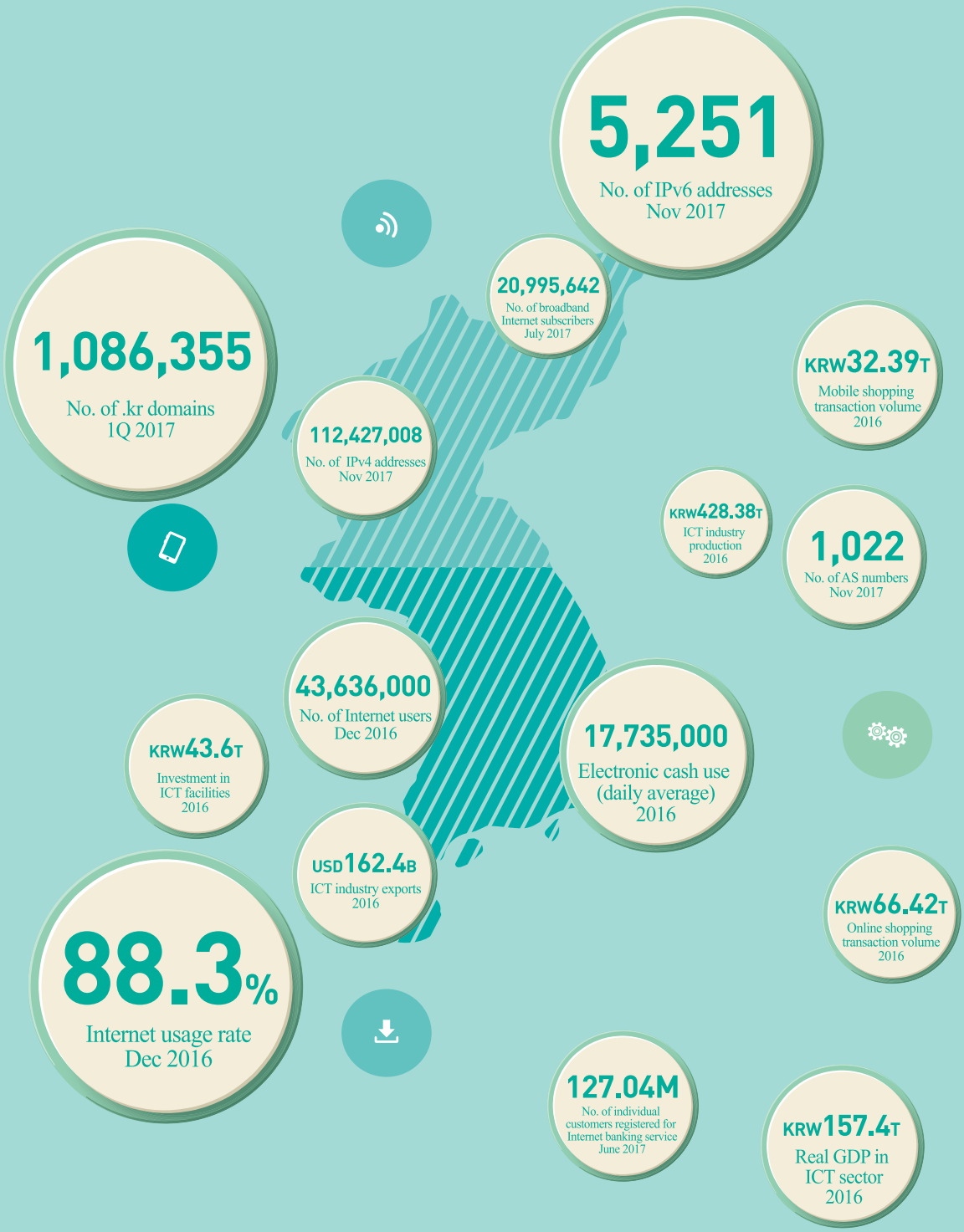
2017

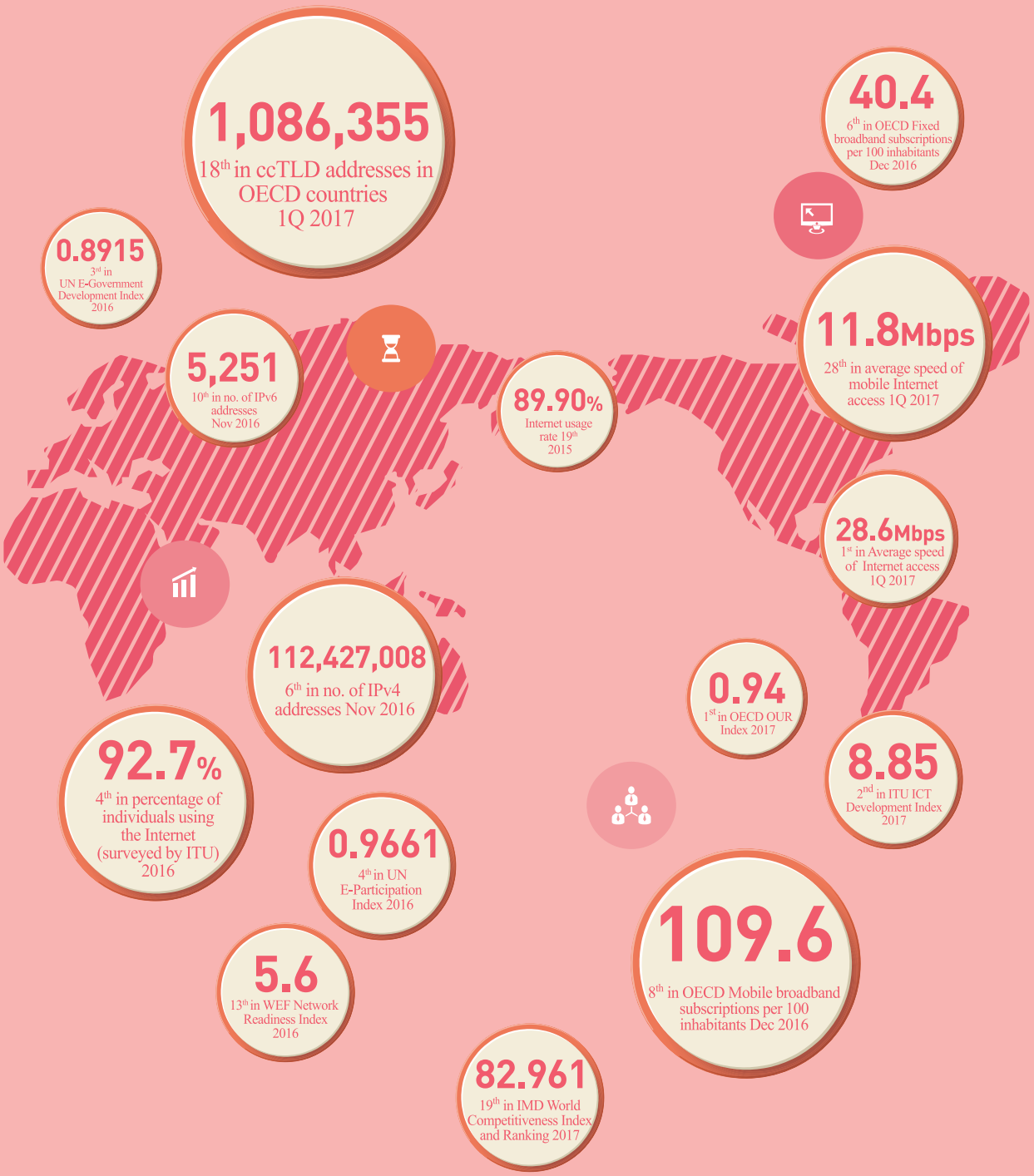
NATIONAL INFORMATIZATION WHITE PAPER

NIA NATIONAL INFORMATION SOCIETY AGENCY

Domestic Data



Global Data


1,086,355
18th in ccTLD addresses in OECD countries 1Q 2017
0.8915
3rd in UN E-Government Development Index 2016
5,251
10th in no. of IPv6 addresses Nov 2016
89.90%
Internet usage rate 19th 2015
40.4
6th in OECD Fixed broadband subscriptions per 100 inhabitants Dec 2016
11.8Mbps
28th in average speed of mobile Internet access 1Q 2017
28.6Mbps
1st in Average speed of Internet access 1Q 2017
112,427,008
6th in no. of IPv4 addresses Nov 2016
92.7%
4th in percentage of individuals using the Internet (surveyed by ITU) 2016
0.9661
4th in UN E-Participation Index 2016
5.6
13th in WEF Network Readiness Index 2016
0.94
1st in OECD OUR Index 2017
8.85
2nd in ITU ICT Development Index 2017
109.6
8th in OECD Mobile broadband subscriptions per 100 inhabitants Dec 2016
82.961
19th in IMD World Competitiveness Index and Ranking 2017

2017 National Informatization White Paper

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2017 National Informatization White Paper

I. Introduction

1. Importance of National Informatization

Mankind has so far experienced three revolutionary changes where development of general purpose technologies significantly improved the economic productivity. The 'fourth industrial revolution' has emerged as a global topic after first being mentioned in the 2016 World Economic Forum and it is not too much to say the era of technological convergence has arrived, in which the borders of physical, digital and biological spaces are blurred. The 4th industrial revolution is expected to bring a whole new level of economic and social reform that is completely different than before. How successfully we cope with such a significant turning point will determine fundamental differences in individual, business and national competitiveness, and therefore, what national informatization means now is ever more important than any other time in history.

Republic of Korea, which has promoted national informatization systematically and efficiently for the last two decades, is now trying to explore and implement informatization strategy under the new paradigm, the intelligent information society. National informatization works as a new driving force that facilitates national development and brings changes in the politics, society, culture and every part of the citizens' lives. In the meantime, the Korean people are expecting to prepare for the 4th industrial revolution through such national informatization.

2. Progress of National Informatization

After computerizing major administrative affairs in the late 1970s, Korea made full-scale investment in projects in the 1980s for modernizing the communication infrastructure and facilitating national informatization. As the result, Korea became the second country in the world to build the Internet, after the United States, and own top-class broadband networks. Since the 1990s, the government focused on digitalizing functions of major administrative institutions. In

particular, it established the Ministry of Information and Communication in 1994 to improve the government's ICT capacity. From the 2000s, the government worked on stabilizing the foundation for electronic business process handling based on the e-government, as the values of national informatization shifted toward improving the citizens' satisfaction with government services and their active engagement in policy making.

The Korean government adjusted its informatization policies so it can secure ICT demand in the public sector first and link such demand with the ICT industry to facilitate rapid growth. Thanks to the aggressive, government-led informatization policies, the ICT industry in Korea continued to show significant growth and played the pivotal role of leading the national economic growth. Despite the harsh trade conditions at home and abroad, Korea's ICT export volume hit USD 162.5 billion in 2016, with the trade balance of USD 72.77 billion, greatly contributing to export growth.

'The 5th National Informatization Master Plan', which is currently implemented by the Korean government, contains strategies for utilizing the information and communication technologies to build the informatization infrastructure that serves as a backbone for the entire industries, and expanding the digital economy to build the foundation for national industry growth and innovation, further to improve the efficiency of economic and social systems on a significant level. All of this is to improve the quality of citizens' lives through national informatization, by enhancing productivity and providing solutions to the current social issues.

In order to support the '5th National Informatization Master Plan' by each area, the government of Korea has developed a wide variety of projects and implemented various policies for facilitating the industry – 'Schemes for nurturing new Internet industries' targeted for IoT, cloud and big data; 'Plans for Content Industry Promotion' aimed at nurturing creative content industry based on the collaboration of the Ministry of Science, ICT and Future Planning (MSIP) and the Ministry of Culture, Sports and Tourism; 'Software Innovation Strategy' for enhancing the national competitiveness through software, the tool for realizing the creative economy; 'Mid and Long-term Strategy for ICT R&D' that contains the strategy and direction for the next five years of R&D; 'Strategy for Big Data Industry Development' for facilitating wide use of big data and foster related industries; 'Plan for Cloud Industry Promotion' that works upon the public and

private collaboration; 'IoT Master Plan' for leading the hyper-connectivity digital revolution; 'K-ICT Strategy 2016' that aims to reach the export volume of USD 210 billion by 2020 through integrating ICT policies into a single brand for raised awareness of the citizens and more synergies between policies, fostering 10 strategic industries, and increasing investments in ICT convergence; 'E-government 2020 Master Plan' which is the first 5-year e-government plan under the E-Government Act; and 'Strategy for the Intelligent Information Industry development' aimed at expanding new convergence industries and innovating the social structure under the vision of realizing a human-oriented, low-cost and high-efficiency intelligent information society. More plans have been als', 'Master Plan for 3D Printing Industry Promotion', 'R&D Plan for National Cyber Security', 'Strategy for 5G Mobile Communication Industry Development', and 'Plan for Facilitating Shipbuilding and Marine Industries based on K-ICT'.

Table 1-1 Korea's national informatization policies and plans

<table>
<tr><td colspan="2" rowspan="3">Informatization Paradigm</td><td colspan="2">1975 20 years ago</td><td colspan="2">1994 20 years of informatization mid 2013</td><td colspan="2">From now to future</td></tr>
<tr><td colspan="2">Age of PC</td><td colspan="2">Age of the Internet</td><td colspan="2">Age of Mobile</td><td>Age of Hyper connectivity</td></tr>
<tr><td colspan="2">Going digital, computerized</td><td colspan="2">Going online, informatization</td><td colspan="2">Going mobile, social</td><td>Going personal, intelligent</td></tr>
<tr><td colspan="2">Informatization Issue</td><td colspan="2">Database, PC communication, GPS, high-speed Internet</td><td colspan="2">E-government, online</td><td colspan="2">Smart phone, mobile Internet, portal, SNS</td><td>Convergence, cloud, big data, IoT, wearable</td></tr>
<tr><td rowspan="3">Master Plans</td><td>Objective</td><td>Computerize public administration</td><td>Expand National Basic Information System</td><td colspan="2">Promote national and social informatization</td><td colspan="2">Establish a knowledge information society</td><td>Achieve creative economy in hyper-connect ed society</td></tr>
<tr><td>Legal ground</td><td>President Park's order to computerize public administration (1975)</td><td>Act on Computer Network Expansion and Usage Facilitation</td><td colspan="2">Framework Act on Informatization Promotion</td><td colspan="2">Framework Act on National Informatization</td><td>Framework Act on National Informatization</td></tr>
<tr><td>Policy</td><td>1978 : 1st Master Plan for Computerization of Public Administration (1978~1987)</td><td>1988 : 1st Master Plan for National Basic Information System (1987~1991)</td><td>1996 : 1s Informatiza-tion Promotion Master Plan (1996~2000)</td><td>1999 : 2nd Master Plan Cyber Korea21 (1999~2002)</td><td>2002: 3rd Master Plan e-Korea (2002~2006)
2003: Revision of 3rd Master Plan Broadband IT Korea Vision 2007 (2003~2007)</td><td>2008: 4th Master Plan National Informatization Master Plan (2008~2012)</td><td>2013: 5th National Informatization Master Plan (2013~2017)</td></tr>
</table>

		1982: 2nd Master Plan for Computerization of Public Administration (1988~1996)	1992: 2nd Master Plan for National Basic Information System (1992~1996)			2006: Addition to 3rd Master Plan u-Korea Master Plan (2006~2010)	2012: Revision of 4th National Informatization Master Plan (2008~2012)	
ICT Projects and Policies for Industry Facilitation		-	1st National Basic Information System Project (1987~1991)	1995: Comprehensive Plan for Korea Information Infrastructure (KII)	2001: E-Government Project	2002: Advancement of Korea Information Infrastructure Project	2009: Giga Internet	2013: Plans for Content Industry Promotion
						2004: IT839	2009: Machine to Machine(M2M) communication	2013: Software Innovation Strategy
						2004: Ubiquitous Sensor Network (USN)	2009: Facilitation of cloud computing	2013: Mid and Long term Strategy for ICT R&D
			2nd National Basic Information System Project (1992~1996)	1997: Plan for KII Improvement	2001: Master Plan for KII Improvement		2011: Smart information using big data	2013: Creative Vitamin Project
						2004: 1st Pilot Project for Broadband Convergence Network (BcN)	2010, 2012: Schemes for facilitating big data services	2013: Strategy for Big Data Industry Development
							2012: Big Data Master Plan	2014: Plan for Cloud Industry Promotion
						2006: 2nd Pilot Project for BcN	2013: Schemes for nurturing new Internet industries	2014: IoT Master Plan
								2014: Master Plan for Facilitating ICT Convergence
								2016: E-government 2020 Master Plan
								2015: K-ICT Strategy 2016: K-ICT Strategy 2016
								2016: Comprehensive Mid- and Long-term Measures for the Intelligent Information Society

Source: Government of Korea, 2017 Annual Report on National Informatization

3. National Informatization Level

Korea's informatization level in 2017 is shown in various global index rankings – 2nd in ICT Development Index, 29th in the technological infrastructure component of the World Competitiveness Ranking, 26th in the technological readiness pillar of Global Competitiveness Index, and 1st in Open, Useful, and Reusable (OUR) Data Index. Although Korea is placed in higher rankings in terms of ICT, its national competitiveness indicators show relatively lower rankings, which calls for more efforts to build up competitiveness of the implementation framework as a whole.

