

Experiences and Emerging Trends Related to Information and Communications Technology, Innovation and Productivity in Korea

Knowledge Sharing Forum on
Development Experiences:
Comparative Experiences of Korea
and Latin America and the Caribbean

Seung Keon Kim
Woo Soo Jeong
Joon Ah Park

Knowledge and Learning
Sector

DISCUSSION
PAPER N°
IDB-DP-407

Experiences and Emerging Trends Related to Information and Communications Technology, Innovation and Productivity in Korea

Knowledge Sharing Forum on Development
Experiences: Comparative Experiences of Korea and
Latin America and the Caribbean

Seung Keon Kim
Woo Soo Jeong
Joon Ah Park

Korea Association for ICT Promotion

October 2015



<http://www.iadb.org>

Copyright © 2015 Inter-American Development Bank. This work is licensed under a Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives (CC-IGO BY-NC-ND 3.0 IGO) license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/legalcode>) and may be reproduced with attribution to the IDB and for any non-commercial purpose. No derivative work is allowed.

Any dispute related to the use of the works of the IDB that cannot be settled amicably shall be submitted to arbitration pursuant to the UNCITRAL rules. The use of the IDB's name for any purpose other than for attribution, and the use of IDB's logo shall be subject to a separate written license agreement between the IDB and the user and is not authorized as part of this CC-IGO license.

Note that link provided above includes additional terms and conditions of the license.

The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.



Contents

Executive Summary	1
1. Introduction.....	2
1.1. Rationale for the Study.....	2
1.2. ICT Diffusion in Korea	3
2. The ICT Sector: Facts and Figures	5
2.1. ICT and Economic Growth.....	5
3. The Role of Institutions	8
4. Public Policies and Programs.....	10
4.1. Analysis of ICT Policy Trends in Korea	10
4.2. Fostering the ICT Industry	15
4.3. Support Program for Startup Companies.....	16
4.4. Program for SMEs: Global Partnership Program.....	17
5. Case Studies	18
5.1. Joonggok Jeil Traditional Marketplace and ICT Technology	18
5.2. Smart Farm	19
6. Conclusion	20
References.....	23

Tables

Table 1 Trend of Production from Korea's ICT Industry.....	6
Table 2 Economic Growth Contribution Rate	6
Table 3 Trade Balance of Korea's ICT industry.....	7
Table 4 Progress of Promotion of the Master Plan for National Informatization.....	12
Table 5 Major Promotion Plan for ICT Development and Fostering Industry.....	15
Table 6 Global Partnership Program result in 2014.....	18

Figures

Figure 1 OECD Fixed (wired) Broadband Subscriptions per 100 Inhabitants by Technology - June 2014	4
Figure 2 OECD Mobile (wireless) Broadband Subscriptions per 100 Inhabitants by Technology - June 2014	4
Figure 3 Trend of Production from Korea's ICT Industry	5
Figure 4 Structure of Production from Korea's ICT Industry in 2013	6

Images

Image 1 Internet Access Devices installed at the Joonggok Jeil Marketplace	19
Image 2 Smart Farm.....	20

Executive Summary

One of the world's poorest countries following the devastation of the Korean War, the Republic of Korea is now the world's fifth largest trading partner and a major manufacturer of semiconductors, LCDs (liquid crystal displays), digital TVs, mobile phones, automobiles, shipbuilding, and steel. In 1962, Korea had only US\$110 of GNI (gross national income) per capita, but this figure dramatically rose to US\$ 10,770 in 1995. As of 2007, GNI per capita had reached US\$19,730, almost 180 times that of 45 years ago.

The ICT sector has played an important role in this transformation, being the single most important engine of economic growth in the country. This research analyzes the impact ICT has had on the Korean economy, illustrating the main government's policies in the area and discussing their effectiveness.

The Korean ICT development strategy has been based on the following elements, that should be considered by any country willing to use ICT as a growth engine: 1) leadership and commitment, 2) human capacity building, 3) institutional arrangements, 4) legal framework and 5) presence of a funding mechanism for the implementation of ICT master plans, capable of operating even in times of economic crisis.

1. Introduction

1.1. Rationale for the Study

Barriers between nations have blurred in the age of global competition as companies compete not only to secure a competitive advantage in local markets but globally as well. The ability to develop new products and services by using information, technology and knowledge is becoming more and more significant. Innovation is defined as the ability of companies to produce new products and upgrade efficiency in business processes to improve competitiveness. ICT development is critical to obtain such innovation.

Recently, industries have been characterized by the phenomenon of accelerated convergence and increasing value through technology recombination. In particular, the ICT industry is entering a new paradigm of growth through the convergence of traditional industries. Within this new era of “creative economy,” there is a rising expectation for industries to adopt ICT technology in order to enhance competitiveness and increase operational efficiency.

The Korean government prioritizes ICT policies because they are expected to contribute to the well-being of citizens. The government recognizes the pivotal role ICT convergence will play in social, economic and cultural areas. The trickle-down benefits of ICT convergence include cost saving, enhancement of service quality, improved accessibility, and the creation of jobs, all expected to positively influence the daily lives of the general populace.

The phenomenal transformation of the Republic of Korea from one of the world’s poorest countries to one of the richest is widely known, from only US\$67 of GNI per capita¹ in 1953 to US\$26,205 in 2013, almost 394 times that of 60 years ago. And the ICT sector is an important factor in this growth, contributing 16.1 percent to total economic growth in 2010, 34.9 percent in 2011 and 15.9 percent in 2013.² In addition, Korea has experience in overcoming economic crises such as the Asian financial crisis in the late 1990s and the global financial crisis in 2008 by incorporating ICT.

Upgrading the efficiency of companies and activating growth in existing industries through innovative ICT technology is not limited to Korea, but it is also applicable to

¹ Bank of Korea Economic Statistics System (<http://ecos.bok.or.kr>).

² International Trade Statistics 2014 (World Trade Organization).

³ Bank of Korea Economic Statistics System (<http://ecos.bok.or.kr>).

⁴ Rate of internet use of at least once within the past one month, 3 years or older.

countries like those in Latin America looking to achieve higher productivity growth. A joint study between Korea and these states is an opportunity for mutual benefit from cooperation.

1.2. ICT Diffusion in Korea

In Korea, where it was difficult to access even basic telephony until the beginning of the 1980s, a total of 23 million landline telephones had been connected by 2002, increasing the landline phone penetration rate per household to above 140 percent. In addition, the penetration rate of mobile phones had reached 100 percent by 2010. All Koreans are currently able to access these means of communications.

