral promotion, regulating the number of firms has been in practice in cellular phone service market, which can be an example of the policy [3].

In sum, in this section, it is reasonable to argue that policy measures that have been effective in other sectors have also been in use in IT sector promotion in Korea, which forms the infrastructure of the digital economy. In the next section, this paper will review the industrial performance of the IT sector in Korea as expressed in published data before going into analyzing the growth of IT infrastructure in Korea.

2.2. Industry performance: an overview of current status of digital infrastructure in Korea

As discussed previously, this paper understands the digital infrastructure as the manufacturing sectors that produce equipment of digital technology, namely, communication equipment and computers. This section reviews the development track of the digital infrastructure industries in Korea during the period this paper is aiming at.

As known to many different layers of audience, Korea's semiconductor industry, mainly memory chip production, has had great competitiveness. This paper, however, excludes the sector in its scope of digital infrastructure to faithfully focus on the impact of policies on the digital manufacturing sectors. As it will be discussed with analytical eyes, Korea's digital infrastructure has seen a fast growth during the 1990s.

2.2.1. Communications equipment sector

In Korea, from the late 1990s on, communications equipment sector saw a dramatic increase of portion taken by cellular phone production. This sector, however, is composed of more than just the cellular phone production. It includes switching system and related sectors including routers and cable manufacturing. During the 1997–2000 period, the sector has experienced a growth of 25.2% in terms of production volume, 7.7% in its value adding, 49% by the standards of export volume, and 17.5% increase in the number of firms (Statistical Bureau of Korea, Manufacturing & Extraction Statistics Report, each year). It is also noteworthy that the sector's portion in terms of total manufacturing sectors has remained as minimal. Statistics show that the percentage of communications equipment manufacturing and related firms among total number of manufacturing firms has marked 1.4% in 2000 by having 1360 firms among the total of 98,110 manufacturing firms, which is a modest growth from 0.9% in 1997.

Viewing from a global perspective, Korea's digital infrastructure as seen in communications equipment production has also recorded a significant growth as with China, as seen in Table 2.

As presented in Table 2, the U.S. production volume clearly showed the country's relative economic downturn, especially the high tech sectors during the year 2001. Another conspicuous finding is that the growth of China and Korea that now show equal proportion in the world production vis-à-vis that of France. Still interesting to observe is that production volume in Asia showed a relatively healthy growth, especially with the cases of China and Korea, while the proportions France and the US took has shrunken. According to the Reed Electronics Research data, during the 1997–2000 period, the world communications equipment market has grown by 11.2% on average, which suggests that if a country's growth in production is higher than the figure, then there must be some plausible causes or scenarios that brought the outcome. As will be explained in the Korean case in this paper, the working of an industrial policy measures can work as a leverage to actualize the growth above the world market trend.

Table 2
Profile of communications equipment industry

Country	1997		1998		1999		2000		2001	
	Production amount	%	Production amount	%	Production amount	%	Production amount	%	Production amount	%
US	94,638	39.0	96,287	39.5	108,676	38.5	123,761	37.2	99,471	33.6
Japan	40,983	16.9	33,392	13.7	39,561	14	46,855	14.1	49,356	16.7
France	14,589	6	15,745	6.5	16,447	5.8	17,672	5.3	15,801	5.3
Korea	6200	2.6	6004	2.5	11,530	4.1	17,078	5.1	15,370	5.2
China	6100	2.5	7400	3	9,300	3.3	12,700	3.8	15,279	5.2

Source: Reed Electronics Research, Yearbook of World Electronics Data, each year.

Table 3
Proportion of PC production and market distribution

Proportion (%)/region	US	Japan	Asia	Europe	Others	Total
Production	24.1	17.4	34	14.9	9.6	100
Market distribution	33.8	16.6	13.8	24.7	11.1	100

Source: Reed Electronics Research, The Yearbook of World Electronics Data 2002.

2.2.2. Computer manufacturing sector

Computer manufacturing industry in Korea has been mainly composed of personal computer manufacturing sector with some segments of server class computers. During the 1997–2000 period, this sector has marked a growth of 26.7% and 11.2% in terms of production volume and number of firms, respectively. In contrast, however, it is noteworthy that this sector has shown a decrease of employed workers by 3.4% in the same period, which shows a degree of automation and modular assembly of parts vis-à-vis other manufacturing sectors. By the standards of production volume, this sector took approximately 4.4% among total manufacturing production volume [13]. The number of firms has been increased from 460 in 1997 to 632 in year 2000.