Table 1-2 Korea's rankings in global informatization indices (2010~2017)

Index		Korea's Rank (No. of countries surveyed)							
Index Name (Organization)	Objective	2010	2011	2012	2013	2014	2015	2016	2017
ICT Development Index (ITU)	Measure the information society development level and digital divide	3 (159)	1 (159)	1 (155)	1 (157)	2 (166)	1 (167)	1 (175)	2 (176)
Networked Readiness Index (WEF)	Measure the ICT usage level for improvement of national economy and competitiveness	15 (133)	10 (138)	12 (142)	11 (144)	10 (148)	12 (143)	13 (139)	-
E-Government Development Index (UN)	Measure capacity and commitment to use e-government for ICT-led development	1 (192)	-	1 (190)	-	1 (193)	-	3 (193)	-
E-Participation Index (UN)	Measure the level of citizen's online participation in policy-making	1 (192)	-	1 (190)	-	1 (193)	-	4 (193)	-
World Competitiveness Ranking (technological infrastructure) (IMD)	Measure ICT sector competitiveness as part of the national competitiveness	23 (58)	22 (59)	22 (59)	22 (60)	26 (60)	25 (61)	29 (61)	29 (63)
Global Competitiveness Index (technological readiness pillar) (WEF)	Measure technological competitiveness as part of the national competitiveness	22 (139)	24 (142)	19 (144)	25 (148)	26 (144)	26 (140)	26 (138)	26 (137)

Index		Korea's Rank (No. of countries surveyed)							
Index Name (Organization)	Objective	2010	2011	2012	2013	2014	2015	2016	2017
OUR Data Index (OECD)	Measure usability, accessibility, and government support for developing and implementing open data strategies	-	-	-	-	-	1 (30)	1 (30)	1 (32)
Open Data Barometer (WWW Foundation)	Measure open data policies and practices	-	-	-	12 (77)	17 (86)	8 (92)	5 (115)	-

- ICT Development Index: ITU, Measuring the Information Society Report 2017, 2017.
- Networked Readiness index: WEF, The Global Information Technology Report 2016: Innovating in the Digital Economy, 2016. 7 (data for 2017 not yet published)
- E-Government Development Index: UN, United Nations E-Government Survey 2016: E-Government in Support of Sustainable Development, 2016. 7.(data for 2017 not yet published)
- E-Participation Index: UN, United Nations E-Government Survey 2016: E-Government in Support of Sustainable Development, 2016. 7.(data for 2017 not yet published)
- World Competitiveness Ranking (technological infrastructure): IMD, World Competitiveness Yearbook 2017, 2017.
- Global Competitiveness Index (technological readiness pillar): WEF, The Global Competitiveness Report 2017-2018.
- OUR Data Index: OECD, Government at a Glance 2017, 2017.
- Open Data Barometer: WWW Foundation, Open Data Barometer, 2016.4.(data for 2017 not yet published)

• Informatization Infrastructure

The 2017 ICT Development Index, which measures the overall ICT development level and digital divide of a country, ranked Korea in the second place out of 176 countries. Specifically, Korea was ranked the 2nd in the Skills Sub-index, 4th in the Use Sub-index, and 7th in the Access Sub-index and its total value increased from 2016 by 0.05 point to 8.85. This can be interpreted as a result from the recent changes in Korea, where the increasing mobile use causes reduction in fixed-line telephone subscription and the increase in ageing population and one-person households creates more households with no PC.

• Open Data and Use

While there are worldwide efforts to enhance government transparency, reduce corruption, invite the citizens to participate in the politics and achieve the open government, indicators like the OUR Data Index of OECD and the Open Data Barometer of the WWW Foundation measure

information disclosure and citizens' participation level. The WWW Foundation's 2017 data are not available yet.

OECD has published since 2015 the OUR (Open, Useful, Re-usable) Data Index for its 31 member economies in its annual report called Government at a Glance to assess their efforts in opening up and using data and further help them develop and implement open data strategies. In 2015, Korea was ranked the top, based on the acknowledgement that the country had implemented strong, government-led open data policies to provide public data in a balanced manner and facilitated data use through enhanced accessibility. As the result, Korea scored 0.98 (full score being 1), well above the total average of 0.58.

Also in 2017, Korea was ranked the top with the score of 0.94, followed by France, Japan, UK, Mexico and Spain. The Index consists of 19 indicators in 3 pillars – data availability, accessibility and government support. Korea scored high (0.33) particularly in the area of government support. In terms of availability, Korea was given also a high score (0.32) for its legal and implementation framework such as the Act on Promotion of the Provision and Use of Public Data and the Open Data Strategy Council. In terms of accessibility, the fact that Korea is providing free data on the Open Data Portal so anyone can easily use was also highly valued (0.29).

• National Competitiveness

The World Competitiveness Ranking, published by the International Institute for Management Development (IMD) measures 4 economic and non-economic elements in 4 sub-indices, which are broken down into 20 pillars made up of 346 variables. The sub-indices are economic performance, government efficiency, business efficiency, and infrastructure; of which the variables of technological infrastructure and scientific infrastructure indicate the country's ICT level. Some changes were made for the 2017 survey – from measuring 11 quantitative indicators and 10 survey questionnaires for the technological infrastructure variable to deleting and adding 1 indicator each and changing the definition of 1 indicator. Korea's overall competitiveness ranking in IMD's survey in 2017 stays the same at 29th place out of a total 63 countries. In terms of its rankings in 4 sub-indices, there are slight changes in rankings from the previous survey – 28th → 26th in government efficiency; 21st → 22nd in economic performance; 48th → 44th in business

efficiency; and 22nd → 24th in infrastructure. Its technological infrastructure ranking climbed down 2 notches from the previous year to the 17th.

As for the World Economic Forum's 2017 Global Competitiveness Index, Korea maintains its place from last year at 26th out of 137 countries. Comparing Korea's rankings from last year in terms of each subindex found some changes – 18th → 16th in basic requirements subindex, 26th → 29th in efficiency enhancers subindex, and 22nd → 23rd in innovation and sophistication factors subindex

• Digital Economy

In 2017, OECD published, along with its biennial Digital Economy Outlook, a special report called 'Spotlight on Korea'. This was the first case for OECD to publish a digital economy outlook report for a particular country and to publish it in a place other than the OECD headquarters in Paris, France. This report analyzed that ICT is the focus of Korea's economic growth as well as the key driver for innovation and export, and its ICT infrastructure including the broadband Internet is well established. In particular, Korea was surveyed to stand at the top in value added of the ICT sector and sub-sectors (10.4%), employment in the ICT sector and sub-sectors (4.6%), ICT expenditure on R&D intensities (3.3%) and specialization in ICT-related patents (18%).

OECD found that Korea has the fastest average Internet speed (29Mbps) in OECD and the second largest share (76%) of fixed broadband subscriptions with the speed of more than 100 Mbps in the world. In addition, it forecasted increase in investment focusing on the network for 5G pilot service in the 2018 Winter Olympic Games in PyeongChang.

II. National Informatization Strategy

1. Change of Environment

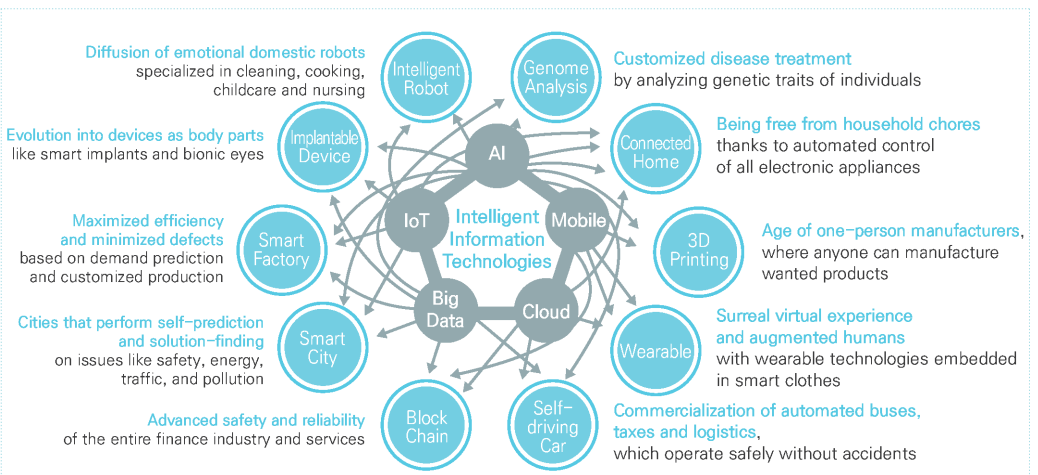
The global economic, social and ICT environments are now rapidly changing. With the start of the hyper-connected age, we expect the ICBM (IoT, Cloud, Big data and Mobile) technologies will interconnect humans and products, while the data industry and intelligent information technologies will grow intensely to create new values. The intelligent information technologies, largely represented by the IoT, cloud, big data and artificial intelligence (AI), are usually serving general purposes to induce innovation of the society as a whole and influence a broad range of social and economic areas. Application of these technologies is continuously expanding through algorithm changes, scalability, deep-learning and other data learning methods. In particular, they are serving as the core elements that significantly enhance productivity and efficiency by converging with different technologies and industries.

As the intelligent information technologies continue to improve its algorithm performance through self-learning on the massive amount of data, the major source of industry competition will be data and knowledge. Businesses that establish the ecosystem for data acquisition and own the algorithm to use such data will lead the market and generate more revenues. Among the global top10 businesses in terms of market capitalization in August 2016, there are 7 ICT businesses, including Apple, Google, Microsoft, Amazon and Facebook, all of which are actively investing into the intelligent information technologies. Such ICT platform businesses using intelligent information technologies are expanding their targets to all industries, breaking down the boundaries of traditional industries as well as threatening the existing manufacturing and service companies.

According to a report called Disruptive Technologies 2013, published by the global consulting company McKinsey, the effect of knowledge labor automation through AI is expected to reach USD 5.2～6.7 trillion worth per year by 2025. Already being aware of the disruptive effect of the technologies, leading countries and businesses around the world are systematically carrying out long-term, large-scale R&D and investments with the focus on gaining the competitive edge through early development and commercialization of intelligent information technologies.

The changes brought by such technologies to the industrial structure are certainly expected to transform the nature of jobs and works, completely changing our lives as a whole. Human labor in each and every corner of the society will be replaced by machine, leading to even expansion of economic and social benefits including increased productivity, reduced amount of work time, and extended health span. However, such automation of work will change the employment structure, where simple, repetitive jobs are diminished and demand for value-added manpower is increased. In order to cope with these changes, it is important to achieve the intelligent information technologies and secure human talents who are armed with the capacity to apply the technologies to various industry areas.

Figure 2-1 Examples of the intelligent information technologies converged with other industries/technologies



Source: Ministries of the Republic of Korea, 2016 Comprehensive Mid and Long-term Measures for the Intelligent Information Society

Rearranging and reallocating manpower in the society through re-training, whose jobs are to be automated, is emerging as a major task in the area of employment in the intelligent information society. There will also be a need for policies that improve the employment safety net focused on salaried workers and ensure social protection of workers of the platform industry.

2. National Informatization Plans

As provided by the 'Framework Act on National Informatization', the Korean government develops a master plan every five years to set out direction and strategy for national informatization of the next five years. The '2016 Action Plan for ICT Promotion and Convergence Facilitation', announced in August 2015 following the 'Master Plan for ICT Promotion and Convergence Facilitation', contains which way the ICT and convergence policies should go in 2016 to cope with the changing technology and market conditions. The Action Plan of 2016 integrates plans submitted by each ministry, largely incorporates them with the 'K-ICT Strategy', the mid and long-term policies developed in March 2015 for ICT industry development, to focus on enhancing the timeliness and feasibility of the policies. In May 2016, the 'K-ICT Strategy 2016' was developed as a follow-up of the 'K-ICT Strategy'. Based on the 'K-ICT Strategy' as a single brand of ICT policies, Korea made significant achievements – winning the first place in 2015 ICT Development Index, third in ICT exports, and software export increase.

In order to be proactive and prepared for the changing global economic, social and ICT environment caused by the 4th industrial revolution, which is often represented by the intelligent information technologies, the Korean Ministry of Science and ICT (MSIT) joined hands with other ministries and came up with the 'Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth (Coping Plan for the 4th Industrial Revolution)' and set out a new vision – 'Achieving the human-oriented 4th industrial revolution that is joined and enjoyed by all'. In the harsh environment with declining birthrates and stagnating economic growth, it is time for Korea to build a foundation so it can take another leap forward in overall aspects of the economy and society through informatization based on the intelligent information technologies. These plans were developed against the backdrop of the hyper-connected society, where the intelligent information technologies that use data to provide intelligent services, are expected to be the major determinant of industrial prosperity under the coming 4th industrial revolution, or the second information revolution.

In addition to the plans, the government developed the first five-year 'E-Government 2020 Master Plan' based on the Article 5 of the Electronic Government Act. This aims to overcome the limit of the existing e-government by taking into consideration the demand for a new e-government strategy that solves complex and challenging social issues such as the increasing youth unemployment caused by low birthrate and ageing and social polarization. The new strategy focuses on re-designing the administrative services for Gov 3.0 and using intelligent information technologies like ICBM (IoT, cloud, big data and mobile) to tackle the issues.

Table 2-1 Major informatization policies of Korea

Name	Contents	Unique Features
K-ICT Strategy 2016 (2016.5.13.) (2016~2020)	- Vision: Creative Korea led by K-ICT - Goal: Achievement of 8% growth rate, KRW 240T in production volume, and USD 210B in exports by 2020 with new innovative industries and stronger major industries - Major tasks ・Nurture 10 strategic industries (5G, UHD, digital contents, smart devices, IoT, cloud, big data, software, information security, and intelligent information) ・Expand investment to ICT convergence: realize convergence in major areas, improve regulations on convergence, expand public demand, etc. ・Improve ICT industry structure: accelerate technological innovation, nurture creative talents, and globalize startups and venture companies ・Strengthen global cooperation: facilitate overseas market entry in ways that best suit each institution and step up global leadership ・Secure competitiveness in leading industries: obtain original technologies for semi-conductors, mobile phones, intelligent semi-conductors, etc.	- Industry development Ministerial collaboration: integration of ICT policies into one single brand - Emphasis on intelligent information technologies - Emphasis on deregulation - Induced investment from private sector
E-Government 2020 Master Plan (2016.6.9) (2016~2020)	- Vision: E-government that provides new enjoyable digital experiences - Goal: Provision of services meeting emotional needs of citizens, achievement of intelligent information-based government, and implementation of sustainable digital new deal - Major strategies ・Redesign government services ・Achieve cognition/prediction-based intelligent administration ・Establish a new ecosystem for e-government that coexists with industries ・Expand reliable future infrastructure ・Take the lead in global e-government order	- Innovation of public administration and services - Emphasis on intelligent information technologies - Public-private collaboration

Name	Contents	Unique Features
Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth (2017.11)	- Vision: human-oriented 4th industrial revolution that is joined and enjoyed by all - Objective · Create diverse range of new industries through intelligent innovation and nurture strong core industries · Solve long-challenging social problems and improve the quality of life · Create new decent jobs and strengthen the social safety net against changes in the job market · Secure world's top class intelligent technologies, data and networks for use by all - Major strategies · Carry out intelligent innovation projects (12 areas) · Secure technological capacity for driving growth · Create industrial infrastructure and ecosystem · Cope with changes in the future society	

Source: Government of the Republic of Korea, 2017 National Informatization White Paper; Ministries of the Republic of Korea, Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth, 2017.

• 2017 National Informatization Action Plans

The total amount of government investment into national informatization in 2017 was KRW 5.37 trillion, which was an increase by KRW 0.3 trillion from 2016. Central government ministries invested KRW 4.19 trillion, while local governments invested KRW 1.18 trillion. The Korean government is implementing a wide variety of programs for national informatization to provide customized administrative services and enhance convenience for the citizens. The Ministry of Science and ICT provides a total of KRW 21.1 billion to 16 programs that facilitate cutting-edge services in government ministries, local governments and public offices – some of these programs are building the intelligent virtual simulation system (Ministry of National Defense), pilot system for medical record exchange between hospitals (Ministry of Health and Welfare), and AI-based one-on-one tutoring system (Educational Broadcasting System, EBS).

Particularly for the PyeongChang Olympic Winter Games, there will be 5G pilot networks constructed in major locations like PyeongChang, Incheon International Airport, and Gwanghwa-mun, to provide visitors with the hologram service, through which they can feel the games right in front of their eyes as if they are in the games, and the indoor and outdoor navigation service using precise determination technologies and augmented reality technologies.

Table 2-2 Project investment based on 2017 National Informatization Action Plans

Area	Project Category	No. of Projects	Budget (100M KRW)	Total
Support for intelligent information technology and service introduction	Internet of Things (development of IoT convergence technologies)	51	1,417	822 projects KRW 1.37 trillion
	Cloud computing (cloud-based integration of old equipment)	282	4,010	
	Big data (construction of spatial big data system)	144	949	
	Mobile (intelligent tax administration service)	320	2,683	
	AI (construction of AI-based adaptive security system)	25	1,308	
Reinforcing information security	R&D Information security policies and R&D - Designation of new ICT infrastructure and raising awareness	153	1,069	1,258 KRW 374.8 billion
	Information security products and services - Improvement of the response system against hacking, viruses, etc.	975	2,289	
	Physical security products and services - Improvement of the protection systems to prevent information leakage	130	390	
Removing Active X	System improvement to provide non-ActiveX pilot service for the Supreme Court	46	222	46 KRW 22.2 billion

*Double-counting for any project that falls into many categories; AI and ActiveX removal projects are counted for the central government ministries only.
Source: Adapted from MSIP 2017~2018 Action Plan for National Informatization.

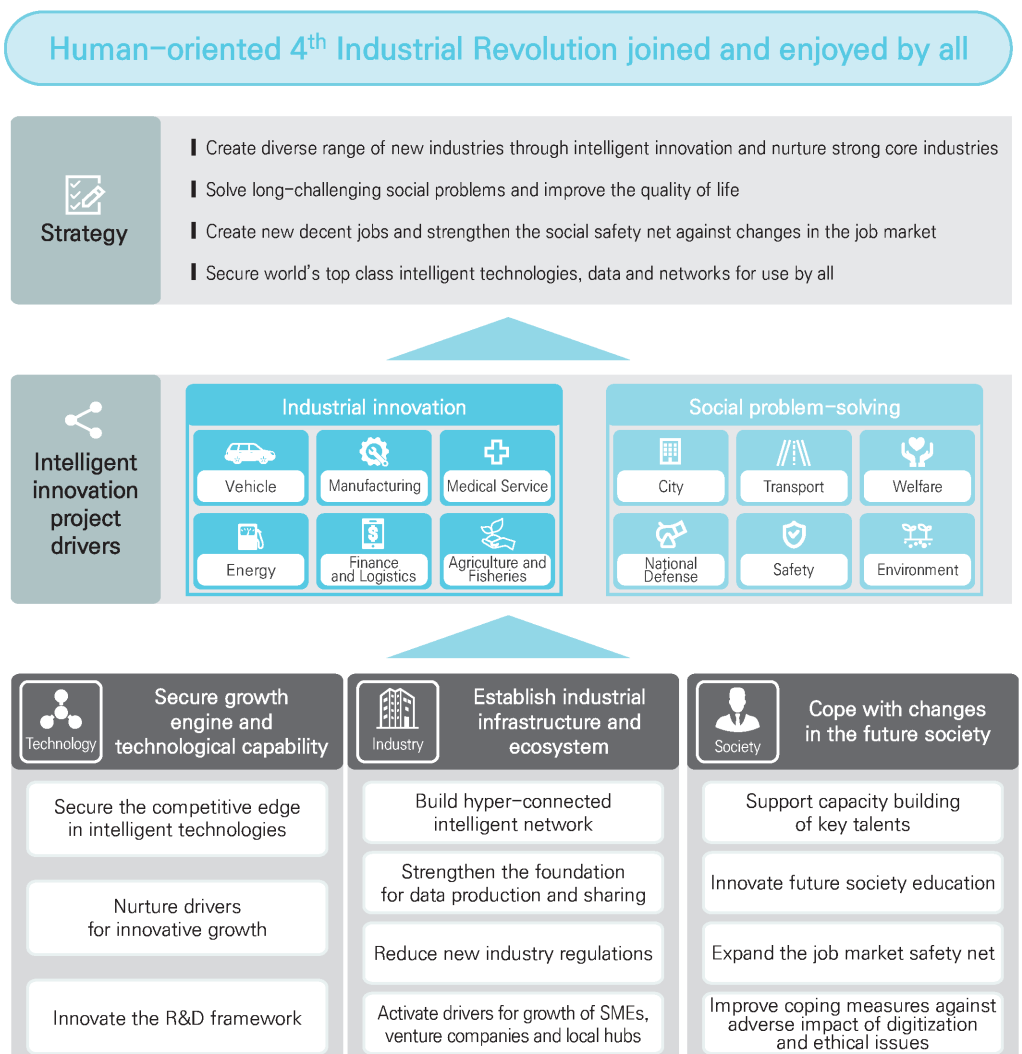
• Coping Plan for the 4th Industrial Revolution

The Plans for the 4th Industrial Revolution is a government-wide scheme that is aimed at supporting 'innovative growth', which is the key policy agenda of the new government, and implementing the 'human-oriented 4th industrial revolution'. The Plan holds significance in that it goes beyond the general theories of the 4th industrial revolution to detailed blueprints for fully making tangible performances and new changes.