Today, Korea is recognized as a highly advanced country in ICT development. In 2013, the rate of internet usage in Korea³ was 82.1 percent, a 3.7 percent increase compared to the previous year. Internet users numbered 40.08 million (a 1.96 million increase compared to the previous year) and 98.1 percent of total households had access to broadband at the minimum speed of 1-Mbps. Fixed broadband subscriptions in Korea reached 37.9 percent in June 2014, and the country had the second highest percentage of fiber fixed broadband connections, 66.3 percent. Further, in 2013 the country Korea introduced 3G along with active promotion of the next generation network and services.⁴ Now, the Korean government is striving to take the initiative in completing a 5G mobile network that is 1,000 times faster than 4G. The government plans to invest US\$1.5 billion by 2020 with the goal of dominating the 5G market.

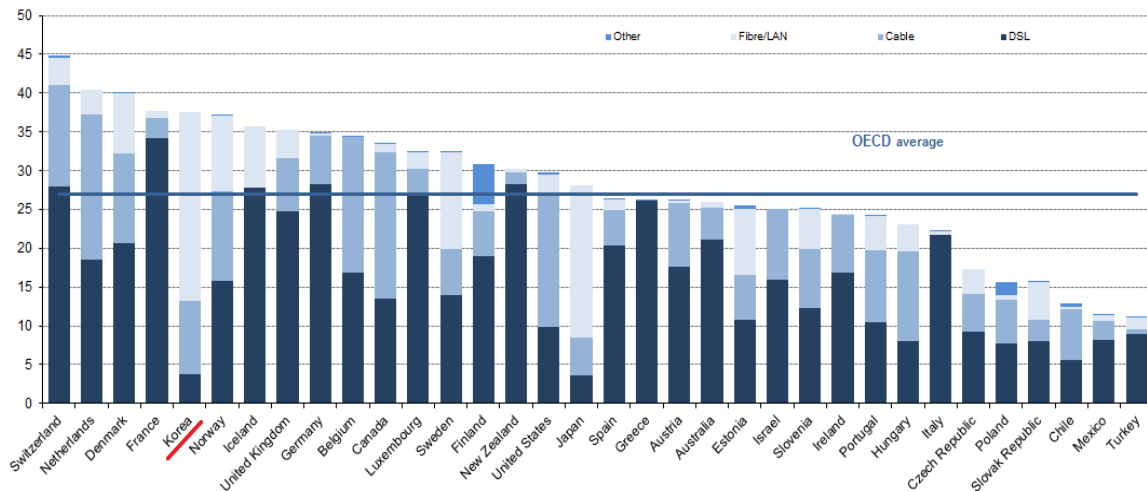
By investing in an advanced ICT infrastructure, Korea is striving to secure global competitiveness of key IoT (Internet of Things)⁵ technologies, which will be the growth engine for the next generation of the ICT industry.

³ Rate of internet use of at least once within the past one month, 3 years or older

⁴ Measuring the Information Society, ITU, 2014.

⁵ Definition of IoT (Internet of Things): Intelligent infrastructure connecting everything for exchange of information and mutual communication between things and humans with information technologies (Source: IoT Activation Plan, 2013, MSIP).

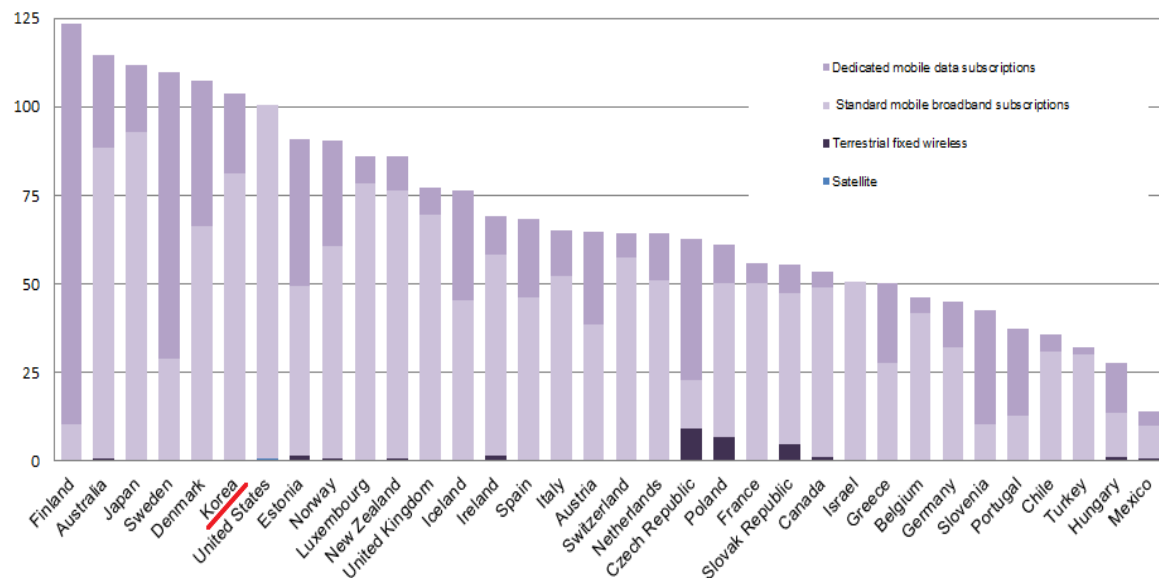
Figure 1 OECD Fixed (wired) Broadband Subscriptions per 100 Inhabitants by Technology - June 2014



Source: OECD, 2014.

Note: Mobil broadband penetration in Korea is above 100%; penetration ranks 6th among OECD countries with a subscription level of 105.3%.

Figure 2 OECD Mobile (wireless) Broadband Subscriptions per 100 Inhabitants by Technology - June 2014



Source: OECD, 2014.