Looking from a global perspective, the world PC market size has been reported as 40,000 units in 1981, which has been increased to 114 million units n 1999. In 2000, it was reported to reach about 132 million units globally, which was reduced in 2001 to 125 million units [14]. In Table 3, it is possible to see the proportion of PC production and market distribution over the world.

From Table 3 and other information, it is possible to get several implications. One is that Asian countries are production bases for the world PC industry, while the US and European countries import those PCs produced overseas [15]. Second, it is also interesting to know the composition of Korea's PC industry. According to industry statistics, about half of Korean PC production volume is exported as shown in Table 4.

Third, PC production and demand for PCs turned out to be sensitive to economic fluctuation [16,17]. At the same time, the fact that PC production and demand have risen in 1999 from a slump in 1998 implies that demand promotion and creation as a policy would work, as it will be analyzed in the later part of this research, which can be exercised as a momentum for the recovery of the economy (Table 5).

Fourth, it is reasonable to comment on the status of the Korean PC industry in terms of its position. That is, in contrast to the regional characteristic of Asia as a whole, Korea's PC industry has been more

Table 4
Market Structure of Korea's PC market

	1997	1998	1999	2000	2001
Domestic production (A)	9631	7619	13,163	17,572	14,518
Export (B)	5320	4669	7267	9531	7672
Import (C)	2294	1470	3122	5110	3989
Domestic consumption (A−B)+(C)	6605	4420	9018	13,151	10,475
Ratio of export among domestic production (%)	55.2	61.3	55.2	54.2	54.2

Source: Korea Association for Information and Communication Industry Promotion 2002.
Unit: million U.S. dollars.

Table 5
Trade specialization index of PC components industry in Korea

	1995	1997	1999	2001
Desktop PC	−86.2	−86.5	48.7	14.3
Hard disk drive	−28.9	3.3	−18.7	−14.3
Floppy disk drive	−52.9	49.5	−20.8	−54.8
DVD	N/A	N/A	50.4	53.4
Printer	−68.6	−37.3	−7.3	20.0
Monitor	96.9	94.8	92.4	78.9
Other peripherals	−25.2	31.3	−39.4	−52.7

Source: Korea Trade Association data.
Trade Specialization index=(Export amount−Import amount)/(Export amount+Import amount) *100.

attuned to domestic market. Of course, with the statistic of nearly 50% of production volume going into export market, one can still argue that the sector is export oriented, but looking at the figure in Table 4 that the ratio of export to total regional production in Asia is 2.46:1, it is arguably correct to present the Korean PC sector as domestically oriented one. One way to understand this comes from the fact that there is no major PC production firm or brand in the world market compared to other Korean electronics products or Taiwanese PC brands with production line in China. Researchers have attributed to this as a misfit between Korea's corporate governance system and the characteristic of PC market and technology development trend [18]. In other words, Korean firms have been at their best at mass production- and economy of scale-oriented manufacturing even in electronics sector such as semiconductors [3] while weak in adapting to fastly moving PC market, which required more sensitive moves in flexible manufacturing style which Taiwanese firms proved to be agile [19].

3. Methodology

3.1. Data

This research utilized the Bank of Korea's statistics on production index of industrial sectors from 1989 to 2000 and final consumption expenditures of households between 1993 and 1999.

3.2. Method

This research employed a set of cluster and discriminant analysis applied to time series data to find out time series natured determinants that have shaped the growth pattern of industrial sectors with an aim at finding the development pattern of IT sectors to analyze whether they would form infrastructure for digital economy with the case of Korea. Previous research utilizing time series-tuned cluster and discriminant analysis has employed wage data to present how economic determinants have molded wage performance and thereby presented economic policy meaning of the determinants (roots) with the case of Korea and international comparison [8,20]. Succeeding the core contents of the methodology used for wage analysis [3,10], this research tried to expand the envelope of the methodology by using a different time series data to reveal the determinants structure embedded within the data. Since the methodology

has proved that it can discover the underlying economic forces from times series data, it is reasonable to argue that the methodology can be applied to economic time series such as production index in this research.