The policy brand for the 'Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth (hereinafter called the Coping Plan)' is 'I-KOREA 4.0', where the 'I' means intelligence, innovation, inclusiveness and interaction. The brand symbolizes the goal of becoming a leading country in terms of the 4th industrial revolution using intelligent information technologies, and putting the priority on the values of inclusiveness, integration and communication

for citizens. It also signifies the continuing efforts of digital innovation of the country, following e-Korea (2002) and u-Korea (2006).

Figure 2-2 Vision and strategy of the 'Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth'



Source: Ministries of the Republic of Korea, Coping Plan for Human-oriented Fourth Industrial Revolution for Innovative Growth, 2017.

III. Progress of New ICT Development

1. Artificial Intelligence (AI)

1.1. AI Market and Industry

The AI industry ecosystem is building up with the focus mostly on global IT businesses and the United States has truly positioned itself as the leader in AI. From global IT companies willing to make investment and active programs for startup and incubating to academia engaged in basic AI research and government policies developed upon solid awareness of the importance of AI and commitment to make investment – there are a wide range of elements that make up the strong ecosystem for technology development.

In particular, China is showing eye-opening achievements in the area of AI. According to the 2015 ICT Competitiveness Analysis by the Institute for Information and Communications Technology Promotion (IITP), China was behind Korea in terms of the AI technological competitiveness. However, for the last two years, aggressive investments were made to AI mostly by so-called BAT-Baidu, Alibaba and Tencent, the three global-level Chinese IT companies, and China climbed up the rankings to the second after the United States.

In the McKinsey & Company's report 'Artificial Intelligence-the Next Digital Frontier', published in June 2017, found the amount of money that worldwide businesses invested into AI in 2016 was around USD 26～39 billion. In particular, global IT companies like Google and Baidu have invested USD 20～30 billion to AI research, of which 90% went to technology development, which shows their determination to become the leaders in AI technology. Venture capital and seed money investment for AI startups take up the remaining USD 6～9 billion.

AI is also the focus of attention in Korea. Major IT companies are recently releasing AI products and services but they are still less competitive than other global IT companies. One of the major AI product type in Korea is voice-recognition speakers and mobile communication service providers and IT companies are competing to take the initiative in the market.

Internet businesses like Naver and Kakao, and large companies like SK and Samsung are creating the competitive environment for AI. The most intense competition in Korea's domestic

AI industry is found in the area of intelligent virtual assistant, where Naver's 'WAVE', SK's 'NUGU', KT's 'Giga Genie', and Samsung's 'Bixby' are competing. AI development in Korea is expected to be focused on voice recognition in Korean language and the natural language processing technology. Naver, for example, is one of the most active companies in Korea in developing AI technologies and has released diverse AI services including the conversation system, interpretation, image search, and intelligent speakers. In January 2017, it worked on separating Naver Labs as an independent corporation to develop the source technologies for AI, and has been conducting researches on voice recognition-based AI, image recognition and processing, self-driving cars and robotics.

The SK Group, on the other hand, introduced Korea's first intelligent speaker NUGU and increased the number of its subscribers to 150,000 in July 2017. It also established in January 2017 a new organization called T-Brain which is dedicated to work on AI. It introduced the IBM Watson and launched its AI service AIBRIL, and started GPU computing infrastructure service for learning through its CloudZ

1.2. AI Technologies and Services

AI, one of the key intelligent information technologies, has positioned itself as a general purpose technology (GPT) just like the steam engine in the past. AI is driving advancement of the society and industry as a whole, and taking the initiative in AI technology development is as influential as a determinant of the national competitiveness.

The go match between AlphaGo and the 9-dan pro Lee Sedol in March 2016 signaled the potential of AI to be widely known to the world. However, professionals in the academia had already predicted the AI's winning even before the match. It was Geoffrey Hinton from the University of Toronto who first introduced the concept of deep neural network in 2006 and opened the prelude of the AI era. After the success of Google Brain Project in 2012, when AI started recognizing the image of cats, the area of image recognition using AI made a huge improvement. Understanding such potential of AI, scientists are working on AI application in their fields. Thus, AI's capability to recognize objects from images has already surpassed that of

humans; moreover, it understands more than two languages at the same time and there are robots even writing news articles.

• Generative Adversarial Network (GAN)

GANs were first introduced in 2014 Conference on Neural Information Processing Systems and soon became the center of attention in the academia and industries for their potentials explained in the GAN tutorial at 2016 NIPS conference. GANs produce new information through two neural networks contesting with each other. For instance, when System A makes counterfeit money whereas System B detects the false money, the two systems go through the competing and learning process where they continuously make and detect counterfeit money to a point when it becomes impossible to tell counterfeit money from the real money – this is how GANs work. The major application area of GANs is automatic image generation, which generates the relevant image based on the sketch input. The recently buzzed-about paintings and drawings of AI were also made from the GANs. Application of GANs is also expanding to other areas, such as image recovery, movement imitation, and new drug development.

• Differentiable Neural Computer (NDC)

In October 2016, Google's DeepMind Technologies Limited, the team that developed AlphaGo, published an article in the world-class scientific journal, Nature, regarding a new AI learning method. The concept of this method called a 'differentiable neural computer (DNC)' starts from the fact that the deduction process of a human involves reorganizing of the memories embedded in the neural network. While the deep learning method so far had no such function as information storage, DNC can be considered as the concept that adds the function of information storage to the general computing function of the artificial neural network. The article introduces how these two functions are combined to make inferences in a way similar to the human brain. In particular, it introduces how DNC performs learning through the process of reading and writing information in the storage space. This shows the potential for learning a larger amount of data more efficiently than now. DeepMind proves DNC's inference function through several cases and examples – it showed 96% of accuracy rate for the Q&A data of bAbI, released by Facebook Research. For instance, as for the bAbI data describing that 'John is on the playground and he has a soccer ball',

DNC infers 'the soccer ball is on the playground' when given a question 'where is the soccer ball?'. DNC's ability to make inferences from bAbI data was described as far surpassing the level that had been mentioned as the result of the existing studies. It also proved excellent performances in other tests-inferring the number of family members from family trees, measuring the shortest routes in London Tube, and playing block puzzle games.

• Reinforcement Learning of Human Behaviors or Movements

In July 2017, Google DeepMind developed and introduced an AI that imitates human behaviors. Reinforcement learning was used here, which created the self-play games of AlphaGo. Reinforcement learning is an AI technology that leads to the optimal strategy after numerous trial and errors and is often used in games with clear targets or goals. However, goals of human behaviors are less clear. For instance, humans'movements that balance the body cannot be discussed in terms of victory or defeat as in games. That is, there may be appropriate or proper movements but no right or wrong movements. The team in DeepMind finally made it to improve the compensated function in reinforcement learning and successfully came to develop an AI that copies human movements

Describing movements of a human or an object implies a wide range of potentials. First of all, the ability to walk like a human will help portray more natural movements in computer animations or games. Structural traits of animals that are already extinct can be also applied to such movements. Moreover, it offers new possibilities of the biomechanics, which analyzes the structures and kinematics of organisms and applies the results in different areas. DeepMind's study provided clues as to how humans learn the ability to walk. The technology can be also applied in the area of humanoids, robots that move like humans, and used for rescue robots that learn by themselves to maneuver around obstacles.

1.3. AI Policies

The AlphaGo match in March 2016 came as a shock to the Korean people and the national consensus started to be formed regarding the importance and potentials of AI. In the midst of

concerns and expectations about the future AI will bring, the Korean government came up with the Comprehensive Mid and Long-term Measures for the Intelligent Information Society in December 2016. The intelligent information technologies, as the key driver for the intelligent information society, are defined as AI converged with ICBM (IoT, cloud, big data and mobile). These measures envision a human-oriented intelligent information society that can be achieved through 4 major strategies

Table 3-1 4 Strategies Portrayed in the Comprehensive Mid and Long-term Measures for the Intelligent Information Society

· Establish an intelligent information society through business-citizen (leader) and government-academia (supporter) partnerships · Achieve a human-oriented future society through implementation of well-balanced policies incorporating technological, industrial and social elements · Secure technical and industrial competitiveness through strategic support as early as possible · Revise policies based on social consensus and build a framework to cope with adverse functions

Source: Ministries of the Republic of Korea, 2016 Comprehensive Mid and Long-term Measures for the Intelligent Information Society

The Korean government's investment in AI R&D in 2017 was KRW 163 billion, a 47.4% increase from KRW 110.6 billion in 2016. Korea continues to make efforts to be more competitive in AI by developing source technologies through various programs including the intelligent information flagship project, AI national strategy project, AI and other R&D challenge programs.

2. Mobile Service

2.1 Mobile Market and Industry

In 2016, mobile became the second largest media in the Korean ad market and it is forecasted to reach the top in 2017. While advertising expenditures on terrestrial TV and printed media have decreased, those spent on mobile ads increased by 36%, showing a large contrast. The mobile ad

market last year increased 36.3% and reached the volume of KRW 1.7 trillion. Among the major ad markets such as broadcasting, printing, digital and outdoor, mobile is the only market that showed a two-digit growth rate.

It is expected that mobile ads will grow 23.1% in 2017, reaching the volume of KRW 2.1 trillion, and take up the largest share in the entire ad market beyond the cable TV. Such fast growth of mobile ads can be explained by the continuous decrease in influence of PC ads.

Table 3-2 2016 domestic advertising expenditures and 2017 forecast

Media	Expenditures (KRW 100M)		Growth Rate (%)		Market Share (%)	
	2016	2017(F)	2016	2017(F)	2016	2017(F)
Broadcasting	39,999	40,345	- 5.4	0.9	36.8	36.1
Newspaper / Magazine	18,492	18,182	- 3.6	-1.7	17.0	16.3
PC	16,372	15,358	- 4.9	-6.2	15.0	13.8
Mobile	17,453	21,493	36.3	23.1	16.0	19.3
Outdoor / Theater	10,091	10,268	0.4	1.8	9.3	9.2
Production	6,425	6,005	11.9	-6.5	5.9	5.4
Total	108,831	111,651	1.5	2.6	100.0	100.0

Source: Cheil Worldwide, 2017.3.

The change in the ad market signifies that our lives are closely related to mobile. People no longer gather together to consume contents; instead, they now prefer enjoying services and sharing contents through mobile on the move rather than searching for information at desk.

Mobile Apps in APAC 2016 Report, published by Google, shows that the smart phone usage rate in the Korean market is 91%, which is a figure significantly higher than the desktop and laptop computer usage rate of 73%. This means the device market turnaround has accelerated and there are more people now who own smart phones but not computers. Considering that the average smart phone penetration rate of 50 major countries is 70%, Korea is the country with a mobile market that is the most developed and highly mature. Korea's ranking stayed in the first place in 2016 following 2015 in terms of smart phone penetration rate and app installment. This means while a Japanese installed average 36 apps, a Korean installed 53.

The smart phone market has reached the saturation point both at home and abroad. Manufacturers like Samsung and Apple are now challenged to meet the 'demand for smart phone replacement', and the government also needs to drastically shift the focus of informatization services from PC to mobile.

As the mobile society has made a strong positioning, the amount and frequency of data use have also increased. In a survey in September 2016, the wireless data traffic increased by 46% from 2015, and the mobile video traffic is expected to grow far more, by 74% in 2017.

2.2 Mobile Technologies and Services

• Media Contents Changing to Mobile Videos

As the mobile became the center of media, content types and service methods have also changed. Local TV broadcasting companies are competitively introducing separate channels and content distribution services dedicated to providing mobile contents. Users who access the mobile on the move are likely to pursue fun, short-time, and less battery-consuming contents. Taking this into account, broadcasting companies are making contents that are unique in themes, differentiated in composition, and moreover, bold and fun. They are abandoning their own distribution channels and instead, distributing contents through social media or video platforms of major portals, which is becoming a new trend.

Table 3-3 Mobile channels of major TV broadcasting companies

Company	Mobile Channel	Main Contents
MBC	MBig TV	Specialized as a mobile entertainment channel
SBS	Video Mug	News video service specialized for social media
KBS	Yettie Studio	Producing multi-channel network (MCN) contents
SBS	Mobidic	Specialized as a mobile entertainment channel
JTBC	JJangTBC	Producing MCN contents
MNET	Channel Madi	Providing short music or entertainment video contents

In terms of the content type, more videos and ads are changing to best fit the mobile environment. New services are emerging, which change the screen from horizontal to vertical, and new video ad formats aim for strong image impact in a time as short as less than 6 seconds. What is analyzed as the major change is that a lot of platforms have emerged, enabling photo and video loading at speeds more than 10 times faster than the web on PCs.

With the wide use of mobile videos, 'V-commerce' combining TV home shopping and e-commerce was launched and is being actively used mostly on social media platforms. The traditional TV home shopping operators use their TV channels, authorized by the government, to introduce and advertise products for about an hour and mostly target customers from the age of 30s to 50s. On the other hand, V-Commerce is directly aired mobile through SNS platforms and the contents are mostly interesting and fun videos of 3 minutes or shorter. The target of V-Commerce is customers in their teens or 20s.

• Widespread Personal AI Assistant Service, Like Chatbots

As the major mobile messenger service companies started using AI-based chatbot technologies, messenger platforms have also introduced chatbot services. Mark Zuckerberg also emphasized the importance of AI chatbot platform in F8 2016, saying that the Facebook messenger will be the next big platform.

Table 3-4 Mobile messenger-based chatbot service

Company		Service
Foreign	Uber	Calling a car
	Burberry	Showing its collection during London Fashion Week
	Taco Bell	Placing food order
	Hi Poncho	Giving weather information in form of a cat
	HelloVote	Helping voter registration
	IcelandAir	Searching and booking flights
	Casper	Serving only at nighttime and alleviating insomnia
Korean	Interpark Talk Butler	Helping product purchase on Interpark app
	CJ O'Shopping	Broadcasting home shopping programs on Kakao TV and helping purchase

A lot of chatbot services are using mobile messenger platforms because the use of messaging apps is increasing while the overall app use is decreasing. According to Record.net, the number of downloads of apps created by the top 15 developers in May 2016 decreased 20% on average. From April to June 2016, 50% of users downloaded less than 1 app each month.

• Growth of Mobile Payment Market and Internet Banks

Along with Internet shopping service providers like Amazon and Alibaba, smart venders like Apple and Samsung have also introduced a wide range of mobile payment services and solutions, which has started vitalizing the mobile payment market and driving its explosive growth. Gartner forecasts that the global mobile payment market will grow 37.8% from USD 450 billion in 2015 to USD 616.8 billion in 2016, with the number of users reaching 450 million. Domestic mobile payment market has also showed a significant growth rate of 45.3% from 2014, reaching the volume of KRW 5.72 trillion in 2015. The number is more than 3.5 time larger than KRW 1.73 trillion in 2013.

Such rapid growth of the mobile payment market stems from financial institutions or mobile communication service providers introducing mobile payment service for financial transactions, as well as device manufacturers and portal service providers releasing easy-to-use mobile payment solutions.

In Korea, also, Naver, Kakao, LGU+, SKT and more IT businesses and mobile communication providers started launching the mobile payment service in 2015. As for 'Samsung Pay' launched by Samsung Electronics in August 2015, the world's first FinTech-based mobile payment system that can be used not only through near field communication (NFC) but also with magnetic secure transmission (MST) readers and smart devices, it quickly dominated the market in a short period of time, with the actual monthly number of users reaching 2.59 million who use the service 41 times a month.

In November 2015, the consortium for 'Kakao Bank of Korea', led by Kakao, and for 'K Bank', led by KT, received screening license for the first time in Korea. These Internet-only banks can do their business online without having to establish physical branch offices and provide all banking services on mobile, from savings to loans, credit cards, debt guarantee, bill

acceptance, and payment agency services. Among the many Internet banks, Kakao Talk, Korea's top instant messaging service, is expected to open the era of FinTech 2.0 service.

2.3 Mobile Policies

The Korean government announced a '3-year Plan for Mobile Government' in September 2016 to actively apply mobile in government services and achieve a mobile government that can be accessed and used at anytime and anywhere.

Table 3-5 10 mobile government tasks in 3 strategic areas

Establish mobile service for citizens	Pursue complete mobile service for citizens Simplify the process of mobile authentication and payment
	Optimize government mobile home page Create an ecosystem for DIY public app development
Achieve mobile administration and collaboration	Expand support for administrative affairs such as e-approval Provide portable, mobile work phones
	Expand support for mobile work in the field Use BaroTalk as the main mobile messenger platform
Establish new mobile governance	Define the mobile government implementation framework Reinforce support for mobile government

Source: Ministry of the Interior and Safety, 3-year Plan for Mobile Government, 2016.9.

The plan sets out step-by-step progress for expansion of complete mobile services until 2018 to solve the issue that not all but only part of public services are being provided via mobile and to extend the service coverage from service request and perusal to certificate issuance (or submission). As part of the plan, the government will increase the number of mobile services provided on 'Minwon24 Mobile' from 32 including resident registration certificate and land register issuance to 1,000 by 2018, the same level as Minwon24 on PC. The method of service provision will be also improved so the service application can be directly delivered via email to the relevant public officials for better processing. Authentication procedures on mobile will be also simplified to reduce inconveniences caused by Active-X on mobile. Users who want to access government services on their computers do not have to install Active-X to log on with their PKI certificates but instead, they can use QR codes and mobile certificates to go through the

authentication process. Simple identification tools are also provided, using fingerprints, faces, and IC card-embedded ID information, which can be verified on mobile devices. In addition, Digital One-pass will be also introduced, which allows citizens to use many different government websites through one-time authentication only.