These figures show that Korea has reached the highest level of ICT development and informatization. The country was also given the highest ranking for four consecutive years, 2010-13, in the ICT Development Index (IDI), as measured by the ITU (International Telecommunication Union), a specialized United Nations agency that compares and monitors

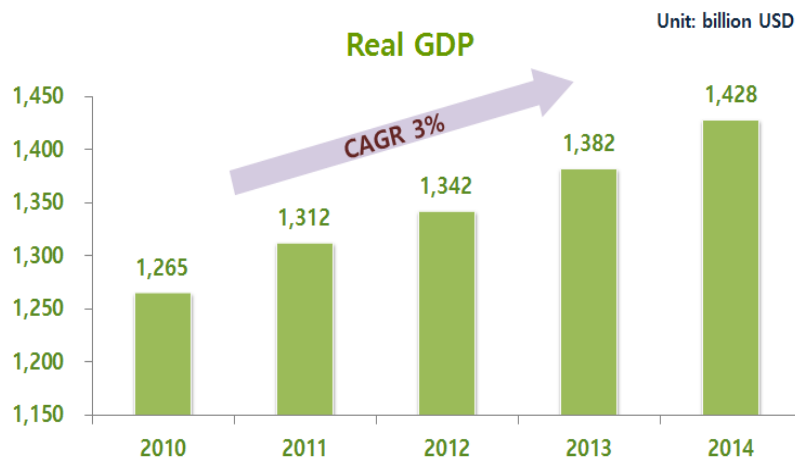
progress in ICT development among member countries. In 2014, Korea was ranked second, after Denmark, in terms of advanced ICT access, usage and skill, followed by Sweden, Iceland and the United Kingdom.

2. The ICT Sector: Facts and Figures

2.1. ICT and Economic Growth

The ICT industry has compensated for Korea's relatively few natural resources by playing a significant role in the country's economic growth. Production generated by the ICT industry increased from US\$44.8 billion in 1995 to US\$399.5 billion in 2013, a growth rate of 12.9 percent compounded annually for 18 years (8.9 times). For the last seven years production has maintained a high growth rate of 7.4 percent.

Figure 3 Trend of Production from Korea's ICT Industry



Source: KAIT, 2014.

The ICT industry in Korea has concentrated on hardware; software accounts for a very small proportion. Flat panel displays and semiconductors account for a large part of hardware, followed by communication devices and devices based on information and communication applications.

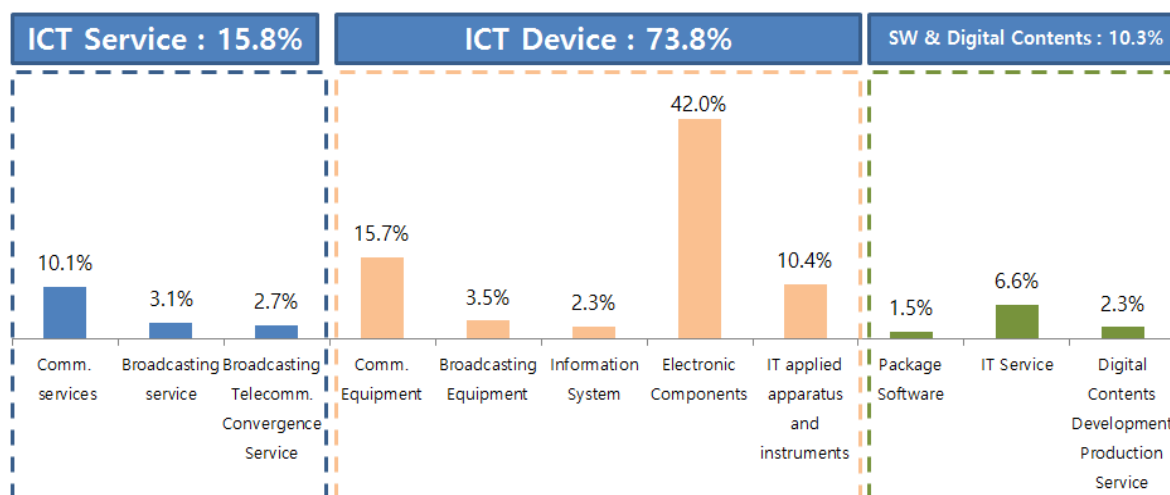
Table 1 Trend of Production from Korea's ICT Industry

(Unit: Million USD)

Year	2007	2008	2009	2010	2011	2012	2013
ICT Service	49,742	52,296.8	54,561.2	56,891.5	59,393.9	61,540.2	62,577.3
ICT Device	190,955	209,964.8	227,295.5	279,355.2	283,446.6	285,142.9	304,694.7
Software	19,958.5	23,600.8	23,452.9	24,554	26,623.6	28,449.8	31,936.1
Total	260,655.5	285,862.4	305,309.6	360,800.7	369,464.1	375,132.9	399,208.1

Source: KAIT, 2014.

Figure 4 Structure of Production from Korea's ICT Industry in 2013



Source: KAIT, 2014.

Table 2 Economic Growth Contribution Rate

(Unit: %, real)

	Category	2010	2011	2012P	2013P
Overall industry	Economic growth rate	6.5	3.7	2.3	3.0
ICT industry	growth rate	12.5	14.8	3.1	5.5
	Proportion of GDP of the ICT	8.6	9.6	9.7	9.9
	Economic growth contribution rate	16.1	34.9	11.5	15.9

Source: Bank of Korea, 2014.

In 2013, the ICT industry posted a 5.5 percent growth rate compared with 2012. In particular, the export of ICT in 2013 reached US\$169.5 billion, an increase of 9.1 percent anchored in increased export of mobile phones. The largest amount of export ever recorded, it comprised 30.2 percent of overall exports and contributed enormously to Korea's trade surplus. In fact, the ICT industry accounted for US\$88.6 billion of Korea's trade balance in 2013, while the trade balance of all industries was about US\$44 billion. Therefore, it can be concluded that the role of the ICT industry for the Korean economy has been so large that the country's total trade balance might have shown a large deficit if the ICT industry had been stagnant.

Table 3 Trade Balance of Korea's ICT industry

(Unit: USD, Hundred Million, %)

Classification		2010	2011		2012		2013	
Export	All Industries	4,664.0	5,552.1	(19.0)	5,481.7	(-1.3)	5,596.3	(2.1)
	ICT	1,539.4	1,566.2	(1.7)	1,522.4	(-0.9)	1,694.1	(9.1)
Import	All Industries	4,252.5	5,244.1	(23.3)	5,195.4	(-0.9)	5,155.9	(-0.8)
	ICT	756.2	815.4	(7.8)	779.3	(-4.4)	808.2	(3.7)
Trade Balance	All Industries	411.5	308.0		282.9		440.5	
	ICT	783.2	750.8		722.8		885.9	

Source: IITP, 2014.

ICTs have led the development of the Korean economy. As of 2013, Korea's ICT industry accounted for 8.9 percent of its GDP, and its contribution to GDP growth was as much as 16 percent.⁶ The establishment of the ICT infrastructure and proliferation of ICT services have attracted development of a hardware industry for communications equipment such as devices and network equipment. Cutting-edge devices like smart phones provide an optimal ICT ecosystem that promotes creation of new services, applications, and contents.