While industrial production index is utilized to present "supply" side of the digital infrastructure, in this research final household expenditures by accounts were used to evidence a partial but empirical side of "demand" side aspect of the digital infrastructure.

Deriving the above discriminant functions can be explained in the following way. Each discriminant function is to distinguish group means in such a way as to maximize between-group variance (B) and minimize within-group variance (W), when coefficients in vector a, the discriminant criterion, λ, can be expressed as follows:

$$\lambda = (a`Ba)/(a`Wa).$$

By getting a condition for λ to be a maximum:

$$\partial\lambda/\partial a = 0$$

$$\left(W^{-1}B - \lambda I\right) = 0 \text{ or } W^{-1}Ba = \lambda Ia.$$

4. Analysis of the digital infrastructure in Korea: findings

4.1. Cluster grouping

4.1.1. Supply side

The aim of cluster analysis in this research is to find a structure of industries based on similarity of cumulative annual change rate of production index. In comparison, in the demand side cluster analysis, the variables of interest are the different consumption accounts to find out a distinctive consumption pattern. Time series-based cluster grouping in this research has produced a two group structure, as shown in Fig. 1. The grouping structure shows a similarity of annual growth pattern of the industries which is the supply side backbone of the digital economy in Korea.

From the grouping, the left-hand side group with computer and communication equipment is the infrastructure, which clearly shows a distinguishable growth pattern compared to traditional sectors.

4.1.2. Demand side

As discussed in the preceding section, Korea's industrial promotion of IT sectors also came in the form of demand creation. This has, in turn, been interpreted as the participation of household expenditures in IT-related service sectors. In the Korean case, 1990s saw a tremendous growth of mobile telephone and broadband high-speed internet services at home, which can be traced through Fig. 2.

In Fig. 2, communication account, among household expenditure items, has placed itself as a distinctive group vis-à-vis other expenditure items and thereby proved that it functioned as a demand creation measure in the IT sector promotion.

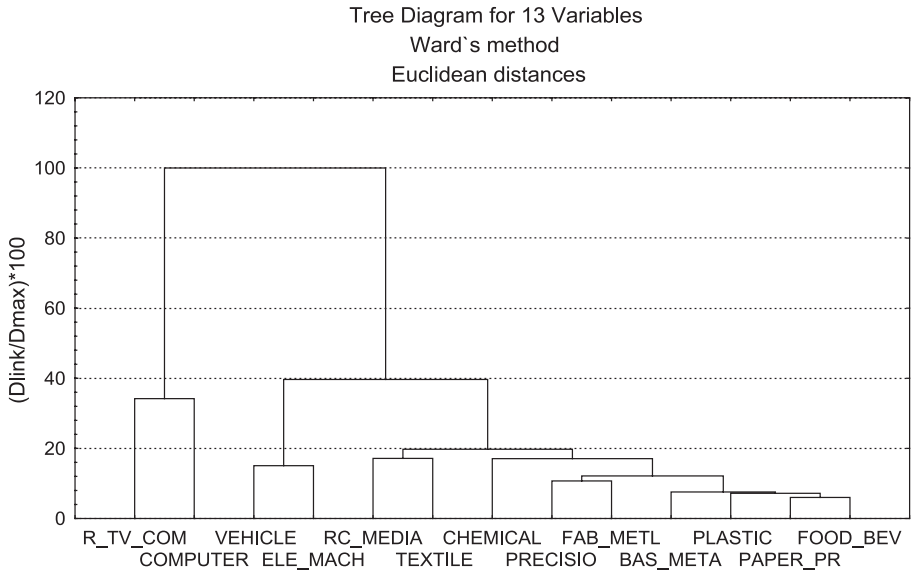

Fig. 1. Cluster tree diagram of the digital infrastructure in Korea 1989–2000 (supply side). Index: sectors and expenditure accounts in full expressions. Manufacturing sectors: group 1—radio, TV, and communication equipment, computer and related equipment; group 2—vehicle, electrical machinery, record and media, textile, chemical, precision equipment, fabricated metal, basic metal, plastic, paper product, food and beverage.