Particularly in 2016, efforts were made to improve the mobile payment system to enable mobile payment of local taxes on WeTax, service charges on Minwon24, and utility bills using FinTech. This function will be applied to major government services in 2017.

In addition, security measures will be reinforced to expand support for public officials' mobile administrative work such as e-approval. The scope of document approval via mobile devices on the move will be expanded from non-confidential to partial or all confidential documents. Systems like E-People and Open Data will be interconnected with 'BaroTalk', mobile messenger service for public officials, to support prompt service provision to citizens. Also, in order to enable all-time access to communication with public officials, even when they are out and about, mobile work phones will be provided to public officials in major ministries and local governments by 2018.

The plan also contains action items for facilitating the mobile industry ecosystem with the help of the citizens. In order to establish the mobile government that works with the citizens, there will be a cloud-based test environment offered to citizens so they can develop apps, and the mobile app procurement system will be improved and the market facilitated so brilliant apps of the private sector can be introduced and used in the government sector.

The Korean government plans to take steps in each project area to shift to the mobile government by 2018.

Table 3-6 Mobile government roadmap

Project Area		Current State	2016	2017	2018	Remark
Service for Citizens	Mobile petition/ service application	Some services and documents	Expand coverage of service application	Operate document issuance/ printing on pilot basis	Expand services like HomeTax	Security consideration
	Homepage optimization	5 ministries	Step-by-step migration (22 homepages)	Step-by-step migration (central ministries)	Expand to local governments and ensure constant management	All ministries

Project Area		Current State	2016	2017	2018	Remark
Service for Citizens	New mobile services		Information strategy planning (ISP and service design	Pilot application	Service expansion	Security/ technical consideration
	Introduction of private-sector apps		Develop legal ground	Pilot application	Service expansion	Security consideration
Administrative Collaboration	Mobile payment	25% of non-confidential documents	Develop security measures and improve functions	Viewing of confidential documents	Viewing and approval of all documents	Security consideration
	Cloud storage	Simple document viewing	Develop security measures	Document editing and storage	Connect with BaroTalk (sharing)	
	Field support	Parking violation enforcement and more (67 tasks)	15 businesses in the field	15 businesses in the field	20 businesses in the field	
	Communi-cation (BaroTalk)	Central and local governments (on Android)	Develop a version on iOS	Add voice communicatio n function and spread use in public institutions	Connect with video conferencing system	
	Mobile work phone		Pilot operation in Ministry of the Interior and Safety (in Seoul and Sejong)	Expand to central government ministries and local governments	Expand to public institutions	
Governance	Implemen-tation framework establishment		Develop legal ground	Strengthen collaboration in performance management	(Continued)	
	Mobile support center/Cyber security reinforcement	Simple technical support	Organize a team dedicated to the Integrated Center/ KISA	Security assessment, Security verification support	(Continued)	

Source: Ministry of the Interior and Safety, 3-year Plan for Mobile Government, 2016.9.

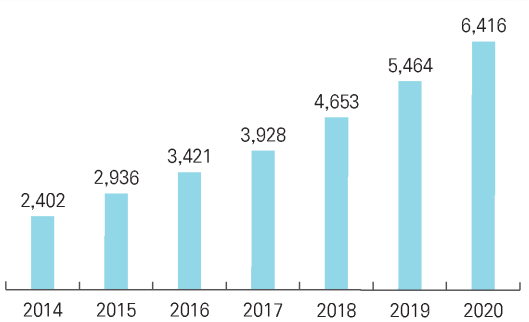
3. Cloud Computing

3.1 Cloud Computing Market and Industry

The cloud market volume in Korea reached KRW 1.19 trillion in 2016 after growing rapidly by 55.2% from KRW 0.77 trillion in 2015. The number of domestic cloud businesses also increased by 51.6% from 353 in 2015 to 535 in 2016. The rate of businesses' cloud use also exceeded the 20% level in 2016, and with the policy in 2017 that promotes cloud use first in public institutions, the number is expected to reach more than 30%.

Considering the growth speed, the Korean cloud market is expected to easily reach the volume of KRW 2 trillion by 2017, which means the cloud service providers will have to join the fierce race to dominate the market. The cloud market in Korea is expanding from its focus on ICT businesses to a wide variety of areas including finance, broadcasting and the public sector, and it is forecasted to spread even further to other industries like education and medical service.

Figure 3-1 Cloud market volume in Korea (USD 1M)



Source: Digital Times, 'Cloud market to reach 4.8 trillion won in 2020… the future source of revenues now revealed', 2017.9.

As the cloud market in Korea is growing fast, global companies like Amazon, Microsoft and IBM are actively tackling the market by opening cloud data centers. Using their experiences and know-how, price advantages that they have accumulated abroad, these companies have already

taken the competitive advantage in the market. They are even offering the cutting-edge services with the massive amount of data in cloud, by applying machine learning and AI technologies to the data. Against such backdrop, a fierce competition is expected between the global companies and local native companies such as KT, Gabia and Naver Business Platform (NBP).

Table 3-7 Cases of global cloud companies entering Korean market

Name	Description
Amazon	Announced to establish Seoul Region as the fifth cloud data center worldwide (January 2016) ※ Leasing data centers of KT (Mokdong) and SKT (Ilsan)
IBM	Built IBM Cloud Center (9th in Asia-Pacific region) with SKC&C in Pangyo
Microsoft	Released SaaS Office (May 2015) and plans to build two new data centers in Seoul and Busan (Jan 2017) ※ Leasing data center of LG CNS (Busan)
Alibaba	Launched its Alibaba Cloud service in Korea using the name 'CloudLink' in April 2016

Source: NIPA, Global and domestic cloud policies and industry trends, 2016.3.

Local companies, particularly the system integrators (SI) and SMEs in the IT sector, are also active in joining the cloud business. KT is operating 3 cloud data centers in Korea and a standalone data center in the United States, using the service name, ucloud biz. LG CNS has built and is operating a total of 6 data centers in Korea and abroad. SK C&C is collaborating with world-class cloud service companies like IBM and Alibaba Cloud to reinforce its 'multi-cloud service'. In terms of software-as-a-service (SaaS), which provides software for cloud, there is an increasing number of cases where Korean companies enter the overseas markets. Infraware's 'Polaris Office' has some 40 million users in 2016, of which more than 90% are users overseas. Cem Ware's 'MathFreeOn', which is a problem-solving SaaS for engineering and math education, has attracted 100,000 users around the world since its launch in late 2015, and was offered as a commercial service in 2016.

3.2 Cloud Technologies and Services

• Continuous Expansion of Cloud Software as a Service (SaaS)

IDC survey found that SaaS market in Korea has grown 35.1% and reached the volume of

KRW 238 billion in 2016. It forecasts the cloud software market in Korea will maintain the CAGR of 16.3% for the next five years and will exceed KRW 500 billion by 2020. Such growth of SaaS market in Korea is mostly led by foreign cloud software service companies like Microsoft, SAP, and Salesforce.com, together with local companies like Douzone and Hancom. In particular, deregulation allowing large businesses to join the cloud SaaS market will fortunately lead to increased cloud use in the public sector, accumulation of business use experiences and sophistication of service models, all of which will contribute to stable market growth.

• Emergence of Hybrid Cloud

Hybrid cloud is a combination of in-house cloud and private cloud, which supports businesses to effectively manage their cloud service provision. As private cloud solutions are spreading wide, in-house cloud has become the major platform for many businesses. Cloud service providers have also increased, and more workers are using solutions provided directly from these service providers without having to go through handling of IT, which raised the awareness that now IT needs a change. The time has gone when IT departments in businesses provided exclusive IT services; instead, it is time for independent service providers to compete with each other for cloud business. Since there are more cloud solutions being adopted, and most of the concerns regarding private cloud have been settled, hybrid cloud is emerging as a new mainstream as the most effective alternative in terms of performance, cost and flexibility.

• Expansion of Public Sector Security Certification

In Korea, system developers and communication service providers including LG CNS, SK C&C, and KT have built large-scale cloud centers for operation. The enforcement of the 'Act on the Development of Cloud Computing and Protection of Its Users' in 2015 started security certification of private-sector cloud services. Cloud computing security certification is to establish an environment where public organizations can trust and use private-sector cloud services. KT was the first to receive the certification in 2016, followed by Gabia and NBP in 2017. More cloud data centers like SK C&C, Douzone and Innogrid are soon expected to get certifications, further facilitating the public sector's use of private-sector cloud.

• Application of Machine Learning to Cloud

AI is already being applied in cloud services. For instance, Google's AlphaGo, IBM's Watson, and Amazon's Amazon Machine Learning have extended application of machine learning or AI to business cloud projects. Google launched its open source machine learning platform Tensor Flow; Microsoft released its cloud-based machine learning platform; and Amazon introduced its 3 machine learning services at the AWS re:Invent. Services that are developed upon the cloud platform in the future will allow machine learning and AI to integrate in more diverse ways.

3.3 Cloud Computing Policies

To promote government-wide adoption of cloud computing, the Korean government established the 'Comprehensive Plan for Faiclitating Government-wide Cloud Computing' in 2009 based on the cooperation of the then-Ministry of Public Administration and Security, then-Ministry of Knowledge Economy, and Korea Communications Commission. Since then, the Korean government has developed and implemented a wide range of plans to encourage the industry.

In November 2015, the 'Plan for Facilitating K-ICT Cloud Computing' was developed, which set out initiatives to find growth engines for the cloud industry from 2016 to 2018 as the first step, and to achieve the vision of advancing toward a leading country in terms of cloud by 2021 as the second step. The plan aims to expand use of private-sector cloud by promoting the public sector to actively adopt cloud and to establish the right cloud ecosystem in the country.

The government plans to first convert the two Government Integrated Data Centers (1 and 2) into cloud, and induce 40% of public sector organizations to use private cloud by 2018. In addition, the law that restricts storage and management of electronic medical records within hospitals will be revised[1]. Also to establish the cloud ecosystem, the government will expand R&D investment, and increase the share of cloud investment in software R&D expenditures from the current 9% to 20%. This will also lead to increased number of cloud businesses from the current

1) In July, the Financial Services Commission already revised regulations to allow financial information such as transaction records in banks or insurance companies to be managed in the cloud.

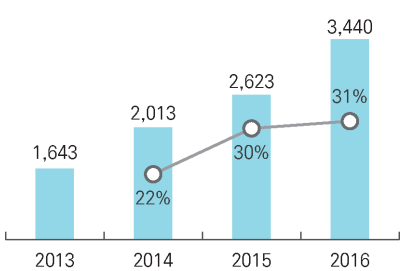
250 to 800, creating related markets worth KRW 4.6 trillion, including the public-sector demand worth KRW 1.2 trillion, for the next 3 years from 2018.

4. Big Data

4.1 Big Data Market and Industry

According to the '2016 Big Data Market Survey' of the Ministry of Science and ICT, the Korean big data market achieved a 31.1% growth from 2015 and reached the volume of KRW 344 billion, thanks to improved awareness of businesses on big data, increased investment from large companies with sales volume of KRW 100 billion, and strong commitment of the government for big data industry promotion. In particular, the government and public sector investment significantly increased, by 43.1%, to KRW 99.9 billion, and this is analyzed to have led the market. By each market area, the government/public sector market increased by 43.1% to KRW 99.9 billion based on the bills for supporting big data industry promotion and strong recommendations to public institutions to actively adopt and use big data, which made this sector achieve a 3% point increase

Figure 3-2 Korea's big data market growth and composition (KRW 100M)



Market		2015	2016	Y/Y Growth Rate(%)
Government/ Public Sector		698.0	998.6	43.1
Private Sector	Business investment in big data systems	1,791.0	2,278.4	27.2
	Big data analysis service	134.0	162.6	21.3
	Subtotal	1,925.0	2,441.0	26.8
Total		2,623.0	3,439.6	31.1

Source: Ministry of Science and ICT, 2016 Big Data Market Survey, 2017.3.

and take up 29% of the market. On the other hand, the private sector market is challenged by demand limited to some large financial and communication service companies, even though the market has high potentials being in the stage of introduction, and its market share decreased to 71% at the volume of KRW 244.1 billion, showing only a 26.8% growth from the previous year.

IDC Korea forecasts that Korea's big data and analytics market will continue to expand, growing 9.9% from the previous year and reach KRW 1.31 trillion in 2017, and to KRW 1.76 trillion by 2020 after growing at 9.4% CAGR. Some of the industries that are expected to make large investments in big data are banks, assembling and manufacturing, telecom, and public sector – the total investment volume from these industries in big data and analytic solutions is expected to reach KRW 724.6 billion in 2017 and KRW 968 billion in 2020.

Among the private sector businesses, financial and telecom companies are the most active in attempting big data use. Banks are recently seeking diverse measures to utilize big data, as the government is promoting big data policies such as the 2016 'Guidelines for De-identification of Personal Information' and new trends are emerging as part of the 4th industrial revolution. Credit card companies have recognized big data as their core competence since 2010 and focused on organizing and improving relevant teams or departments as well as recruiting specialists in the area. Insurance companies are mostly using big data for differentiating insurance premiums and reducing loss ratios[2)], and they are gradually expanding their big data use – developing loan products based on big data credit assessment, introducing insurance package linked to driving habits, insurance consulting, and sharing big data with other organizations.

The three telecom providers in Korea are also reinforcing their organizations and infrastructure to fully prepare for big data management. They are using their big data experiences and skills learned from KT's roaming service for preventing infectious diseases, SK Telecom's T-Map, and LGU+'s video portal, which contributed to improving their service quality.

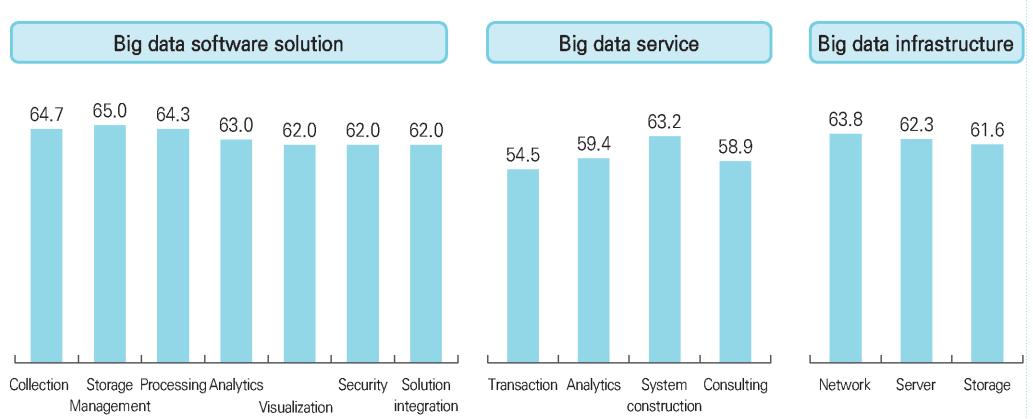
2) Amount of insurance paid as compared to premium collected

4.2 Big Data Technologies

As for the big data technology level in Korea, analyzed with the technologies of local big data providers, it is evaluated at 65.7 points with the level of advanced countries being 100 points; the gap between technologies in Korea and advanced countries is 3.1 years; and it would take 3.4 years for Korea to reach the level of advanced countries. The results signify that big data technologies of Korea are still far behind advanced countries and it would need a significant amount of time to close the gap.

Such technological divide comes from the fact that most of the big data technologies are subordinate to major foreign companies, causing a large share of infrastructure and software to be imported for big data accumulation and analytics, whereas the skills and products of local companies are being neglected due to the low stability and reliability as well as difficulty in maintenance. More recently, however, the private demand and related market is rapidly growing in the local big data market, causing more IT businesses to join the market along with more advanced technologies being introduced. As a result, the big data technology level of Korea improved by 3.1 points in 2015 to 65.7 points in 2016, the technological gap decreased by 0.2 years to 3.1 years,

Figure 3-3 Korea's technology level by area (technology level of advanced countries = 100 points)



Source: Ministry of Science and ICT, 2016 Big Data Market Survey, 2017.3.

and the time required for Korea to reach the advanced country level also decreased by 0.2 years to 3.4 years.

In terms of technological areas, the big data software/solutions and infrastructure are well above average with relatively better competitive advantages, but the service area still lags behind. This means that Korea's technical skills are relatively high in big data storage/management, collection, processing and infrastructure-building but they are low in transaction, consulting and analytic services due to the lack of big data distribution framework and lack of experience with data-driven application services.

4.3 Big Data Policies

In the 'K-ICT Strategy', announced by the Ministry of Science and ICT in March 2015, big data was selected as one of the 9 strategic industries. In May 2016, the 'K-ICT Strategy 2016' was announced as a revised version to cope with the environmental changes at home and abroad and the new ICT industry paradigm. The new strategy expanded the plans from 6 ICT convergence areas－education, medical service, tourism, urban development, energy, and transport－to 10 areas by adding finance, home, agro-livestock-fisheries, and manufacturing; and sets out plans for regulatory reform to facilitate new ICT convergence industries like IoT, cloud, big data, and O2O services. The Ministry of Science and ICT has also established the 'K-ICT Big Data Center' in National Information Society Agency (NIA) and is implementing various lead projects in major industries like manufacturing, finance and distribution to create demand in the private sector. In addition, the Ministry of the Interior and Safety (former Ministry of the Interior) is also supporting data-driven policy making to build a competent government, has organized the Big Data Analysis Division in the National Information Resources Service (former Government Integrated Data Center) for proactive development of public services, and is conducting infrastructure operation and thematic analyses. The major government schemes for big data are the Big Data Flagship Pilot Projects of the Ministry of Science and ICT (MSIT) and the Public Big Data Program of the Ministry of the Interior and Safety (MOIS).

• Big Data Flagship Pilot Projects[3] of MSIT

In order to create new values through expansion of big data, which is considered as the major source and service in the future, and develop new drivers for growth, Korea has worked on big data pilot projects since 2013. In 2016, projects on big data industry expansion, intelligent information technology application, and data transaction brokerage were carried out. As for 2017, projects are carried out in stages of planning/verification and testing/expansion so best cases of big data use can be identified and widespread. These cases are particularly in the areas of transport, public health/medical service, and disaster safety, which have large impact on the society and can contribute to finding solutions to the current social issues.