⁶ Bank of Korea Economic Statistics System (<http://ecos.bok.or.kr>).

Furthermore, ICTs have strengthened the fundamentals of the Korean economy and laid the groundwork for the future by enhancing efficiency and productivity, creating jobs and developing new businesses.

3. The Role of Institutions

There has been a sustained political commitment to ICT development from the highest positions of government. Every administration has called for a strong initiative supported by sound policy strategies and restructured governmental organization responsible for implementation in a timely manner. This has allowed different agencies and ministries to coordinate their respective informatization policies. The establishment of the Ministry of Information and Communication (1994) was pivotal for the design and implementation of national ICT policies and initiatives.

In the 1990s, Korea's government had a strong determination that the country would not lag behind in informatization even though it came late to industrialization. Having selected ICT as the new impetus for economic growth, the Korean government established master plans for the development of the information society beginning in the mid-1990s; there was the first Master Plan for Informatization Promotion (1996) and CYBER KOREA 21 (1998). The master plan concept continued into the 2000s with e-KOREA VISION (2003). It is often said that robust government initiatives are a key factor behind Korea's success in the ICT sector. Over the entire process of planning and implementing national projects, the Korean government has effectively used various policy tools, ranging from master plans to the legal framework and regulation, to funds and organizations.

There were several rounds of an ICT national plan, and each plan was supported by relevant laws and regulations. The Computer Networks Act (1986), Informatization Promotion Act (1995), and E-Government Act (2001) ensured legal status and strong support for funding. For the ICT Promotion Fund established in 1996, the government invested a minimum of US\$0.7 billion and a maximum of US\$1.5 billion yearly in ICT R&D, developing ICT human resources, standardization, creation of an R&D environment and loans to ICT ventures. In summary, Korea was equipped with the necessary legal framework, organizations and funding to jumpstart its ICT industry.

Because Korea lacked the technological capability required for industrial development the government established technological institutes in the 1960s to overcome this weakness in private industries and to help them adapt to new technologies. Notably, the

government established the Korea Institute of Science and Technology (KIST) in 1966 and the Korea Science and Technology Information Center (KORSTIC) in 1962. Since 1976, the Electronic and Telecommunications Research Institute, ETRI, focusing on ICT research, has made an immense effort to advance Korea's remarkable growth in the ICT field. The pattern is for the government to announce a clear technology goal within the global market and then encourage private innovation through public R&D projects. For example, in the 1980s, a one-phone-per-household initiative brought significant changes to the everyday lives of Koreans, and was realized by the development of TDX, Time Division Exchange, a fully digital electronic switching system developed by ETRI. Korea started to dominate the world's semiconductor industry by its development of 4M DRAM successfully. During the 1990s CDMA (code division multiple access) phones were commercialized for the first time anywhere. In the 2000s ETRI developed Terrestrial DMB, WiBro, and 4G LTE Advanced, which became the foundation of Mobile Communication. Recently, ETRI is supporting communication and convergence by developing SAN Technology (a cutting-edge ICT that converges with shipbuilding) as well as a Korean to English world-class portable automatic interpretation technology and development of adjustable display technologies, such as transparent display. ETRI continues to contribute to R&D projects and technology development in the ICT sector.

Along with research institutes, the need for scientists and engineers of top quality also arose. The transformation of teaching-oriented universities into research-oriented universities was critical. To encourage this transformation, the government provided financial support to those universities with excellent research performance, and many of Korea's major universities responded with various programs designed to change university education in Korea. The Korean Advanced Institute of Science and Technology (KAIST) is a good example of the type of research-oriented university that Korea supports. Since its foundation in 1971, KAIST has received preferential funding from the government and has been able to recruit the nation's best students for training as world-class, quality engineers. Pohang University of Science and Technology (POSTECH) was founded with similar aims by the Pohang Steel Corporation in 1986, the first private sector initiative of its kind in Korea. Using the KAIST model, the government founded the Gwangju Institute of Science and Technology (GIST) in 1995 and recently established the Daegu-Gyungbuk Institute of Science and Technology (DGIST) in 2004 to promote balanced regional development. Korea was able to lower the risk of product development by creating a pre-market through government-led

R&D projects. These also contributed a foundation for ICT development by attracting top human resources and nurturing a research culture.

From 2000 to 2002, the government offered internet and computer literacy programs to 10 million people, 21 percent of the population, including housewives, the disabled, farmers and even prison inmates. Inexpensive computers were distributed to allow more people to gain access to the internet and more than 2,000 free-of-charge information facilities were set up across the country in already existing community centers. In 1997, the government announced that PC providers and the internet service providers (ISPs) would provide PCs and fixed internet connection to all K-12 schools for free or at discounted rates. The firms provided 290,000 PCs and free internet connection as well as computer usage classes at schools for affordable prices. This effort created a huge demand and market for the ICT industry by knowledgeable domestic consumers. Students familiar with using PCs and the internet contributed to sales of household PCs up to 2 million in the first half of 1999. The sales amount was a 59.2 percent increase over that of 1998, reaching 1.1815 trillion KRW (about U\$1.07 billion).⁷ The high literacy rate and school enrollment were also contributing factors in the widespread adoption and usage of ICT.

4. Public Policies and Programs

4.1. Analysis of ICT Policy Trends in Korea

The 1980s were challenging for Korea. Communications conditions and core infrastructure related to the ICT industry were lagging in both quality and quantity. As an underdeveloped country, Korea was experiencing problems of chronic telephone congestion, aging of facilities, low rates of automation, and divergence between urban and rural areas. In response, the government prioritized the development of ICT to secure state-level competitiveness in the global arena. From 1987, the government began to digitalize major administrative data regarding the nation, such as resident information, land and finance. These projects evolved into a matrix of e-government infrastructure that digitalizes all administrative businesses and connects administrative organizations online.

Another effort to increase capacity by expanding infrastructure through public

⁷ IT Industry Trend Report (2000)

enterprises involved the installation of 10 million telephone lines by 1987. As the government pushed forward in the complete digitalization of public administration by introducing PCs to public departments, Korea paved the way for development of ICT through expansion of its communication infrastructure. It can be said that the 1980s was a time when there was a sustained policy effort to reinforce competitiveness in the communications industry. Although there was a foreign exchange crisis, Korea was able to overcome it with relative ease through ICT development, and it became an opportunity for economic progress. In essence, Korea exerted efforts to develop a digital information system, and the result was use of e-government, CDMA service, and more than 10 million educated internet users, among other benefits.