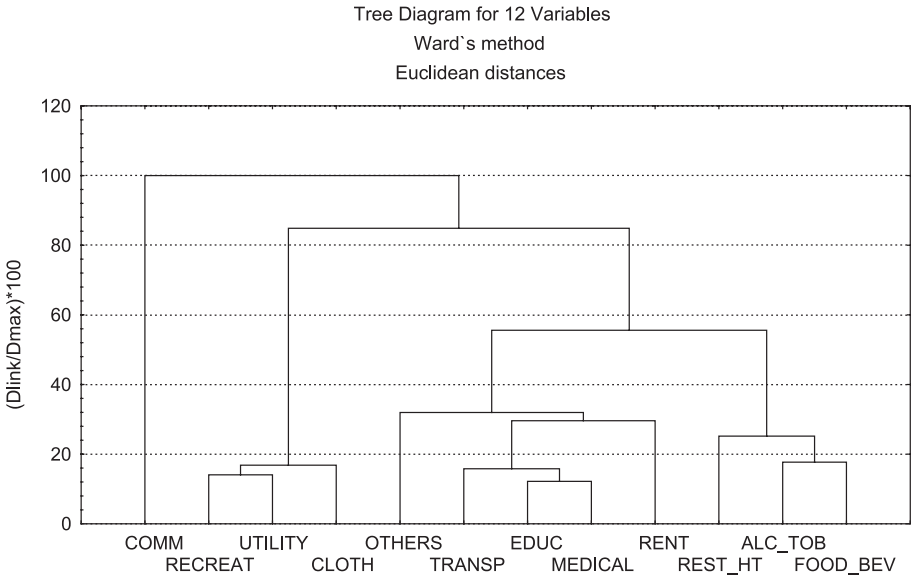

Fig. 2. Household expenditure growth pattern (1993–1999). Index: sectors and expenditure accounts in full expressions. Household expenditure items: group 1—communication services (fixed line, mobile phone, broadband internet services, cable TV, etc); group 2—recreation, utility, cloth; group 3—other expenditure, transportation, education, medical expenditure, rent; group 4—restaurant/hotel, alcohol and tobacco, food and beverage.

4.2. Determinants of supply-side infrastructure

The cluster structure yielded was utilized in time series-tuned discriminant analysis in order to extract historical determinants that have shaped the digital infrastructure pattern in supply side from 1989 to 2000 period in Korea. With iterative matching with various time series indicators, a determinant was found, which was turned out to be best matching with the root with historical meaning. Especially, in this type of analysis utilizing discriminant analysis, those roots were extracted by maximizing between-group variance, and minimizing within group variance, following Ward's [21] method.

In this research, the two group structure yielded a single statistically meaningful root, which takes nearly 100% of total variance of industrial production growth for the period in this research. This root was best matched with the annual investment of the Korean economy [3] in the period under study in time series format, as seen in Fig. 3. From the matching with the annual investment series, it becomes reasonable to analyze industrial performance of IT and non-IT sectors in the following section.

4.3. Interpretation of the impacts of policy variable: annual investment

4.3.1. Analysis of the first root

After extracting the historical root that has shaped the growth pattern of IT and traditional sectors over the 12 years, it becomes crucial to analyze the impact of the discriminant root on both IT and non-IT(traditional) sectors, which can be explained with Fig. 4. Fig. 4 shows how different industries can be located with respect to vertical and horizontal axes.

In Fig. 4, the vertical axis is the cumulative increase of production index from 1989 to 2000 expressed in percentage, while the horizontal axis shows scores of each sector on the annual investment root. The cumulative increase of production for each industrial sector reflects the sector's general characteristics of growth during the 1989–2000 period, while the meaning of root one, the annual investment, can be approached by understanding the sensitivity of each sector to the root. In other words, scoring high on the first root means that when annual investment in Korea increases, a sector's sensitivity of industrial production is high. This implies that when a sector has a high cumulative growth with low sensitivity to the investment root, the growth of that sector should be explained with an alternative explanation.