Table 3-8 2017 Big Data Flagship Projects in the stage of planning and verification

Area(Consortium)	Project Name	Project Description
Employment (National Pension Service with Kredit Data)	Development of job information service for the socially disadvantaged people using big data of the National Pension Service	The project develops a monitoring system for job market trends in terms of employment/unemployment, recruitment, and residential cost against revenues by using internal (pension holder and business information) and external (recruitment information) data of the National Pension Service.
Disaster (SundoSoft with Korea Electrical Safety Corporation)	Development of big data-based algorithm for machine learning on electrical accidents and research on a pilot platform for disaster prevention and prediction	The project develops a platform that analyzes and predicts electrical accidents based on the converged data of Korea Electrical Safety Corporation's safety information and other materials (electrical fire status).
Energy (Korea Energy Agency with ESCOpro)	Construction and study of a platform for open data-based assessment of building energy performances	The project develops a platform that analyzes energy consumption of office, commercial, educational buildings (about 900 buildings of 243 local governments) with area of 2,000㎡ or larger, by using the electricity consumption data and real-time energy data.
Urban Development (Korea Research Institute for Human Settlements, Korea Credit Bureau, and Busan Metropolitan Government)	Urban polarization monitoring and simulation based on combination of financial big data and agent-based modeling	The project develops a data-driven urban polarization analysis and simulation model and build a pilot system (in Busan), which combines financial and spatial data to perform in-depth analysis of social and economic polarization issues in cities.

3) Name changed in 2017

Area(Consortium)	Project Name	Project Description
Economy (Shinhan Card with En.Core)	Support for proactive data-driven measures regarding economic opportunities or impact at home and abroad	The project develops an export decision model and provides export outlook monitoring service through improvement of national statistics and analysis of elements that affect the export market using credit card transaction data.

Source: National Information Society Agency Press Release, 'Solving Transport, Medical, and Social Issues with Big Data', 2017. 3. 15.

• Public Big Data Program of MOI

The Public Big Data Program of the Ministry of the Interior and Safety, carried out since 2013, have passed the stage of implementing pilot projects for analysis – from 2016, they are in the stage of implementing new projects for analysis and defining and expanding the standard analysis model. The first public big data analysis project was first carried out in 2014, and about 4~6 new projects are developed every year for implementation. Any cases found in the process of analysis, which can be shared with other organizations for similar work, are identified through the standard analysis model and for widespread introduction.

Table 3-9 2017 Public Big Data Analysis Projects

Project Name (Managing Organization)	Objective	Expected Benefits
Detection and prediction of patients with multiple accident history to prevent auto insurance premium leakage (Health Insurance Review and Assessment Service, General Insurance Association of Korea)	Identify patients with multiple traffic accident history and predict auto insurance fraud by analyzing auto insurance claims, patient treatment records, and insurance fraud information	Prevent increase in social insurance cost of auto insurance holders; Prevent excessive hospitalization and false claims; Prevent collusion between patients and medical institutions; Prevent fraudulent claims of medical expenses based on intentional accidents or collusions
Capture of suspects evading duties of military service through big data analysis (Military Manpower Administration, National Health Insurance Service)	Detect persons who are suspected for evading duties of military service through analyzing physical examination, qualification and license information of those exempted from military service and identifying atypical increase patterns	Improve investigation performances through identifying a group with high risk of evasion; Trace record of military service evasion and crimes under management of other authorities through big data analysis; Actively use the result for cooperative investigations; Create social atmosphere for fair military service provision where those completing military service are respected and treated well

Project Name (Managing Organization)	Objective	Expected Benefits
Selection of locations for installing electric vehicle charging infrastructure (Daegu Metropolitan Government)	Install electric vehicle charging infrastructure through scientific and reasonable selection of locations	Expand charging infrastructure to promote use of electric vehicles; Use big data for effective planning of infrastructure installation; Reduce emissions of air pollutants, greenhouse gas, and micro-dust caused by the increase of electric vehicles
Prediction of hazardous road section on Gyeongbu Expressway using intercity bus DTG* (Korea Transportation Safety Authority)	Predict hazardous express road section through analysis of DTG patterns; Publicize safe driving and improve facilities by identifying hazardous sections; Use the data to prevent big accidents	Publicize safe driving and improve facilities to root out intercity bus accidents; Prevent big accidents; Save social costs caused by accidents; Use the data as the base for transportation safety policy development
Model for improving basic living infrastructure through analysis of foreign residential districts (Ministry of the Interior and Safety/ Ansan City Government)	Develop policies for basic living infrastructure through analysis of foreign residential area types, which are affected by immigrants' economic and social conditions, and use the data as policy guide to improve those areas	Predict demand for public administration customized to foreigners and their basic living infrastructure in a prompt manner; Enhance foreign immigrants' settlement rate based on analysis of foreign residential areas by nationality; Facilitate local economy by interconnecting tourist and cultural programs

*DTG: Digital Tacho Graph

Source: Ministry of the Interior and Safety, Press Release on Eradication of Auto Insurance Frauds and Military Service Evasion using Big Data, 2017.6.20.

5. Internet of Things (IoT)

5.1 IoT Market and Industry

As the IoT market is turning into full-scale growth, competitions are also growing to secure technological standards and to dominate the market. In Korea, the market is continuing to grow, with the number of IoT service subscribers exceeding that of new mobile phone subscribers in 2016 and hitting 6 million in June 2017. Other countries around the world are creating new marketplaces and intelligent service industries by applying IoT and intelligent technologies to different areas. In particular, based on the common platform that enables storage, management,

analysis and sharing of data of products, Korea has started developing a decentralized cooperative intelligence reinforcement platform to provide intelligent services in the areas of smart home/city, disaster/safety, transport/logistics/ and manufacturing/service.

In addition, the country is also developing massive IoT technology for low-power, long-distance, non-licensed band communication and large-scale connection, as well as the cognitive network technology, which offers the optimal integration of disparate service requirements in the EDGE network environment. At the same time, it is also developing intelligent devices that directly deliver values to humans beyond the simple functions of sensing, communicating, monitoring, and delivering information to servers.

Google's Nest Generation 2 features technologies that change surroundings for user's preference and safety by connecting with sensors around – for instance, it changes room temperatures automatically when the user is in the living room, when he/she is entering the bedroom, and when the house is empty or occupied.

In Korea, Hyundai introduced its electric self-driving car, Ioniq, at the LA Motor Show in November 2016. The company held a test driving event in Las Vegas in December 2016, and then presented the car fully self-driving at level 4 at CES in January 2017. Samsung Electronics also joined the self-driving car platform business by acquiring HARMAN, the leader of smart car infotainment platform in March 2017, and has since been active in test operation of self-driving cars of local and foreign makers. LG Electronics also filed an application for self-driving car manufacturing license to the Ministry of Land, Infrastructure and Transport in May 2017, and started testing Hyundai cars with their platform embedded.

5.2 IoT Technologies

• Sensor Network Technology

In June 2016, SKT launched the nationwide IoT network service called RoLA. Being Korea's first network dedicated to IoT, the company offered a shocking price of minimum KRW 350 (380 with VAT included) for 1-hour/access use per month and KRW 2,000 (2,200 with VAT) for 100M

data use per month. Remote gas or water metering and environmental monitoring, which are also introduced as service examples, are available for reasonable prices and contract or multi-line discounts are also offered. KT and LGU+ are working on construction of the NB-IoT network, which is expected to be launched soon after signing of the agreement on joint network construction in November 2016, completing standardization in March 2017, completing network construction in the metropolitan area in June 2017, and completing expansion of the network throughout the country in late 2017.

There are a lot of efforts going on for developing the framework technology that processes the information delivered through sensors. Washington University in the United States developed the Open Data Kit (ODK) sensor framework, which enhances convenience of IoT application service development and reduces error probability; Dartmouth College developed Community Similarity Networks (CSN) that provides the environment where users having similar data features can exchange information that is captured through sensing within personal smart devices. In Korea, too, Electronics and Telecommunications Research Institute (ETRI) developed Sensor Virtualization Machine (SVM), which allows users to develop various services and applications through connection to external sensor network.

• Technology Standardization

To achieve the IoT environment where a wide range of products are interconnected and information is shared, it is required to establish interoperability standards. There are global movements to make the IoT technologies for the Internet and mobile communication network as new international standards through ITU-T, ISO, IETF, OneM2M and 3GPP. As for Korea, efforts are made to promote open M2M technology, which is used in ITS, smart metering, e-health, and smart home, as an international standard through OneM2M[4]. There are efforts going on also to develop light-weight implementation technology and low-power, low-loss communication technology, which is used for connecting the Internet on various IoT devices, and to establish it as international standards.

4) A cooperative body for international standardization of technologies in the area of M2M

Table 3-10 IoT standardization

Type	Organization	Description
Public standard organization	ITU-T	IoT service, network, communication and security standards - ITU-T, SG13 (network), SG17 (security), SG20 (IoT and application), etc.
	ISO-/IEC JTC-1	Sensor network, IoT concept and market requirements, IoT standardization gap analysis - JTC1/SC31 (auto identification), SC6 (information and communication), WG7 (sensor network), WG10 (IoT), etc.
Private standard organization	oneM2M	IoT/M2M common support layer standards for structure, requirements, protocol, security, semantic technology, etc. Announced Release 2 in 2016.
	IEEE	Wireless LAN/PAN technology standards for smart metering, outdoor/ low-power/ LAN/ long-range communication
	IETF	Internet protocol standards for low-power wired/wireless network application layer and CoAP
	ETSI	Focus on IoT reference architecture, interoperability and smart city standards on issues lacking interoperability; leading the standard group of AIOTI, EU's IoT alliance, and standards for large-scale testbed projects
	3GPP	Focus on cellular communication standardization from physical to transport layers – standards for load management in simultaneous access of IoT/M2M devices to base stations, network operation architecture, low-power cellular communication, etc.
	W3C	Technology research for a new interest group called Web-of-Things, particularly, leading data and product standards using semantics
Consultative organization	OCF	OIC was a consortium developing device/resource standards and open standards at the same time to provide general-purpose IoT connection framework for various industries. In 2016, it merged with AllJoin and changed the name to OCF. Joined by Qualcomm and Microsoft, OCF is focusing on integration of IoT standards and interoperability between solutions.
	Thread Group	Pursuing interoperable IoT through wireless communication IP and threads for smart home

Source: Institute for Information and Communications Technology Promotion, IoT Industry Trends and Forecast, 2017.5.

• IoT Security Technology

Korea is applying and testing the 2016 IoT Security Guidelines in the Smart Challenge Project and supporting development of security guidelines for each service area. There are efforts going on for operation of a consultative body for IoT security, improvement of related infrastructure and establishment of the Information Sharing and Analysis Center (ISAC) for each area, which are aimed for better coping with the new environment. To reinforce IoT product reliability, Korea is improving laws and regulations and also preparing for pilot implementation of the IoT Security Verification Scheme. It is also cultivating IoT specialists and developing measures for stable manpower supply in order to help continuous development of the IoT and related industries.

5.3 IoT Policies

The Korean government is continuing to make efforts for focused development of IoT – it announced the 'IoT Master Plan' in May 2014 to take proactive measures in preparing for the hyper-connected age. Based on this Master Plan, 'K-ICT IoT Strategy' was developed in December 2015 to accelerate further application of IoT.

There are IoT demonstration projects in the major areas of vehicle/transport, healthcare/medical service, energy, city and manufacturing, which will lead the market and facilitate early launch of new products and services in the market. Some 150 businesses or institutions (including 116 SMEs) participated in the demonstration projects, where they tested 76 services as well as supported smart product and service development in SMEs.

Also, the government invested KRW 73.4 billion in 45 tasks through its IoT R&D support program, which has started active launch of new products and services based on development of IoT core technologies and applications.

Table 3-11 2016 government-funded IoT R&D projects

Project	Description	2016 Budget (Billion KRW)	Organization
Development of IoT convergence technologies	Reinforce IoT industry competitiveness and establish an ecosystem for new convergence services through developing IoT core, application technologies and creating diverse products and services	12	Electronics and Telecommunications Research Institute and more
Development of USN core technologies	Lead in global technology competition by securing IoT, RFID and sensor network core technologies; Support development of innovative technologies to tackle problems in industry application; Promote wide use of RFID/USN technologies in everyday life	3	Busan National University and more
Development of broadcasting communication technologies (Home Network)	Develop key smart life technologies to create new, high added-value based on IoT	12.5	Korea Electronics Technology Institute and more

Source: Ministry of Science and ICT, 2016 Project Plan, 2016.1.

The government invests KRW 7.3 billion again in 2017, to nurture competent small and medium businesses in the area of IoT – the key infrastructure for the intelligent information society – as the leaders of the 4th industrial revolution.

Table 3-12 2017 government-funded IoT R&D projects

Type	Project Category	2017 Budget (Billion KRW)	Estimated No. of Tasks
New	(Service verification and expansion) Develop a wide array of IoT application services and support their commercialization through verification and expansion of their technical feasibility and business value	2.9	5
	(Commercialization of convergence products) Support commercialization of IoT convergence products and devices in Korea and abroad	2.0	15
Continued	(Additional support) Provide additional support for 2016 projects (services) with substantial performances by expanding their verification scope and helping with advancement	2.4	3
Total		7.3	23

Source: Ministry of Science and ICT, 2017 Project Plan, 2016.12.

IV. Advancement of Convergence Infrastructure

1. Giga Internet

1.1 Giga Internet Market and Industry

The number of broadband Internet subscribers in Korea hit 20 million in 2015 and reached 21 million in July 2017. Giga Internet, first commercialized in October 2014, started rapid growth from 2015 and the number of subscribers reached 4.4 million by the end of 2016. As KT's subscribers hit 3 million in May 2017, the total number of subscribers to the three major providers in Korea is now estimated to be around 5 million. This means 24% of the broadband subscribers use Giga-level Internet. Considering local providers claim their 500Mbps and 1Gbps services to be Giga Internet, the Giga Internet market, in a strict sense, is estimated less than 10% of the total market.

Table 4-1 Giga Internet subscribers (in million)

Year	2013	2014	2015	2016	2017.5.
No. of subscribers	1.6	12	198	441	500 (estimate)

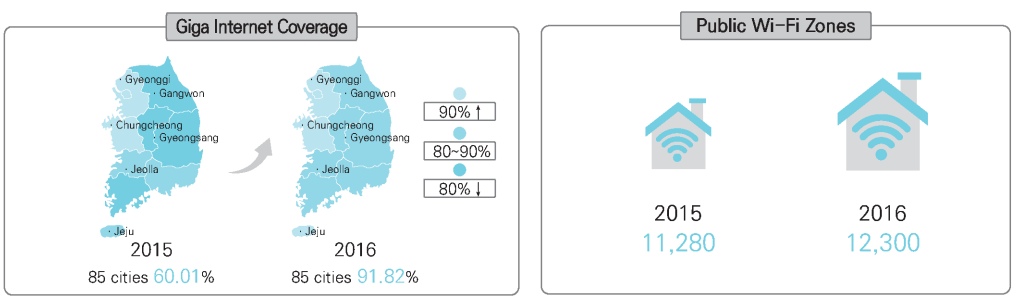
Source: Ministry of Science and ICT, 2017 Annual Report on National Informatization, 2017.8.

The Korean government has constantly enforced strategic policies for network construction – High-speed Network Strategy (1995～2005), Broadband Network Strategy (2004～2010), and Broadband Convergence Network Strategy (2009～2014). In 2016, it collaborated with Land & Housing Corporation, communication service providers and cable operators and finally launched the service to install the Giga Internet infrastructure for old, public rental apartments built before 2000.

Also in 2017, the government planned to work together with the private sector to expand joint construction of the Giga Internet in small and mid-sized cities with low Giga Internet coverage. It is also working on closing the network divide between cities or social classes through joint construction of the Giga Internet and offering free Giga Wi-Fi to six cities – Nonsan, Boryeung, Taebaek, Sacheon, Yeongju and Mungyeong – and old, public rental apartments with more than

3,000 households. As the result, the Giga Internet service coverage in 85 cities nationwide reached 91.82% in 2016. The number of public Wi-Fi zones also increased to 12,300 nationwide, which helped reduce the digital divide between cities. The government plans to expand the Giga Internet coverage to 95% by 2020.

figure 4-1 Increase of Giga Internet coverage and public Wi-Fi zones in Korea



Source: Ministry of Science and ICT, 2017 Annual Report on National Informatization, 2017.8.

1.2 Giga Internet Technologies

• Advancement of Giga Internet Technologies

Technology development for Giga Internet in Korea has been mostly focused on the subscriber network to solve the issues of lack of incoming lines to houses and their ageing, which are the biggest obstacles to increasing Giga internet penetration. As for houses and apartments having incoming fiber optic cables, E-PON (Ethernet Passive Optical Network), G-PON (Gigabit PON), DOCSIS (Data Over Cable Service Interface Specifications) 3.0 technologies are used to provide the Giga Internet service. These are the major Giga Internet subscriber network service technologies that use fiber optic cables like FTTx, HFC and LAN.

As for old households with only telephone lines coming in, G.hn or G.fast technology has been developed, which provides the speed of 500Mbps even without replacing the old copper lines. The speed had been increased to 1Gbps in the late 2016. The technology, also known as ‘Giga Wire’, is drawing more attention as an alternative to the Giga Internet not only in Korea but in old towns of Europe and the United states having difficulties in installing new subscriber networks.

Table 4-2 Giga Internet service technologies and specifications (June 2016)

Technology	E-PON	G-PON	DOCSIS 3.0	G.hn	G.fast
Standard	IEEE 802.3ah	ITU -T G.984	ITU -T J.222	ITU -T G.996X	ITU -T G.970X
Downlink Speed	1Gbps	2.5Gbps	800Mbps (16 channel bonding)	500Mbps (1 pair telephone lines)	500Mbps (1 pair telephone lines)
Uplink Speed	1Gbps	1.25Gbps	108Mbps (4 channel bonding)	100Mbps (1 pair telephone lines)	100Mbps (1 pair telephone lines)
Maximum No. of Branches	128	32	-	-	-
Main Provider	KT SK Broadband LGU+	SK Broadband	SK Broadband LGU+ CJ Hello Vision T-Broad D'Live Hyundai HCN	KT	SK Broadband

Source: Telecommunications Technology Association, Dictionary of ICT Terminologies, etc.

In the meanwhile, subscriber network technologies developed in Korea is 10G-EPON with 10Gbps speed, which is also called 10Giga Internet, and NG-PON2 with 40Gbps speed.

Table 4-3 10Gbps or faster Giga Internet subscriber network technology development

Technology	Downlink 10G		Downlink 40G
	XG-PON	10G-EPON	NG-PON2
International Standard	ITU-T G.987	IEEE 802.3av	ITU-T G.989
Speed (Downlink/Uplink, Gbps)	10/2.5	10/10 10/1	40/40 40/10
Maximum No. of Branches	128	64	Depending on speed / distance
Main Provider	SK Broadband	KT SK Broadband	SK Broadband

Source: Netmanias, Optical subscriber network standardization and market trends, 2014.11.

• Giga Wi-Fi Technology

While Giga Wi-Fi is constantly advancing into new versions, the Giga Wi-Fi 2.0, which started commercial service in 2016, provides the maximum speed of 1.73Gbps through application of the next generation standard, IEEE 802.11ac Wave2 (Phase 2). This is a speed where a user can download one UHD movie (16GB) in one minute, or 100 digital, FLAC songs (4GB) in 17 seconds.