Korea established the foundation for national digitalization in the 1990s. ICT policies and the significance of ICT development increased all around the world in accordance with the proliferation of the internet. In response to accelerating changes in world trends and to push forward with development of the ICT industry, the Korean government revised the Government Organization Act in December 1994 and reorganized administrative departments on a large scale. At that time a new department, the Ministry of Information and Communication, was established.

The ministry promoted the significance and functions of ICT propagation and took command of the digitalization of information and IT industry-related policy functions in order to push forward with a balanced ICT supply and demand policy. In addition, in August 1995, the ministry enacted the Framework Act on Informatization Promotion to promote national digitalization and thereby provide a legal footing for ICT development. In 1996, the first master plan for the national informatization process in the next five years was drafted to reflect changes in the informatization paradigm and steadily put forward a new vision and strategy. Under the plan, the government promoted an overall and systematic ICT policy by establishing and executing implementation plans for each department each year. That same year, an informatization promotion fund was set up as a stable foundation for ICT development by intensively investing and allocating funds to ICT-based fields, e-government, technical development, and training of manpower.

In the 1990s Korea exerted all out efforts at the government level to build an information superhighway which could serve as the new social infrastructure for the 21st century. In 1995, the General Promotion Plan for Building the Base for the Information Superhighway involved building a nationwide optical transport network; the ATM network was completed after a total investment of 3.2 billion KRW up to 2005. During this process,

the government actively encouraged competition in the communications industry to promote investments and to build a low-cost network environment.

By supporting competition among the common carriers and startups by new local call operators, the government promoted private investment and invited foreign investment to catalyze the early development of a high-speed network. With increased convergence of wired and wireless communications, broadcasting and internet, the government had in place a nationwide network where broadband multimedia services could be provided stably through expansion of the communications infrastructure under the Master Plan for Building of Broadband Convergence Network (BcN) (2004-10). This plan to build the next-generation ICT infrastructure allowed diverse convergence-type services of communications, broadcasting and internet after overcoming the technical limits of the existing information superhighway. As a result, Korea came to possess a high-level ICT infrastructure with 17.86 million high-speed internet subscribers.

The IT839 strategy (2004) was initiated to enhance economic growth through the virtuous cycle of developing ICT infrastructure for service and industry. The strategy encompasses eight key services (including HSDPA, W-CDMA, Wibro, Broadband Convergence Service, DMB, and DTV Service), three advanced infrastructures (BCN, USN, and Soft Infracore), and nine growth engines (including Mobile Communications, Telematics, Broadband Home Network Device, Digital TV and Broadcasting equipment). It has contributed to the propagation of new ICT-based services in Korea in an environment where everyone can access the internet whenever and wherever they want by tapping into a sophisticated network of wired and wireless infrastructure. Despite achieving national access, Korea hasn't slowed efforts to build an intelligent future network encompassing a foothold for Internet of Things (IoT), Giga Internet, LTE Mobile Communications, and Wi-Fi Service.

Table 4 Progress of Promotion of the Master Plan for National Informatization

Classification	Year of Establishment	Title of the Plan	Period	Vision
The 1 st	Jun. 1996	Basic Plan for Promoting Informatization	1996~2000	• Realization of the world's highest level of informatization by 2010
The 2 nd	Mar. 1999	Cyber Korea 21	1999~2002	• Building up of the creative knowledge -based nation
The 3 rd	Apr. 2002	e-Korea Vision 2006	2002~2006	• Building up of e-Korea, a global leader
The 3 rd (Revised)	Dec. 2003	Broadband IT Korea Vision 2007	2003~2007	• Building up of the Broadband IT Korea
The 3 rd	May 2006	Master Plan for u-Korea	2006~2010	• Contribution to building up of the advanced Korea through realization of u-Society on the

				worlds' highest level u-Infrastructure
The 4 th	Dec. 2008	Master Plan for National Informatization	2008~2012	• Realization of the advanced knowledge and information society with creativeness and confidence
The 4 th (Modified)	Mar. 2012	Master Plan for national informatization	2008~2012	• Realization of knowledge and information society under basis of creativity and credibility
The 5 th	2013	Master Plan for National Informatization	2013~2017	• Realization of knowledge and information society under basis of creativity and credibility

The 2000s brought change. Efforts to move the core area of ICT evolution from the public to the private sector began with the presidency of Lee Myung Bak. During a period of stagnation in industrial development and the absence of ICT oversight, the government responded to increasing calls to dissolve the Ministry of Information and Communications, and then establish the Ministry of Science, ICT and Future Planning. This new ministry was expected to lead efforts fostering a creative economy.

Throughout the decade following the Electronic Government Act of 2001, the government designated eleven major national projects as an institutional base for electronic government. The government actively supported the propagation of informatization in the private and public by initiating 31 major e-government projects over five years, beginning in 2003. In the second half of the 2000s, the government pushed an informatization policy focused on value creation, directed to solving urgent issues such as a decreasing birth rate, an aging population, and low labor productivity. The best-known policy was the 2010 campaign for a smart work environment followed by the Smart e-Government Plan in 2011. The goal was to increase “smart work” to include 30 percent of the entire working population by 2015 through the establishment of smart work centers, improvement of mobile working environments, and establishment of a remote collaboration system. In addition, the government has worked toward improved and smarter e-government services that reflect rapid changes in the mobile environment and the new ICT. Thus, Korea has achieved national informatization in a short period by comprehensively pursuing medium- and long-term plans and systematically linking separate informatization plans drafted by each department of government.

In March 2012, in line with the dynamic changes in informatization both in the domestic and international environment, the government modified the 2008 master plan for national informatization to reflect recent paradigm and technology evolution from the conventional concept of IT Power Korea to a more contemporary Smart Korea. The new plan reinforced old targets and direction while updating objectives for each department. The direction of the new strategy reflected recent changes in the informatization environment.

Announced in 2013, the fifth master plan for national informatization (2013-17) presented fifteen tasks conforming to four core strategies for a creative economy that utilizes innovative ICT. The key tactics are: 1) to foster new national industries to lead a creative economy, to create demand through propagation of new technologies, to reinforce the ICT-based creative corporate capability, and to build a foothold for new internet businesses; 2) to realize intelligent administration to guarantee the health of the people through ICT, to build an affluent and smart environment for innovative ICT utilization by the nation and society, to establish an ICT-based national safety network and aim for the sustainable and new intellectualization of SOC (service on a chip); 3) to reinforce future-oriented ICT capabilities, promote a healthy internet culture, and to realize that an abundance of indiscriminate information will reinforce the innovative spirit of the people; 4) to recognize the need for sophisticated digital infrastructures for a creative Korea, to build an intelligent future network, to expand the basis for a safe nation, and to upgrade the national information resource system. The fifth master plan will be assessed as a national strategy in 2017.