Interpreting Fig. 4 suggests the following points. First, it is reasonable to argue that the growth of IT manufacturing sector as the digital infrastructure in Korea has been made independent of the annual

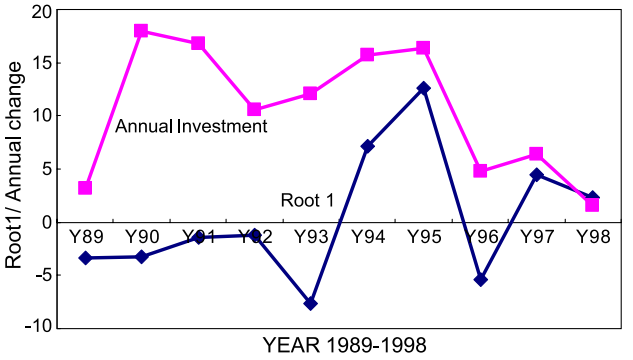

Fig. 3. Annual investment and the first root matching.

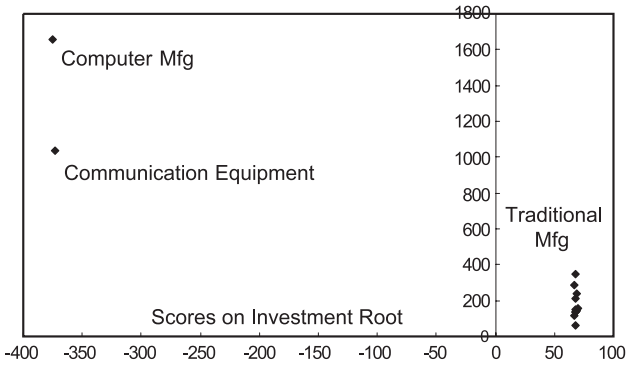

Fig. 4. Annual investment root and the cumulative increase of production index (vertical).

investment pattern of the economy. This argument is made based on the finding that IT sector's score on the canonical root has turned out to be low. Second, despite the fact that IT manufacturing sector has been in disadvantageous position in relation to the impact of annual investment, the overall growth of the IT manufacturing sector has been tremendous by being grown over 1000 % during the 1989–2000 period (1037% for communication equipment and 1659% for computer manufacturing sector, respectively), in contrast to the traditional manufacturing sectors which grew only between 100% and 400% during the same period.

As mentioned earlier, this "seemingly unusual" growth pattern should be explained with an alternative way, which is through the mechanisms of different policy tools. As with other manufacturing sectors, it is undeniably true that Korea's IT manufacturing sector has received government's attention. Despite the common point, what has made the IT sector's growth pattern so unique is found in that not only supply side (investment) policy but also demand side policy has been utilized and made effective with a heavier weight and efficacy on the latter as a hindsight in interpreting the results from this research.

As discussed, in the earlier section, policies of industrial promotion includes demand side promotion, and in the Korean case household and service sector demand for IT sector products in a broad sense has brought the phenomenal growth of the IT sector. This is all the more eye-catching in the sense that IT manufacturing sector marked a sharp growth even when Korea's investment was sluggish after the 1997 financial crisis. Thus, it would be fair to claim that government's general policy to boost the economy through consumption has found an "exit", the IT sector, to buy more "manufacturing products, which marked the gigantic growth of the IT sector with the Korean economy's transition by being coupled with the IT technology.

Of course, if one is determined to list all the policies of demand creation and nonmonetary incentives, it would be possible even to present citizens' PC policy[1] in 1999 or government's directional policy for high-speed network providers[2] in the sense that the policies worked as vision making. It would be,

[1] The Korean government has implemented a policy to provide a low-cost citizens' PC with aims to spread the use of internet services and also to boost the PC industry. The target price of the machine was lower than what industry has expected. So only venders that they claimed they can meet the price zone participated in the program, and the machines were available through postal offices.

[2] The Korean government also wanted to install high-speed internet networks in 1990s, at which time industry expressed objections due to their fear for low demand. Government's directional policy, vision making, to invest and create markets in high-speed networks gave industry business confidence.

however, more important to recognize the efficacy of demand side policies vis-à-vis supply side promotion policies which has widely been used in the Korean soil.

4.3.2. Implications

From this case, two implications can be gleaned.