As the demand is increasing for indoor wireless access through smart phones and tablets, the Giga-WiFi started spreading wide, along with the Giga Internet. Giga Wi-Fi will be applied to the public Wi-Fi in the future, and with the policy of 2017 for opening up the public Wi-Fi for free, it will be used and expanded even more.

1.3. Giga Internet Policies

In the initial stage of Giga Internet commercialization in Korea, there was a lack of application services that required the Internet speed as fast as 1Gbps. Therefore, the government decided to encourage the Giga Internet foundation building and application service development all at the same time since the early stages. When the Giga Internet was launched in 2015, the government built the 'K-ICT Next Generation Network Test Sites (Giga Network Test Sites)', and promoted new application service development and demand increase.

In 2016, the government launched the 'Giga Internet Test Site Project' to raise public awareness on the Giga Internet and expand the service in full scale, while at the same time identified and supported seven application services including HDR (High Dynamic Range) UHD TV, Giga cloud virtual reality (VR) broadcasting, ultra low-latency VR streaming, and Giga smart home care. As part of the project, the DMC Plaza in Sangam, Seoul, was arranged as a Giga Wi-Fi Special Zone, which provided free Giga Wi-Fi service to tourists and visitors from home and abroad. An Exhibit Hall was also built, which demonstrated the excellent features of Korea's Giga Internet through real-time speed comparisons of connection between Korea and the United States. The Exhibit Hall also provides a testbed for service development and demonstration by

interconnecting the virtual and augmented reality services with KORNET (Korea Telecom Internet) and the Giga internet.

The Korean government established quality standards and a measurement system for managing the quality of Giga Internet and application services, along with the service level agreement (SLA) already established and in operation. In 2013, National Information Society Agency (NIA) upgraded the connecting lines in the quality measuring system installed in the communication service provider network to 10Gbps level to measure the Giga Internet quality. Since the Giga Internet launch in October 2014, the government is working closely with the academia and communication service providers in setting and applying the minimum quality threshold.

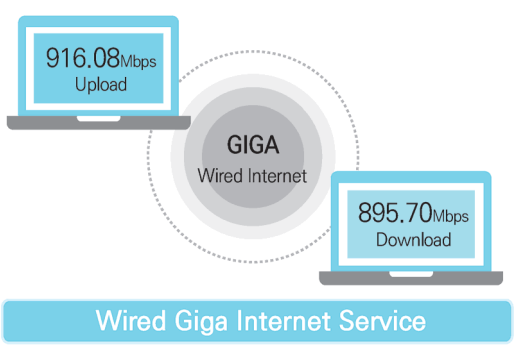
Table 4-4 Minimum speed quality for Giga Internet (download speed)

Type	500Mbps Service	1Gbps Service
Minimum Speed	75Mbps	150Mbps

Source: Terms and conditions for communication service providers

In 2015, the Giga Internet was included in the 'Communication Service Quality Assessment', which is a scheme that aims to provide reliable information on communication service quality to help users make reasonable choices on services as well as induce investment from businesses. The 2016 assessment showed the average download and upload speed of 1Gbps wired Internet - 895.70Mbps and 916.08Mbps respectively.

Figure 4-2 2016 Giga Internet quality assessment result



Source: Ministry of Science and ICT, 2016 Communication Service Quality Assessment Report, 2017.5.

2. 5G Mobile Communication

2.1 5G Mobile Communication Market and Industry

Qualcomm-IHS report 'The 5G economy: How 5G technology will contribute to the global economy' forecasts that 5G technology application will be more accelerated and be widespread throughout the entire industries by 2035. As the result, the total global economic output will reach the volume of USD 12.3 trillion and 22 million jobs in 16 major industry sectors including wholesale/retail, education, transport/storage, and manufacturing. Korea was selected as one of the top seven countries (the United States, China, Japan, Germany, South Korea, France and the United Kingdom) at the forefront of global 5G development, with 963,000 jobs and USD 120 billion worth of gross outputs expected.

Major countries around the world have chosen 5G policies to take the lead in the 4th industrial revolution, and are trying to work on expanding the scope from 5G technologies, spectrum, requirements and PoC (Proof of Concept), and international collaboration further to pilot service, network construction planning, and convergence with other industries.

Table 4-5 5G mobile communication in major countries

Country	Progress
China	· Ministry of Industry and Information Technology selected 5G as a national project, announced 'Next Generation IT Industry Plan (2016~2020)' and planned massive-scale investment of CNY 500B (KRW 85T) until 2020 for 52 businesses, schools and research institutions (2016.10) · Huawei showcased connected car experience using 5G and VR interconnected (2017.2, MWC2017) · ZTE and China Mobile demonstrated 5G eMBB scenario and achieved 2Gbps single-user speed at 100MHz bandwidth (2017.6, MWC2017 Shanghai)
Japan	· Japan has worked on testing three 5G service scenarios for 3 years, consisting of 40 projects in 6 areas, under the leadership of Ministry of Internal Affairs and Communications (2017.5) · Major 3 mobile communication service providers developed an JPY 5T investment plan to launch 5G service in 2020 Tokyo Olympic Games, and to gradually expand commercial 5G service to the entire country by 2023 (2017.6). · NTT docomo exhibited its VR factory facility model and demonstrated remote controlling of industrial robots via 5G network at the speed of 600Mbps (2017.2, MWC2017).

Country	Progress
EU	· Following the 1st stage project for 5G technology development, 5G-PPP started its 2nd-stage project with the aim of applying 5G technologies in various industries through a study on 5G network evolution and operation methods (2017.6; the project consists of 21 items including 5G Car and 5G City). · A report on the '5G for Europe Action Plan' was published, which sets out step-by-step plans for 5G commercialization in Europe (2016.9) and 5GIA (5G Infrastructure Association) announced the 5G Pan-European Trials Roadmap (2017.5). · Ericsson revealed the half-sized, all-in-one 5G base station equipment that holds 256 beam-forming antennas and features the existing LTE functions (2017.2, MWC2017). · Nokia and Ericsson demonstrated factory automation (robot control and AR-based network management service) and remote control (real-time, remote car control and robot surgery) (2017.2, MWC2017). · UK announced through its 2016 Autumn Statement the plan to invest GBP 1B in constructing nation-wide optical cable network and 5G (2016.11).
US	· The White House spearheaded establishment of AWRI (Advanced Wireless Research Initiative), through which it announced the plan to invest USD 400M for 7 years to research foundations in the country (2016.7) · US FCC took the initiative in implementing policies for mobile communication service providers and their partners to easily install small cells (2017.4). · Verizon released 5G standards for services fixed at 28GHz and provided 5G pilot services with Samsung and Intel (2017.4). · Intel expanded its operating frequency band and introduced its third-generation, double-capacity mobile test platform for 5G (2017.2, MWC2017). · Qualcomm demonstrated its 5G modem chip technology that uses 800MHz bandwidth and offers 5Gbps capacity at 28GHz millimeter wave (2016.10).

Korea is also striving for developing key technologies, market-friendly business models and services based on partnership between the major three Korean mobile communication service providers and global IT companies. KT says it expects the launch of 5G mobile communication in the market to be the year 2020, but it will focus all resources to achieve 5G mobile in the PyeongChang Winter Games in 2018. SKT presents its plan to grasp the new possibilities in the global communication industry by leading the 5G mobile communication network technology, and LGU+ says it is preparing to take the second leap in the market by focusing on the 5G mobile communication sector.

In this regard, the three providers and manufacturers are conducting R&D on enhancing the user experience, building high-capacity IoT infrastructure, and achieving low-latency, highly-reliable communication, further to realize the 5G vision developed in 2016 and key performance indicators. In May 2017, the plan for developing convergence scenarios was made to

ensure diversification and wide reach of the services combining 5G and other industries. As part of the plan, the three providers are taking the initiative to develop services representing 5G convergence, which will be put to test and demonstration from 2018.

2.2 5G Technologies

As 5G technologies are still at a development stage before commercialization, it is important for each country to take the lead in global standardization by developing core technologies and services. This is why many countries are actively involved in standardization activities through the International Organization for Standards. ITU named the 5G mobile communication technology IMT-2020 with plans to come out with the wireless access technology recommendations by 2020; the 3rd Generation Partnership Project (3GPP) plans to finalize 5G Phase1 (Rel.15) by June 2018 and 5G Phase2 (Rel.16) by December 2019, which will be submitted as an IMT-2020 candidate technology in 2019.

• ITU-R Standardization

ITU-R WP5D published a set of recommendations in the IMT-2020 Vision in September 2015. The report is the top-level document for IMT-2020 and not only emphasizes the speed with eMBB (enhanced mobile broadband), but also other elements of communication such as mMTC (massive machine type communications) and urLLC (ultra-reliable and low-latency communications), unlike the past standards putting focus only on the speed. As of June 2017, ITU-R had completed identifying the 5G vision recommendations, name, standardization procedures, technical performance requirements, and evaluation methods. The invitation for submission of proposal for candidate IMT-2020 technologies is scheduled from October 2017 and evaluations of candidates will start from October 2018. The standards will be finally endorsed in 2020 through adjustments and consultations based on the evaluation results.

There was the 27th WP5D meeting in June 2017, through which the IMT-2020 performance requirements and evaluation methods were finalized. ITU-R WP5D, in charge of mobile

communication sector in ITU, added 5 indicators to the 8 key performance indicators (KPI) proposed in the IMT-2020 Vision and defined 13 minimum-level performance requirements that should be satisfied in 5G mobile technologies.

The most noticeable procedure here is the reception and evaluation of the IMT-2020 candidate proposals. ITU-R does not discuss technical specifications but uses other standardization groups such as 3GPP to receive proposals. This means, in the end, the technical specifications submitted by 3GPP become the international standards through ITU-R endorsement. Therefore, collaboration between ITU-R and other organizations like 3GPP is very important for the process of 5G standard development. It is especially important to understand the current state of standardization activities of 3GPP, which is emerging as an organization proposing the most powerful candidate technologies.

• 3GPP Standardization

3GPP establishes standards for mobile access technologies, service technologies (requirements, core network architecture, security, etc.) and specific protocol technologies connecting terminals and the core network through its Technical Specification Group (TSG) for RAN(Radio Access Network), SA (Service and System Aspects) and CT (Core Network and Terminals). The market has already defined standards for LTE, or the 4G mobile communication–3GPP Releases from 10 to 12 are LTE-Advanced; Release 13 and onward use the name LTE-Advanced Pro. The start of 3GPP's 5G mobile communication technology standardization was from the SA1 working group in February 2015. The full-scale discussion was followed in the TSG RAN plenary meeting in December 2015, where an agreement was made regarding general time plans and concept of 5G standardization and new technologies like new radio (NR) were defined. 3GPP is also going to continue improving the standards for technologies evolving from LTE. It plans to define technical standards for NR but before that, it decided to call all standards from Release 15 and onward '5G' in its meeting in October 2016.

SA1, which defines 5G service requirements, completed making its report TR 22.891 in March 2017, which contains 74 cases of technology use. These cases are classified into three service groups – eMBB, massive IoT and critical communication – along with the detailed requirements

for each group. All requirements related to the network operation for these groups were categorized as NEO (network operation), and a total of four building blocks (BB) technical reports were endorsed in the TSG meeting in June 2016. SA2, which studies technologies for the 5G core network architecture, completed its documentation work on TR 23.799 in December 2016. It identified 21 major issues on defining the higher-level architecture and developed related solutions, of which the work on network slicing and the QoS framework was the most active part. SA3 provides security technologies and completed TR 33.899 in March 2017.

The 5G mobile technology standardization activities in 3GPP RAN are carried out in two tracks – maintaining backward compatibility with the existing LTE standard called LTE-Advanced Pro and considering forward compatibility with the future standard called NR. 3GPP agreed to provide 3 releases by 2020. In terms of NR development, RAN selected SI for NR in March 2016; RAN WG1 started SI standardization targeted for March 2017, considering all scenarios and requirements without any decision made regarding priorities; standardization work on NR Phase1 (Release 15) started in March 2017; Phase 1 Technical Specification (TS) was completed in June 2018; Phase2 standardization will begin in June 2018, targeted for completion in December 2019.

What is interesting is that Phase1 Rel-15 must ensure both forward and backward compatibility with Phase2 Rel-16. This means 3GPP considers that Rel-15 and Rel-16 are not two different technologies when it comes to 5G standardization, and it provides the standards to the market one after another based on how Rel-14 is accepted, which is still under research. As for Rel-15 NR standard, 3GPP decided to first tackle the non-standalone (NSA) mode regarding eMBB and urLLC services, and exclude NR-based mMTC.

As Korea plans for 5G pilot service launch before 2020 and full-scale commercial service launch in 2020, application of Rel-15 standard would be the most important point for taking the lead in 5G standard technologies. The 5G standardization technology, so-called NR, pursues mobile communication technology standardization that combines industry sectors vertically – cars, factories, entertainment, e-health, and energy. This is the process that truly reflects the age of convergence – something totally different from the existing mobile communication technology that simply fuses wired and wireless services.

2.3 5G Policies

To cope with the changing environment at home and abroad, caused by the global 5G market competition and the coming of the 4th industrial revolution, the Korean government is also implementing policies for facilitating 5G mobile communication industry and the related convergence industries. In July 2016, the relevant ministries developed strategy for standardizing the future growth engines and planned a comprehensive analysis on the speed of industrialization and the degree of standards completion for each of the 19 growth engines for the future. The strategy also aimed to help Korea take the lead in standards and patents through connection of R&D, standards and patents in the area of 5G mobile communications. In September 2016, a consultative body called 5G Standardization Research Group was established, consisting of members from the industries, universities, research institutions and the government, under the 5G Strategy Committee. The Research Group has currently decided to submit 5G candidate technologies to ITU and is currently working on the matter. In October 2016, the 3rd 5G Global Summit was held in Korea, where government officials from the Asia-Pacific region joined to share policies and trends of the 5G and ICT convergence industries and cooperate globally with each other. In December 2016, the Korean government developed the 'Strategy for 5G Mobile Communication Industry Development' to focus on promoting convergence with other industries, building on the existing 'Strategy for Future Mobile Communication Industry Promotion' of January 2014, which targeted early commercialization of 5G.

In January 2017, 'K-ICT Spectrum Plan' was announced as the mid and long-term radio-frequency plan reviewing all areas of frequency use in Korea. Some of the contents include expanding the bandwidth to minimum 1.3GHz – to 1GHz at 28GHz band and to 300MHz at 3.5GHz band by 2018; and if user requirement conditions allow, to 3.3GHz bandwidth by expanding extra 2GHz bandwidth at adjacent 28GHz band. In the meanwhile, the three mobile communication service providers are developing '5G convergence service scenarios' since May 2017 as part of the 'Strategy for 5G Mobile Communication Industry Development'. The report on representative services of 5G, which is one of the outcomes, will be used as a preliminary report for preparing the 5G test projects along with the article contributions to ITU-R WP5D.

V. Usage Status

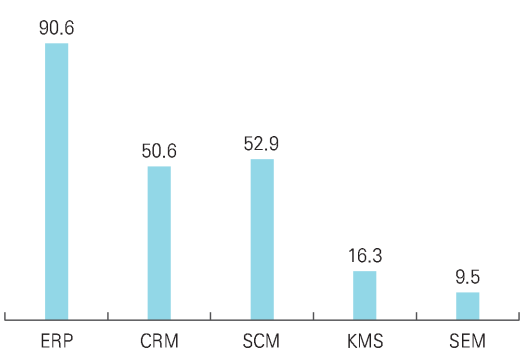
1. Information Use in Businesses

1.1 IT and Software Use in Businesses

• IT and Software Platform

ERP was the most used system, as 90.6% of the businesses are using it. CRM user businesses were 50.6%, SCM users 52.9%, and business knowledge portal system and strategic enterprise management system users were respectively 16.3% and 9.5%. ERP was used in 90% of the businesses with 50 or more employees, and almost all businesses with 1000 employees or more. On the other hand, the adoption rates of CRM, SCM, business knowledge portal and strategic enterprise management system were relatively lower than that of ERP.

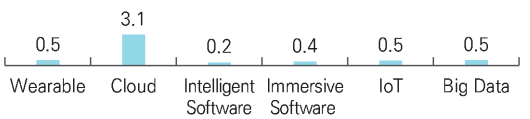
Figure 5-1 Major information systems in use for business integration (%)



*2016 ERP survey was revised to include questions on HR management system in addition to ERP.
Source: MSIP/NIPA, 2016 Survey Report on IT and Software Use by Local Businesses, 2016.12

The usage rates of new IT and software were 3.1% for cloud, 0.5% for wearable computing, IoT and big data, 0.4% for immersive software (VR/AR), and 0.2% for intelligent software (AI).

Figure 5-2 Use of new technology elements (%)

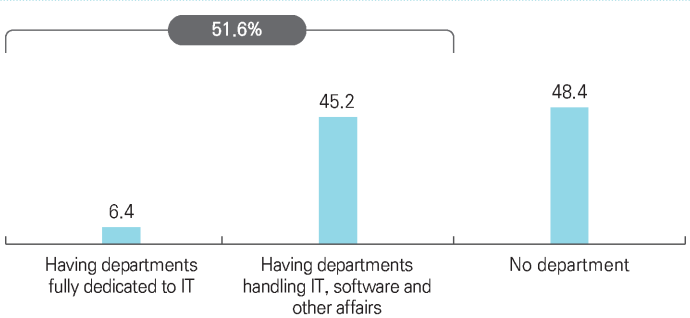


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• IT and Software Management

The 'establishment and operation rate of departments fully dedicated to IT and software affairs' shows how IT departments in businesses are established and operated in a stable manner. 6.4% of businesses had fully-dedicated IT and software departments and 45.2% had other departments taking care of IT and software affairs in addition to other work, which means a total of 51.6% of businesses had departments fully or partially dedicated to IT and software.

Figure 5-3 Departments dedicated to IT and software affairs (%)

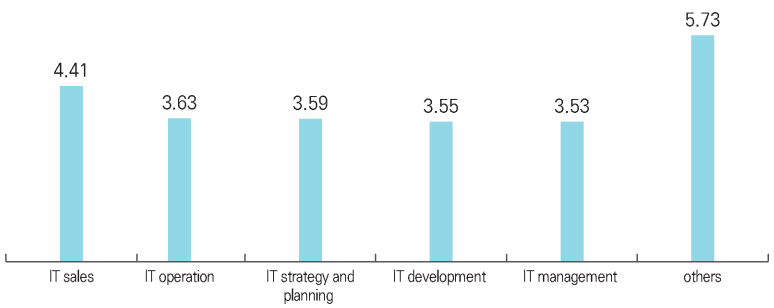


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

The number of workers in IT and software departments by each task area[5] was 4.41 for IT sales and 3～4 for IT operation, IT strategy and planning, IT development, and IT management.