The ICT policy that has driven Korea for the last 20 years or so has increased overall efficiency of the nation and society, enhanced productivity, and allowed Korea to develop world-class ICT infrastructures quickly. As a result, ICT is firmly embedded in the daily lives of the populace. People are able to surf the internet rapidly and conveniently, and are able to handle shopping and business conveniently through mobile services without any restriction in time or place. The culture of communication and sharing through social networking services (SNS) is commonplace. Furthermore, mobile and new ICT-based economic and social activities are prevalent, and diverse mobile public services are provided for the benefit and safety of the people; for example, SOS services (sensor observation service) and smart phone reporting of inconvenience in daily lives. Such changes in the utilization of ICT show that informatization is leading the national economy and society as a key driving force that is creating value by enhancing productivity and efficiency, instead of simply being a useful tool.

In an era when creative activities and ideas have economic value, the role of informatization will expand further. It is expected to contribute to creating new demands and resolving pending social issues by prompting the creative utilization of knowledge and information, and by convergence based on the sophisticated informatization that has accumulated so far. Recent technologies like IoT (Internet of Things), Big Data and Cloud are likely drivers for further change in the field of national informatization. New ICT has allowed people to become part of a hyper-connected and intelligent society, with opportunities for new markets. Policies should address these newfound opportunities and the

creative economy which emphasizes ICT as a key driver for creating new industries and which is the economic paradigm of President Park Geun-Hye's administration. With accelerated developments in the ICT ecosystem closely linked with contents, platforms, networks and devices, an important need for an integrated strategy without set demarcations of domain is widely recognized.

4.2. Fostering the ICT Industry

Recognizing that the information and communication industry is promising, Korea has invested in developing key products such as television sets, switchboards, semiconductors, computers, mobile communication and TFT-LCD. The government and private enterprise have worked together through large-scale joint projects to develop these industries so that they are competitive both at home and abroad. In the 1980s, the Development of an Electronic Switching System (TDX) and the Joint Development Project of ULSI Semiconductor Technology (4M, 16M, 64M DRAM) were pushed forward. In the 1990s the Development of CDMA Mobile Communications Technology and the Next-Generation Flat Panel Display (TFTLCD, PDP) Technology Development Project were pushed. As the Republic of Korea entered the 2000s, the IT839 Strategy (eight major services, three major infrastructures and nine key growth drivers) was promoted. In particular, the success of the TDX Development System has been the foundation for large-scale joint development projects for semiconductor and mobile communications.

Table 5 Major Promotion Plan for ICT Development and Fostering Industry

Project Name	Development Period	Major Development Targets	Major Achievements
Development of Electronic Switching System(TDX)	1982~1986	Development of Switching System (500, 9,600 Lines)	<ul style="list-style-type: none"> Developed for the 10th time in the world, achieved 100% automation of telephone exchange (1987), laid foundation for development of information and communications
Joint Development of ULSI Semiconductor Technology	1987~1993	Development of Prototypes of 4M, 16M, 64M and DRAM	<ul style="list-style-type: none"> Developed a prototype using 64M DRM for the 1st time in the world (1992), ranking 1st in production of memory elements (2001), ranking 1st in production of DRAM since 1998
Development of CDMA Mobile Communications Technology	1991~1995	Development of CDMA Digital Mobile Communications Terminal and System	<ul style="list-style-type: none"> Commercialized CDMA for the 1st time in the world (1996), established the foundation for ranking 1st in production of CDMA mobile phones (2001) and ranking

			1 st in production of mobile phones
Development of Next-Generation Flat Panel Display (TFTLCD, PDP) Technology	1995~2001	Development of 30"-Class TFT-LCD and PDP	<ul style="list-style-type: none"> • Emerged as the largest TFT-LCD (Large Size: More than 10") producing country in the world (since 2001)
IT839 Strategy	2003~2007	8 Major Services, 3 Major Infrastructures and 9 Major New Growth Engines	<ul style="list-style-type: none"> • Started the services to use DMB (2005) and Wibro (2005) for the 1st time in the world

4.3. Support Program for Startup Companies

In recent years, Korean economy has shifted from a labor/capital (industrial) economy to a knowledge/information (knowledge) economy. Today, it is moving to a creative economy. It means that economic growth is expected to be the result of extraordinary imagination and ideas that conjure up disruptive products and services. This new paradigm centered on creating new markets and jobs through innovation, intensively fostering ventures and small and medium businesses with a high likelihood of job creation.

In this context, Korea has established its own plan to utilize scientific technologies and ICT capabilities under the leadership of the Ministry of Science, ICT and Future Planning (June 2013). The goal of a creative economy involves the creation of new jobs and markets through creativity and innovation, reinforcement of global leadership within the creative economy, and realization of a society where creativeness is respected and displayed to the fullest.

One important expression of this creativeness in the economy is considered to be the creation of new technological enterprises. Then, a diverse array of political support is available to Korean startups, so that they can become global rather than remaining limited to the narrow domestic market. They receive global-level consulting and network connections. Those with good prospects for competing in the overseas market, as determined by domestic performance, are linked with local overseas infrastructure and networks supported so that they can challenge the global market as quickly as possible. For strategic export areas like Silicon Valley and China, they can receive relevant help through the Overseas ICT Supporting Center, Korea Venture Startup Center and diplomatic offices (Small and Medium Business Supporting Center), etc.

The Ministry of Science, ICT and Future Planning established a Global Startup Center

on September 2013. This is a specialized agency that helps startup and venture companies to target world markets. The center's manpower includes international lawyers, accountants, patent attorneys, venture investment specialists, and marketing specialists who help with overseas market entrance and global startups. In the 13 months between September 2013 and November 2014, the center provided consulting services in more than 2,539 cases for 662 companies. A total of 29 cases of investments have been recorded, equaling US\$23 million.

4.4. Program for SMEs: Global Partnership Program

One of the private sector's contributions to the further growth of ICT is the Global Partnership Program, which aims to match highly competent Korean ICT SMEs with ICT companies in emerging economies, especially telecom service operators, for collaboration and partnership. Looking to create and expand markets, KAIT (Korea Association for ICT Promotion) has been hosting the Global ICT Partnership Program since 2013. The objective is to create a strategic business to business (B2B) meet-connect-partner platform for global telecom operators (hereafter telcos) and Korean ICT SMEs.