4.4. The first implication: financial aspect of the dynamic

Conventional understanding and research findings on the Korean economy have mainly centered around what government has done to develop or promote a specific sector in the economy [22]. Thus, one can also argue that Korea's IT manufacturing sector as the backbone of the digital infrastructure in Korea has also been a subject of government's promotion. There is, however, a subtle but significant difference in understanding the development of the IT sector. That is, while the development of most industrial sectors in Korea has been performed with supply side policy measures, which include monetary and nonmonetary incentive policies that aim at increasing and creating production capabilities, the IT sector promotion has been practiced with demand creation approach. This difference has to be understood with a broader angle on the Korean economy.

As most audience would recall, the Korean economy has experienced an economic crisis since 1997 [23], which resulted in changes of the ways the Korean government can promote industries and necessities to boost the economy. In fact, even before the crisis and independent of the economic crisis, the Korean government's move to promote an industrial sector has been "limited" by the WTO agreement on Subsidies and Countervailing Measures which describes no direct subsidy to an industry. Together with the existing limits imposed by international regimes like the WTO agreement, policy measures to meet economic crisis found a solution from a boost of the domestic economy.

As explained earlier in this paper, the boost was found in diverse ways including policies to "buy" more IT products and services. To enable this, government and the central bank, The Bank of Korea, allowed commercial banks to make loans approval to households and personal loans easier. Also put into practice was to increase credit lines for personal loans and credit cards owned by individuals.

4.5. The second implication: policy mechanism

As the second implication, it would be meaningful to note the financial aspect of the dynamic. As mentioned in the preceding segment of this paper, increasing "credit availability" to households and individuals provided a necessary condition to purchase more IT products and services [24]. Despite the "fulfilled" condition, it is noteworthy that it was households that eagerly purchased "durable" goods including cars, PCs, high-speed internet services, and cellular phones with the increased credit. Firms had relatively little appetite to invest in IT products and services vis-à-vis households due to relatively decreased annual investment with the economic crisis.

That is why, in Fig. 4, the performance of IT manufacturing sector in Korea showed a very distinctive pattern by showing high growth rate independent of the dynamic of annual investment pattern. In other words, IT manufacturing sector in Korea, especially during late 1990s and early 2000s, marked a phenomenal growth even when annual investment growth was weak due to strong demand creation. This is understandable with a logical sequence that the increased credit line was, first, used to buy more durables including IT products, which, then, had a spill-over effect to overall economy.

5. Conclusion: possibility for generalization

It is also possible to infer few points regarding the possibility for generalization with the case of installing digital infrastructure in Korea. First, it is not all new to find that demand creation was used to boost the economy from a slow recovery. Since the New Deal era, it has been an often used policy measure. Like the characters in the Wizard of OZ[3], who symbolize the Great Depression of 1930s, households in Korea in 1990s were left in the downturn of the economy. Like the characters restored in the novel, the Korean households clearly contributed to the revival of the economy with their spending from increased credit lines.

Second, there is, however, another point to recall in understanding the recovery of the Korean economy and IT sector growth. On this, it is important to be reminded that Korea's electronics sector was "out-there" to receive the shower of demand. If there were no such sector with preparation, in a counterintuitive sense, it would have been difficult to expect the growth of IT manufacturing as the IT infrastructure in Korea. Also noteworthy is the relative domestic market-oriented nature of Korea's PC components sector. Except for monitors, most of the PC components show relatively low-trade specialization index for export.

Third, it is arguably interesting to point out that one of the critical reasons to "invite" the financial crisis of 1997 has been government-controlled banks [25]. Despite the crisis, the phenomenon of government dominance has not waned out as one infers from the findings from the recovery of the Korean economy. As mentioned, government-guided policy to increase credit lines and commercial banks allowed more personal and household loans. In this process, it is important that government, through the central bank, could exercise more than interest rate policy could do. At least one evidence was found in a move in the fall of 2002 to recover ill-managed household loans without changing interest rates. Thus, it would be a point of academic discussion in times to come whether a national characteristic would remain or how long would it take to change a national tradition of government dominance in managing the financial sector.

Fourth, it is also meaningful to note a side effect of the demand creation policy backed by credit line expansion. As one can imagine, some of the loans turned out to be ill-managed debts, while credit card and cellular phone issuance to teenagers created ill credit problems to those subscribers. In fact, ill-managed loans have more to do with real estate market speculation. Compared to this, building IT manufacturing sector as the digital infrastructure is worthy of being called as a policy success with its contribution to the recovery of the economy.