5) Task areas for IT and software departments: IT strategy and planning – IT strategy, consulting, planning, software product planning, big data planning and analysis / IT development – software architecture, application software engineering, embedded software engineering, database engineering, network engineering, security engineering, UI/UX engineering, and system software engineering / IT operation – IT system management, IT education and IT support / IT management – IT project management, IT quality assurance, IT test and IT auditing / IT sales – IT sales and marketing

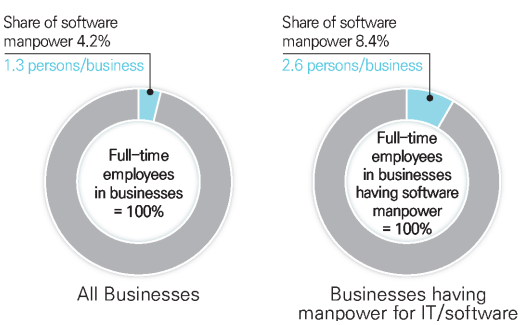
Figure 5-4 Workers in charge of each task area in businesses having dedicated IT and software departments



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

Regardless of the existence of dedicated IT and software departments, the share of IT and software manpower in businesses was 4.2% of the total employees, which was 1.3 persons per business. The percentage was 8.4%, or 2.6 persons in businesses having one or more employees assigned for IT and software affairs.

Figure 5-5 Share of IT and software manpower in total employees

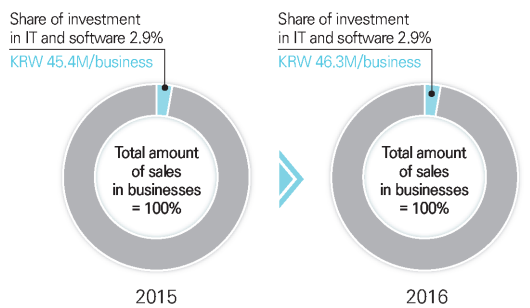


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

The share of IT and software investment in businesses was 2.9% of total sales in 2016, showing not much difference from 2015. However, the average amount of investment per business slightly increased from KRW 45.4 million in 2015 to KRW 46.3 million in 2016. As for new investment areas, the largest share went into information security service and system

reinforcement at 27.6%, followed by business SNS[6] adoption and use at 2.4% and IoT-driven product and service innovation at 0.2%.

Figure 5-6 IT and software investment (expenditures)

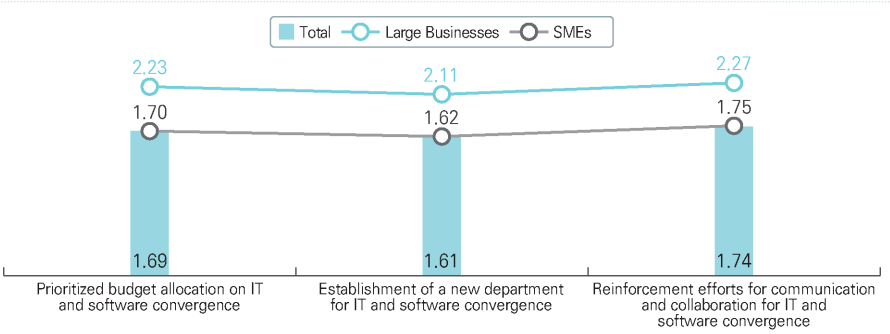


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• IT and Software Acceptiveness and Leadership

In terms of education and training of IT and software use, 54.0% of the businesses were providing education and 13.7% were providing education on specialized skills for specific tasks.

Figure 5-7 CEO's interest and commitment on IT and software convergence (1～5 points)



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

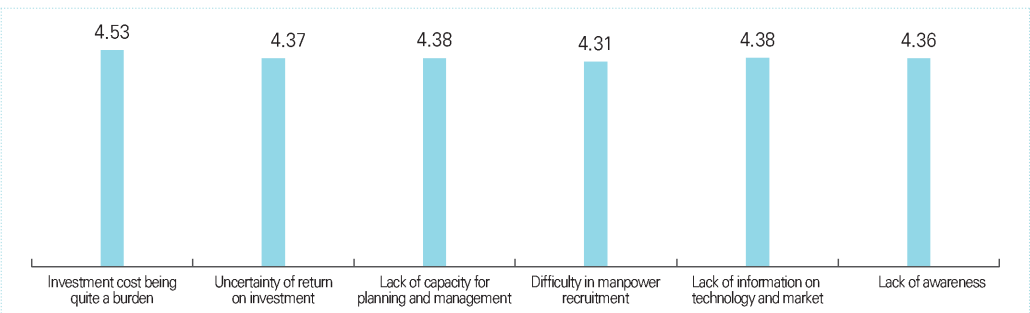
6) Business SNS: A new means of productivity enhancement, where SNS is applied to business environment and facilitates communication, collaboration and information exchange within businesses

CEO's interest and commitment to IT and software convergence scored low in all indicators (less than 2 out of 5 points), while large businesses scored in between low and moderate. The results were 1.69 points for prioritized budget allocation, 1.61 points for establishment of a new department, and 1.74 points for communication and collaboration reinforcement efforts.

• IT and Software Environment

When asked to measure the impact scale of various obstacles to IT and software investment on a scale of 7, businesses chose 'the investment cost being quite a burden (4.53)' as the biggest obstacle, which was the financial issue. Other major obstacles were the lack of capacity for planning and management (4.38), lack of information on technology and market (4.38), and uncertainty of return on investment (4.37).

Figure 5-8 Obstacles to IT and software investment (impact scale of each obstacle)
(On a scale of 7, where 1 = very low, 4 = moderate, 7 = very high)



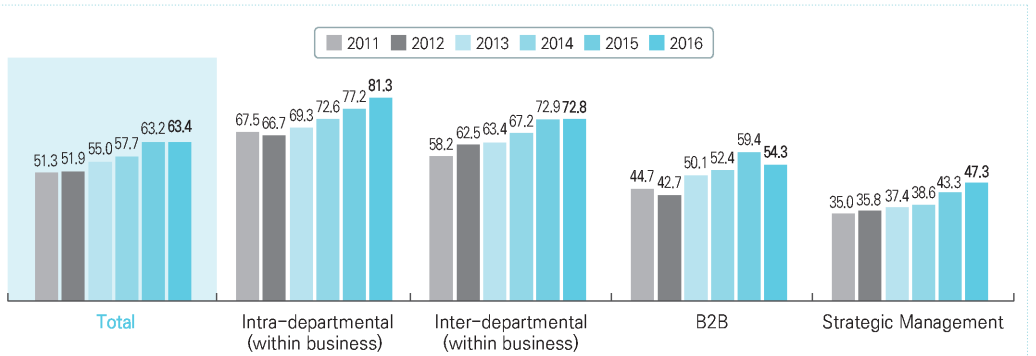
Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

1.2 Level of IT and Software Use in Businesses

Ministry of Science, ICT and Future Planning (MSIP) and National IT Industry Promotion Agency (NIPA) use the results of the Survey on Local Businesses' IT and Software Use to calculate the IT Usage Index every year. The IT Usage Index is defined as "the business capacity to efficiently use and manage IT in cooperation with stakeholders with the aim of creating values such as business performance, customer values, collaboration performance, and value chain innovation".

The final IT Usage Index (0～100 points) is measured in four domains-intra-departmental (intra-functional) use, inter-departmental (inter-functional) use, business-to-business (B2B) use, and use for new project creation and strategic management (strategic management) after each being weighted by industry type, size, and business area. In 2016, the IT Usage Index of the total Korean businesses was 63.4 points, with each domain scoring 81.3 points for intra-functional use, 72.8 points for inter-functional use, 54.3 points for B2B use, and 47.3 points for strategic management use.

Figure 5-9 IT Usage Index at a glance (points)

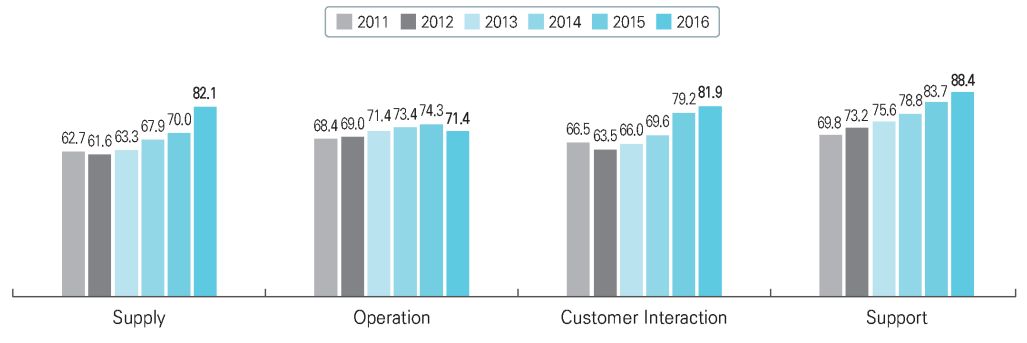


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• IT and Software Usage Index by Task Area

The intra-functional IT and software usage was assessed in terms of four task areas – supply (purchase), operation, customer interaction and support. The supply area consists of tasks related to resource/material supply and stock management; operation includes tasks related to product planning/management and service development; customer interaction includes tasks like customer management; and support consists of tasks for overall business activities such as personnel management, financial accounting, and e-document management. The Intra-functional IT Usage Index was the highest in business support, with 88.4 points, followed by 82.1 for supply, 81.9 for customer interaction and 71.4 for operation. The Intra-functional IT Usage Index showed a significant increase from 2011, especially in the area of supply with 19.4 points

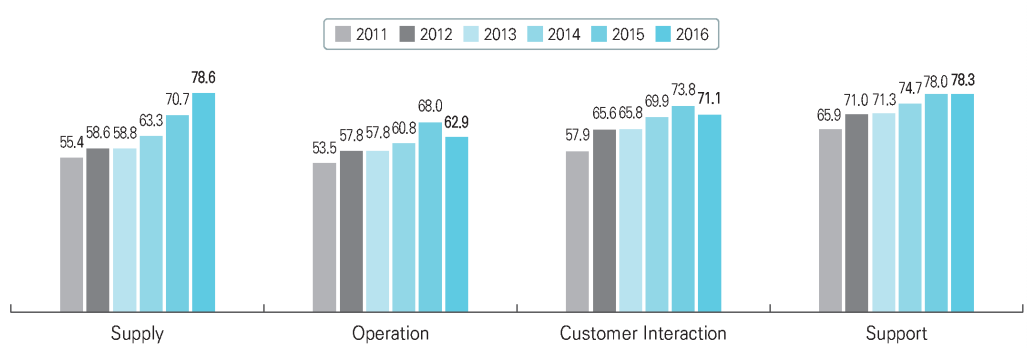
Figure 5-10 Intra-functional IT Usage Index (points)



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

The inter-functional IT usage was measured based on how much IT was used for information sharing in the four task areas of supply, operation, customer interaction (sales) and support. The inter-functional IT usage was the highest in supply with 78.6 points, followed by 78.3 for support, 71.1 for customer interaction and 62.9 points for operation. The Inter-functional IT Usage Index showed a significant increase from 2011 especially in the area of supply with 23.2 points

Figure 5-11 Inter-functional IT Usage Index (points)

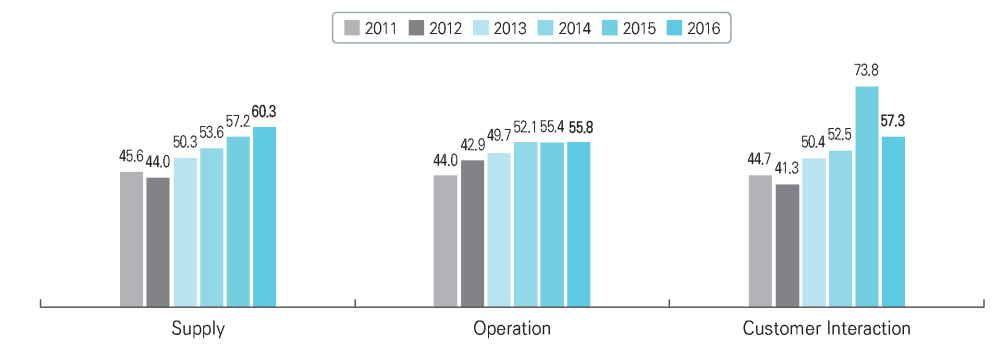


Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12.

The B2B IT usage was evaluated by considering how much IT was used for information sharing in three task areas – supply (purchase), operation and customer interaction. The B2B IT Usage

Index was the highest in supply with 60.3 points, followed 57.3 for customer interaction and 55.8 for operation. The supply area showed the largest increase from 2011, reaching 14.7 points.

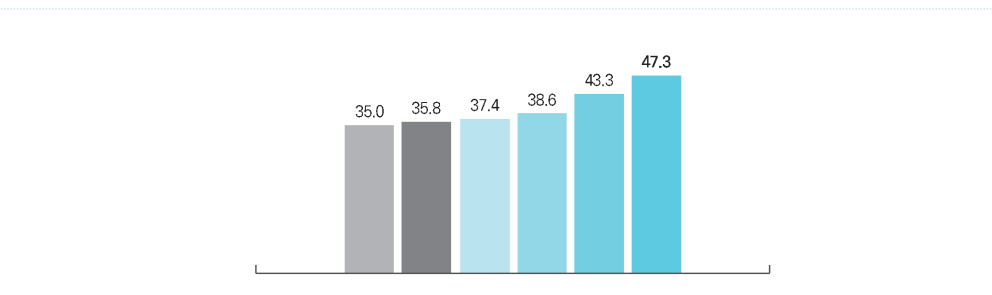
Figure 5-12 B2B IT Usage Index (points)



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

The level of IT use for strategic management was measured to find out how much IT is used for strategic management and new project creation.

Figure 5-13 IT Usage Index for strategic management (points)



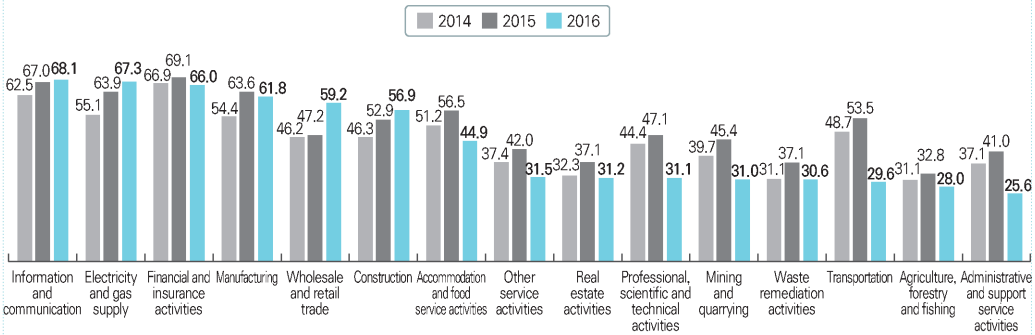
Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• IT and Software Usage Index by Industry Type

By industry type, the IT Usage Index was the highest in information and communication with 68.1 points, followed by 67.3 for electricity and gas supply and 66.0 for financial and insurance activities. On the other hand, the Index turned out to be relatively lower than others in

transportation industry with 29.6 points, in agriculture, forestry and fishing industry with 28.0 points and in administrative and support service activities with 25.6 points.

Figure 5-14 IT Usage Index by industry (points)



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• Analysis of IT Development Stages in Businesses in Korea

The 2016 survey found the IT Usage Index of businesses in Korea was 63.4 points, which means they are in the transitional period from the stage where information sharing and electronic collaboration is achieved through B2B IT systems (Stage 3) to the stage where innovative management and new project creation is achieved through IT and software use (Stage 4).

Table 5-1 IT and software Usage Index and development stages

STEP 1 Business process streamlining	STEP 2 Collaboration within business	STEP 3 Collaboration with other businesses	STEP 4 Strategic management
IT and software use by individuals and within departments	IT and software-based collaboration with other departments	IT and software-based collaboration with other businesses	Innovative management and new project creation through IT and software use

4.7points 26.3points 27.5points 41.8points 44.6points 58.6points 64.4points 85.1points

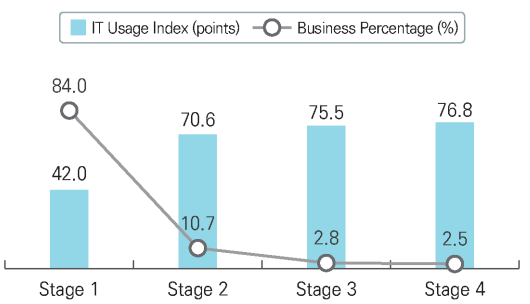
2009(44.1points) 2015(63.2points)

*Shades between stages show the transition period from one stage to another

Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

It is estimated that 84.0% of businesses in Korea are in Stage 1 – 'business process streamlining'; 10.7% in Stage 2 – 'collaboration within business'; 2.8% in Stage 3 – 'collaboration with other businesses'; and 2.5% in Stage 4 – 'strategic management and new project creation'.

Figure 5-15 IT Usage Index and percentage of businesses by development stage



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

• Analysis of IT Development Stages by Business Size

In terms of business size, large businesses were already in Stage 3 at the time when the survey first started, and they entered Stage 4 in 2012, after consistent improvement through 2010 and 2011. On the other hand, SMEs had been staying in Stage 2 for a while and finally entered Stage 3 in 2014. Considering the high-level features of Stage 4, it is expected to take quite some time for SMEs to get onto the next stage.

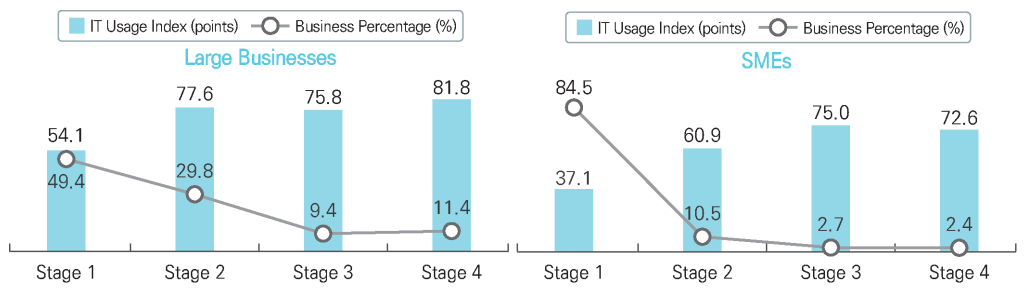
Table 5-2 IT Usage Index and development stage by business size

Year	2009	2010	2011	2012	2013	2014	2015	2016
Total	44.1	46.7	51.3	51.9	55.0	57.7	63.2	63.4
	Stage 2-3	Stage 3						
Large Businesses	58.5	59.1	64.1	67.0	70.3	71.6	79.3	74.3
	Stage 3	Stage 3-4		Stage 4				
SMEs	27.9	32.4	37.6	34.4	39.0	42.2	44.8	53.9
	Stage 2					Stage 3		

Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

Looking at the distribution of the businesses by size and IT usage level in each development stage, the most large businesses and SMEs were positioned in Stage 1 – 'business process streamlining' (49.4% and 84.5% respectively). The IT Usage Index of large businesses was the highest in Stage 4 – 'strategic management and new project creation' (81.8 points), while the IT Usage Index of SMEs was the highest in Stage 3 – 'collaboration with other businesses' (75.0 points).