KAIT organizes the Global ICT Partnership Program and One-on-One Business Matching meetings where a delegation of global telcos and Korean ICT companies chosen through a comprehensive filtering and matching process can meet to explore a partnership. The program provides opportunities to exchange information related to Korea's ICT products and global market opportunities. The program also plays a bridging role for further partnership, cooperation, and ventures of mutual benefit. In a recent partnership program a total of 41 overseas ICT companies from fourteen countries attended business meetings that scaled up to US\$54.4 million. The ICT Partnership Program held October 20-21, 2014 in Busan featured participation by 51 overseas ICT companies from seventeen countries and resulted in a contract amount of US\$100 million. KAIT is confident that the partnership program will serve as a platform for ICT companies looking for breakthroughs in the competitive market and cooperative development such as revenue sharing.

Table 6 Global Partnership Program result in 2014

Date	Lists of Countries	Number of Companies	Results (Unit:10,000 USD)
17~18 April, 2014	Rwanda, Tanzania	12	1,100
20~21 May, 2014	Bangladesh, Malaysia, Vietnam,	5	1,180
24~25 June, 2014	Bangladesh, Cambodia, Fiji, Indonesia, Mongolia, Vietnam	10	1,590
3~4 Sep, 2014	India, Kazakhstan, Papua New Guinea	4	1,570
Total	14 Countries (Asia 11, Africa 2, Eastern Europe 1)	41	5,440

5. Case Studies

We illustrate how ICT can contribute to increased productivity with two case studies. The first shows how large firms can support SMEs' productivity with ICT. The second case is about how the latest emerging technology, IoT, is applied to farming.

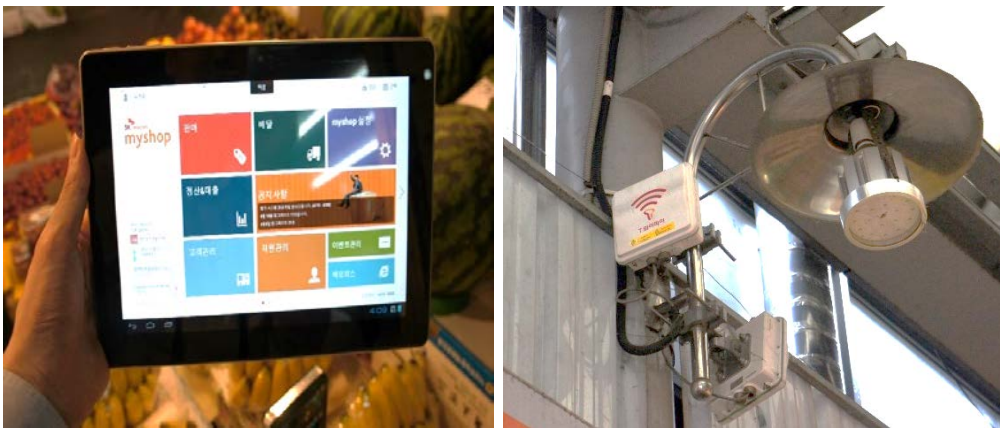
5.1. Joonggok Jeil Traditional Marketplace and ICT Technology

The first case involves convergence of ICT application and non-ICT. Joonggok Jeil Traditional Marketplace is located in the northern part of Seoul and was struggling because of competition from large stores such as Emart and Homeplus, the Korean version of Walmart. Nowadays Koreans tend to shop at large markets with convenient parking and easy access to many types of products, from clothing to toys and groceries. These large markets even provide both online and mobile services for consumers, including payment by credit card and home delivery of purchases. In contrast, the traditional marketplaces usually prefer cash and have rather small or no parking places. To solve these challenges, Joonggok Jeil Marketplace issued prepaid gift cards and coupons in 2005; however, these efforts did not lure consumers from the large markets.

In 2012, Korea's top mobile operator, SK Telecom, offered ICT solutions and management and marketing support as a pilot project. It provided free internet connection to shoppers by establishing the wired and wireless broadband connection within the market, and touchscreen tablets were provided for free to the vendors. The tablet functions as an

electronic cash register and also features software to help small businesses improve their performance, such as by checking inventory and sales data online. SK Telecom launched the initiative in response to a call from the government for large companies to lend a hand to smaller businesses struggling to stay competitive. With this project, digital coupons could be issued easily through smart phones, and the Marketplace was able to provide an online and mobile shopping service. The store owners who adopted the service provided by SK Telecom saw sale revenue start to rise. In 2014, of 143 Marketplace stores, 51 percent now use the service.

Image 1 Internet Access Devices installed at the Joonggok Jeil Marketplace



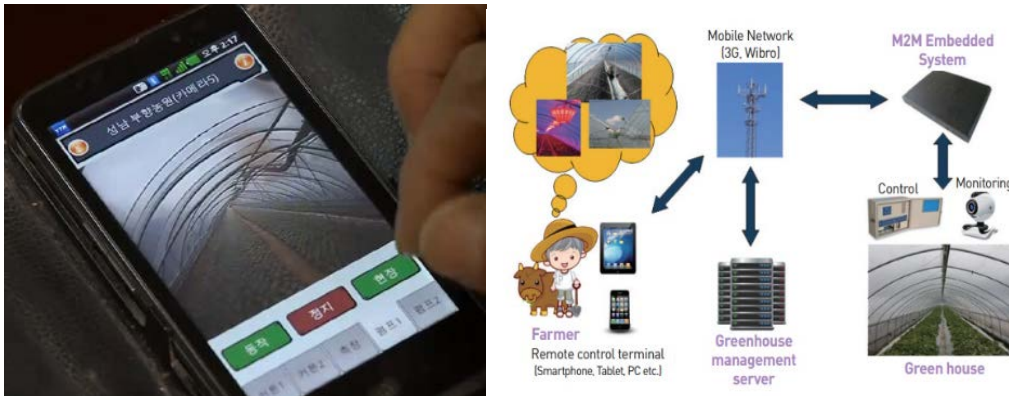
Source: SK Telecom, 2014.

5.2. Smart Farm⁸

This case shows ICT convergence with agriculture via smart phones and enabled by Korea's high-speed wireless networks and latest IoT technology. The project allows farmers to remotely control the temperature and humidity of greenhouses and indoor farms. Through smart farm application, farmers can open and close the ventilation system and sprinklers, control watering and application of manures. Thus, farmers increase their efficiency and crop production and also save time and expenses through increased labor productivity. Smart farm also helps to prevent incidents such as cold weather damage. For example, when a power failure in the middle of the night is sensed, the heating system of the greenhouse turns on automatically.