Acknowledgement

This research was supported by Kon Kuk University.

References

[1] Don Tapscott, The Digital Economy: Promise and Peril in the Age of Networked Intelligence, McGraw-Hill Trade, 1995.
[2] Don Tapscott, Creating Value in the Network Economy, Harvard Business School Press, Cambridge, MA, 1999.
[3] Junmo Kim, The South Korean Economy, Ashgate Publishing, Aldershot, England, 2002.
[4] James W. Cortada, 21st Century Business: Managing and Working in the New Digital Economy, Prentice Hall, 2000.

[3] Characters in the Wizard of OZ symbolize the people who are without purchasing power. In the novel, one should note that the "OZ" is a unit of gold, the monetary standard of the time.

[5] Don Tapscott, David Ticoll, David Ticoll, Alex Lowy, Harnessing the Power of Business Webs, Harvard Business School Press, Cambridge, MA, 2000.
[6] Hyung-Koo Lee, Korean Economy: Perspective for the 21st century, State University of New York Press, Albany, NY, 1996.
[7] R.D. Norton, Industrial policy and American renewal, J. Econ. Lit. 24 (1986 (March)) 1–40.
[8] James K. Galbraith and Kim Junmo, Cambridge University Press, 2001.
[9] Il Sakong (Ed.), Macroeconomic Policy and Industrial Development Issues, KDI, Seoul, 1987.
[10] James K. Galbraith, Junmo Kim, The legacy of the heavy and chemical industrialization in Korea, J. Econ. Dev. 23 (1) (1998) 1–20.
[11] Junmo Kim, "Firm size and inequality of government policy" (in Korean) The Korea Public Administration Journal, The Korea Institute of Public Administration, Seoul, Korea, 1999.
[12] Marie Anchordoguy, Mastering the market, Int. Organ. 42 (3) (1988 (Summer)) 509–543.
[13] Statistical Bureau of Korea, Manufacturing and Extraction Statistics Report, each year.
[14] Korea Association for Electronics Industry Promotion, Korea Electronics Industry Yearbook 2002.
[15] John Senyo, Digital Bridges: Developing Countries in the Knowledge Economy, Idea Group Publishing, 2002.
[16] Erik Brynjolfsson, Brian Kahin (Eds.), Understanding the Digital Economy: Data, Tools, and Research, MIT Press, Cambridge, MA, 2000.
[17] Stan Liebowitz, Re-thinking the Network Economy: The True Forces that Drive the Digital Marketplace, AMACOM, 2002.
[18] Oz Shy, The Economics of Network Industries, Cambridge University Press, 2001.
[19] Bennet Harrison, Lean and Mean: The Changing Landscape of Corporate Power in the Age of Flexibility, Basic Books, New York, 1994.
[20] Junmo Kim, Economic integration of major industrialized areas: an empirical tracking of the continued trend, Technol. Forecast. Soc. Change 67 (2–3) (2001) 188–202.
[21] J.H. Ward, Hierarchical grouping to optimize and objective function, J. Am. Stat. Assoc. 58 (1963) 236–244.
[22] Alice Amsden, Asia's Next Giant: South Korea and Late Industrialization, Oxford University Press, New York, 1989.
[23] Gi-Seok Hong, "An Empirical Study on the Cause of the Financial Crisis" (in Korean) KDI Policy Studies Series.
[24] KDI Economic Outlook 2001 Seoul, Korea. Korea Development Institute.
[25] In Seok Shin, "Korea's Financial Crisis: A Study on the Mechanism" KDI Policy Studies Series, Korea Development Institute, Seoul, Korea, 1999.

Junmo Kim is an Assistant Professor at the Dept. of Public Admin, Konkuk University, in Seoul, Korea. Before coming to the University, he has served as an Associate Research fellow at the Science & Technology Policy Institute (STEPI) and Korea Inst. of Public Admin (KIPA). His areas of interests include Science, Industrial and Technology Policy, Regional Development, Wage analysis, and Policy Evaluation. His major publications include The South Korean Economy (Ashgate 2002) and "Economic integration of major industrialized areas" (Technological Forecasting & Social Change vol 67. No. 2–3, 2001).