⁸ The Smart Farm management project is a part of the pilot project of the IoT activation Plan, which is partly funded by the government.

Image 2 Smart Farm



Source: SK Telecom, 2014.

According to the Ministry of Agriculture, Food and Rural Affairs, farms that adopted ICT showed a yield increase of 10 percent per 3.3 m², a decrease of 94 percent in management time and expense. Farms that adopted ICT have reached sales volume of more than US\$500,000. SK Telecom has serviced 150 smart farms serviced since 2012, and in 2014. KT, Korea's second largest mobile telecom service provider offered smart farm service to mushroom farming in greenhouses. The convergence of ICT and the agriculture sector has immense possibilities for growth.

6. Conclusion

This research analyzes ICT's role in Korea's economic development. It shows how effective the government's policies, especially ICT policies, have been for economic growth. Furthermore, it promises to be a useful tool not only for Korea but also for countries in Latin America striving to reach a new frontier for continued growth. To this end, we have considered Korea's ICT policies in detail, while looking at ICT companies and their successful expansion. By analyzing Korea's ICT policies and trends, a better understanding is gained concerning how Korea's economy developed through ICT policies.

The success story of Korean ICT development could be summarized as follows. First, there has been a strong and sustained political commitment to the informatization and development of the ICT sector from the highest echelon of government: Administrations have called for a strong initiative for nationwide informatization supported by a timely comprehensive policy strategy and restructured government organization. The second factor was human capacity building: Public informatization training programs bridged the digital

divide and at the same time boosted the self-sustaining ICT demand among a large segment of the population. The third initiative was the creation of a competitive environment for telecom service providers. The fourth government initiative leading to a successful ICT industry was the development of basic ICT technologies.

Behind these four success factors, there were unique and powerful tools to support development efforts. One of these was the ICT Promotion Fund established in 1996. The size of this fund had risen up to several billions in US dollars by early 2000. Using this funding mechanism, the Korean government could drive the implementation of its ICT master plans very vigorously. The government invested a minimum of US\$0.7 billion to a maximum of US\$1.5 billion yearly in ICT R&D, developing ICT human resources, standardization, R&D environment creation and loans to ICT ventures. This fund was created right before the Asian financial crisis in 1997 and operated smoothly in spite of the financial turmoil experienced during the crisis.

With its successful ICT policies, Korea achieved remarkably rapid economic growth while overcoming the global financial meltdown in 2008 as well as the Asian financial crisis. It presently seeks a new growth momentum by pursuing a paradigm shift in ICT. In fact, the Korean government now aims for further growth within a creative economy. It is promoting momentum for new growth by introducing ICT into traditional industries while actively helping competitive SMEs to venture into global markets. The first is often referred to in terms of nutrition, with ICT playing the role of a vitamin. The prime example for the latter is the Global ICT Partnership program, which allows products and technologies to be exchanged at a low cost between domestic and foreign companies through a customized program. In 2014, the program helped SMEs in Korea to engage in approximately US\$100 millions worth of transactions with companies in Asia and Africa. As these companies learn from ICT companies in Korea, mutually win-win opportunities are expected.

The centrality of ICT has major implications for SMEs and the government. ICT adoption improves efficiency and productivity, and can enhance opportunities for innovative investment. Securing market opportunities and encouraging investment are among the most important priorities. Even though ICT is critical for a company to generate higher profits in a competitive market, it also entails limitations because of the higher cost of managing employees and investing in R&D. To overcome such limitations, mutual collaboration and support are needed for creating new markets and expanding existing markets, rather than engaging in severe competition in a limited market. Therefore, companies need a comprehensive perspective that looks through the entire process of improving its productivity

through ICT as well as considering a strategic managerial skill of efficiently using key resources.

The importance of government policies should never be underestimated. A survey showed that companies most wanted tax exemption for technological development (52.2%) followed by support for commercialization (46%). Even though these are critical for SMEs, only a small number of companies are practically enjoying such benefits. Therefore, financial support needs to be expanded to promote SMEs. Needless to say, support should accompany efforts toward less regulation to improve the current corporate environment. Furthermore, a specific plan for managing the fund needs to be firmly established to ensure that it will indeed be used for R&D projects as originally intended. Finally, a user-centered ecosystem needs to be established. As ICT becomes ever more sophisticated, the center of gravity in its ecosystem is shifting from the market to users. Therefore, for the sake of efficient investment, companies need to approach investment decisions strategically in terms of when, where and how to invest. In addition, continuous dedication needs to be devoted to creating new markets through ICT. In other words, avenues for new growth need to be continuously explored by converging traditional industries with ICT.

References

Bank of Korea (2014), Economic Growth Contribution.

ETRI (2000), IT Industry Trend Report.

Institute for Information and Communication Technology Promotion (2014), Trade Balance of ICT Industry of Korea.

ITU (2014), Measuring the Information Society.

KAIT (2014), Information & Communication Technology Survey.

Korea Public Administration Research, Volume 22, pp.165-195.

LG Electronics (2014), LG Electronics IR Report 2013.

Korea Association for ICT Promotion (KAIT) (2014), ICT Industry Status Survey.

Ministry of Information and Communication (MIC) (2000), White Paper 2000 (in Korean)

Ministry of Information and Communication (MIC) (2001), National Informatization White Paper 2001 (in Korean)

Ministry of Information and Communication (MIC) (2005), Broadband IT Korea 2005 (in Korean)

Ministry of Science, ICT and Future Planning (MSIP)(2013), IoT Activation plan.

Ministry of Science, ICT and Future Planning (MSIP) (2015), Statistics on Fixed Broadband.

Samsung Electronics (2014), Samsung Electronic Sustainability Report 2014, June.

Websites

Bank of Korea Economic Statistics System (<http://ecos.bok.or.kr>)

DAUMKAKAO (<http://www.daumkakao.com/main>)

International Trade Statistics 2014 (World Trade Organization)

KT (<http://www.kt.com/main.jsp>)

LG Electronics (<http://www.lge.co.kr/lgekr/main/LgekrMainCmd.laf>)

LGU+ (<http://www.uplus.co.kr/>)

NAVER (<http://www.naver.com/>)

OECD Broadband Portal (<http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm>)

Samsung Electronics (<http://www.samsung.com/sec/home/>)

SK Telecom (http://www.sktelecom.com/index_real.html)

SK Communications (<http://corp.nate.com/>)