Figure 5-16 IT Usage Index and percentage of businesses by development stage



Source: MSIP/NIPA, 2016 Survey Report on Local Businesses' IT and Software Use, 2016.12

2. Information Use in Citizens

2.1 Internet Use

• Internet Usage Rate

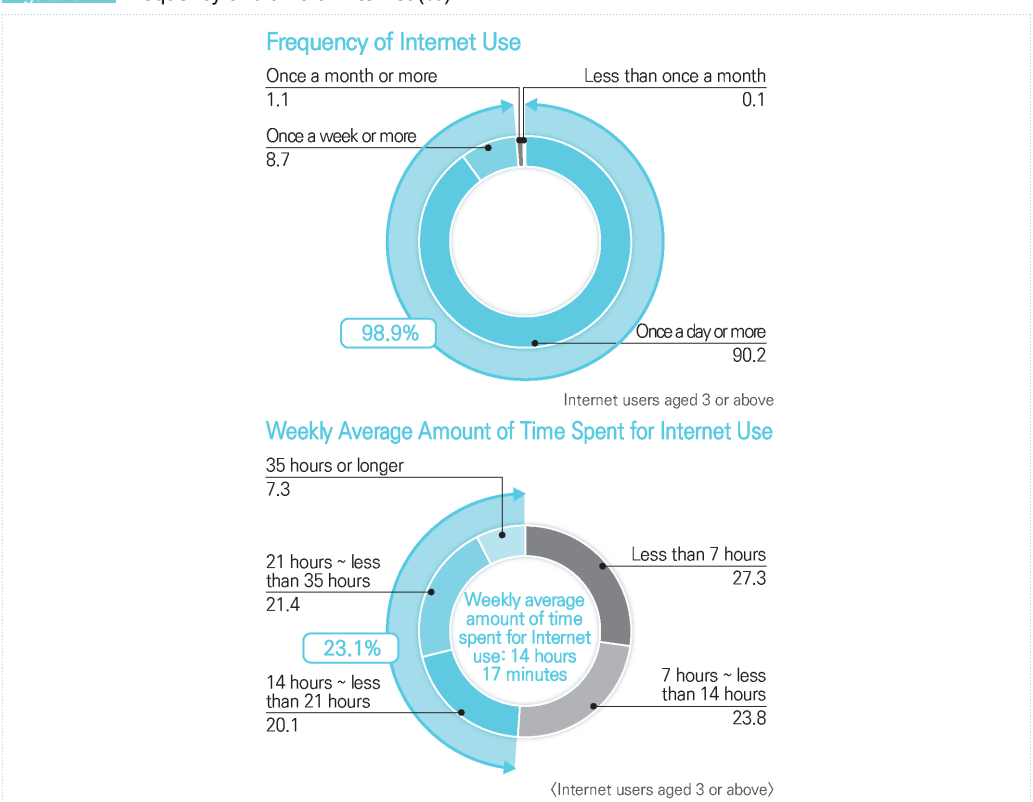
The number of Internet users and usage rate by gender was 91.0% (22,451,000) in male and 85.6% (21,185,000) in female and the usage rate in male was 5.4%-point higher than the rate in female. By age group, the usage rate was 100.0% in teens, 99.9% in 20s, 99.8% in 30s, and 99.4% in 40s – signifying that most of the citizens are using the Internet. The rate in the 50s was also very high at 94.9%. On the other hand, 7 out of 10, or 74.5% of the citizens in their 60s were Internet users and the rate in age 70 or older was 25.9%, which was an 8% increase from the previous year, showing that even though the rate is lower than other age groups, it is constantly increasing every year.

By region, the rate was relatively high in Ulsan (96.6%), Busan (92.7%), Daegu (91.7%), Gwangju (91.4%) and Sejong (91.0%); whereas it was relatively lower in Gangwon (74.6%), Joennam (81.2%), Chungnam (84.7%), and Jeonbuk (85.6%).

• Internet Use Patterns

The survey found that most of the Internet users, 98.9%, use the Internet once a week or more often. Those who use the Internet once a day or more often was 90.2% and the weekly average amount of time spent for Internet use was 14 hours and 17 minutes (about average 2 hours per day). 48.8% of the Internet users were found to be using 14 hours or more a week on average.

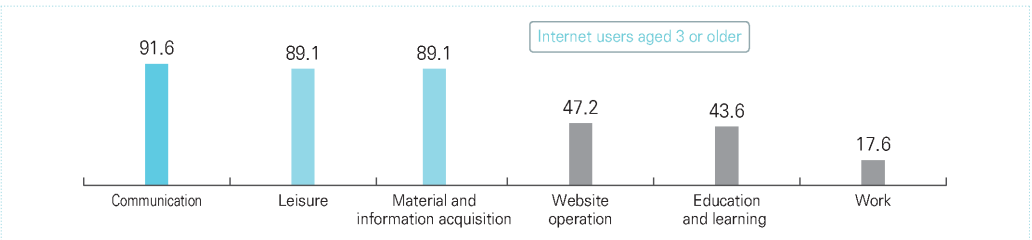
Figure 5-17 Frequency and time of Internet (%)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

9 out of 10 Internet users were using the Internet for communication and those who answered they use the Internet for leisure and material and information acquisition were 89.1% each. Other purposes of Internet use were for website operation at 47.2%, education and learning at 43.6%, and work at 17.6%.

Figure 5-18 Purpose of Internet use (multiple response, %)

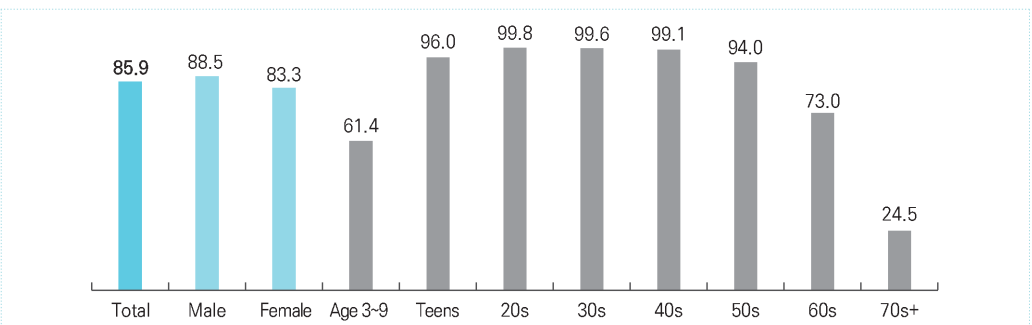


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

• Mobile Internet Use

The mobile Internet usage rate was higher in male than female by 5.2% points, with high rates above 90% in age groups from teens to the 50s. As for the amount of time spent for mobile Internet use, 2 out of 10 (24.4%) were using the Internet through mobile devices for 14 hours or more on weekly average, and the weekly average time spent for mobile Internet use was 8 hours and 37 minutes (1hour and 14 minutes on daily average).

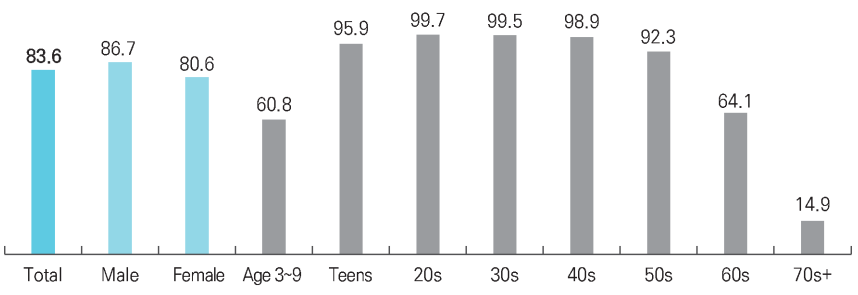
Figure 5-19 Mobile Internet usage rate (%) – in population aged 3 or older



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The rate of Internet use via smart phone was 86.7% in male, which was higher by 6.1% points than in female at 80.6%. By age group, the groups from teens to 50s showed high smart phone usage rates of above 90% (95.9% in teens, 99.7% in 20s, 99.5% in 30s, 98.9% in 40s, and 92.3% in 50s). The rate was 64.1% in the 60s age group.

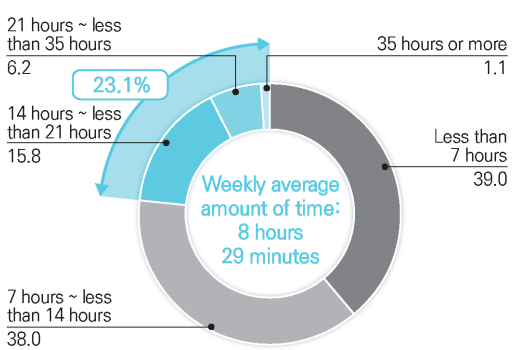
Figure 5-20 Smart phone usage rate (%) – in population aged 3 or older



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

As for the amount of time spent for smart phone use, 2 out of 10 were using the smart phone for 14 hours a week on average. The weekly average amount of time for Internet use via smart phone was 8 hours and 29 minutes, which was 1 hour and 13 minutes on daily average.

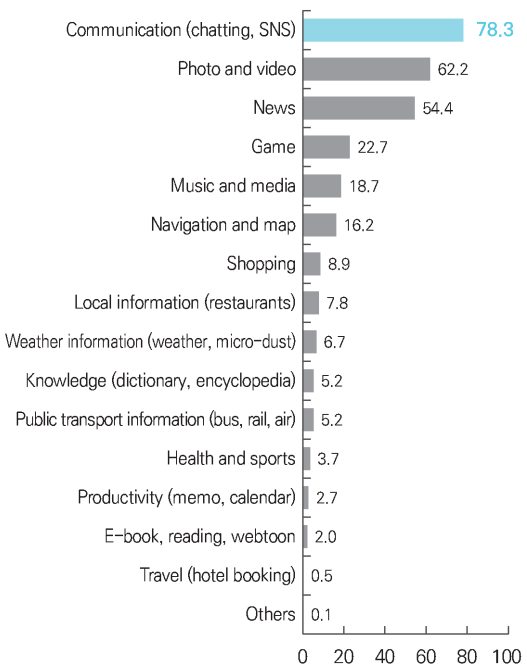
Figure 5-21 Weekly average amount of time spent for smart phone use (%) – in population aged 3 or older



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The most used applications in smart phone users were in the categories of ‘communication such as chatting and SNS’ at 78.3%, followed by ‘photo and video (62.2%)’, ‘news (54.4%)’, ‘game (22.7%), ‘music and media (18.7%), and ‘navigation and maps (16.2%).

Figure 5-22 Most used smart phone applications (%, 3 choices) - in smart phone owners aged 12 or older

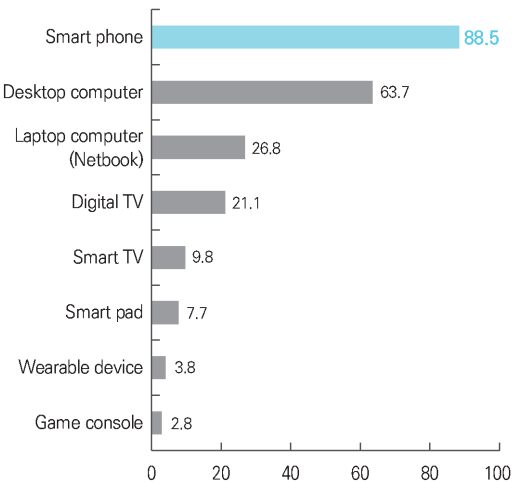


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

• Internet Access Environment

The most used means of household Internet access was smart phone, at the usage rate of 88.5%. Following this was desktop computer at 63.7%, laptop computer at 26.8%, digital TV at 21.1%, and smart TV at 9.8%.

Figure 5-23 Devices for household Internet access (multiple response, %)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The survey found that most households (99.2%) were using mobile phone service including smart phone, and 85.1% of the households were using the 'wired Internet'. The usage rate of the Internet-access IPTV service was 29.1% on a similar level from the previous year. The usage rate of VoIP service was 18.0%.

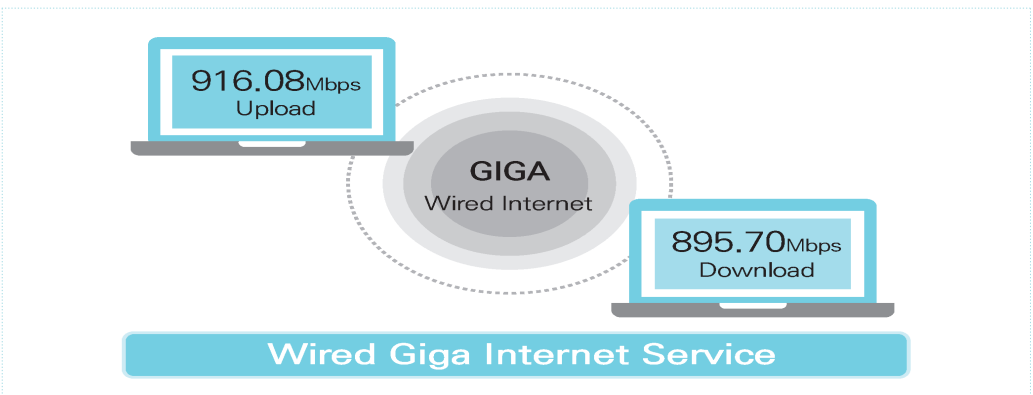
2.2 Internet Service Use

• Communication

The instant messenger service allows real-time sharing of data online, such as messages and photos, through computer or smart phone. Major messenger services used in Korea are Kakao Talk, Line, Nate-on UC, Facebook Messenger, and Google Hangout. 92.5% of the Internet users used the service within the last one year period. This figure is a 1.6%-point increase from 2015 and the rate is showing a constant increase every year.

As for the rate of instant messenger service by gender, both male and female showed similar levels at 93.0% and 92.0% each. By age group, the usage rate was high at above 90% in users aged from 20s to 50s. In particular, there was a significant increase in older age groups – by 8.0% points in 60s and by 12.3% points in 70s or older.

Figure 5-24 Instant messenger usage rate by gender and age (%) – in population aged 6 or older

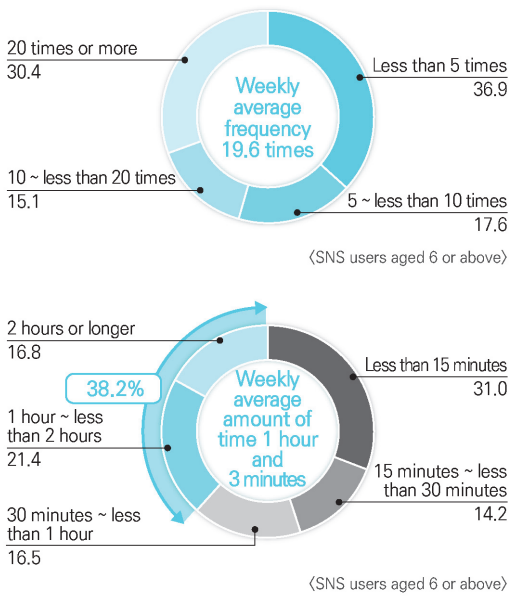


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

Social network service (SNS) is a service allowing users to strengthen relationships with friends and colleagues or expand their human network by making new connections with people. Mini-hompi, blogs, Twitter, Kakao Story, Facebook and Google Plus fall under the category of SNS. 65.2% of the Internet users used SNS within the last one year period, of which 64.7% through mobile and 23.4% through computer. The SNS usage rate was on similar levels regardless of gender (male 65.0% and female 65.4%), and the age 20s had the highest rate at 91.5%, followed by 30s at 83.9%, 40s at 69.5% and age 6～19 at 57.5%.

The frequency of SNS use was 19.6 times on weekly average (2.8 times on daily average) – specifically, 36.9% answered they used SNS less than 5 times, 30.4% said 20 times or more often, 17.6% said 5～less than 10 times, and 15.1% said 10～less than 20 times. The weekly amount of time spent for SNS use was 1 hour and 3 minutes, and 38.2% answered they use SNS at least for '1 hour or longer' per week.

Figure 5-25 Weekly average frequency and time for SNS use (%)

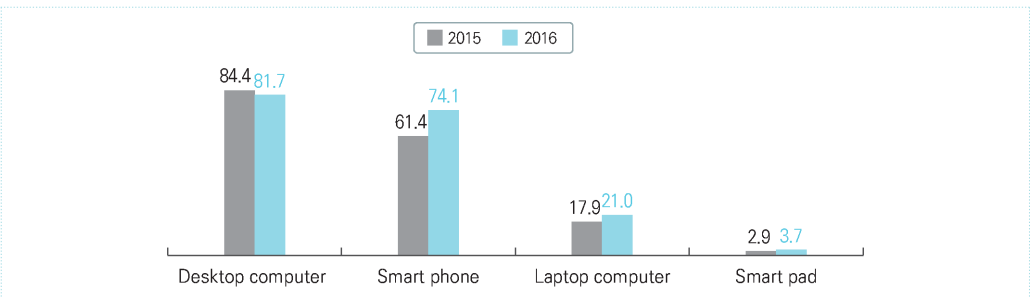


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

Despite the continuing increase in messenger service and SNS use, the traditional communication means, email, stayed almost on the same level at 59.1% for a year from the previous year (increasing 0.1% point). The rate was higher in male (64.1%) by 9.4% points than female (53.7%). By age group, the rate was higher in the 20s at 91.3%, 30s at 85.5%, and 40s at 70.2%. 54.6% of the email users used the service one or more for personal matters other than work – 17.9% said once a day or more and 36.7% said once a week or more. 81.7% of office-working email users used email for business purposes.

As for the devices for email use, 'desktop computer' was used the most at 81.7%, which was a 2.7%-point decrease from the previous year; on the other hand, the share of email use via 'smart phone' was 74.1%, a 12.7%-point increase from the previous year. Email usage rate via desktop computers was higher in male (84.3%) than female (78.4%), and the rate via smart phone was similar in male (74.7%) and female (73.3%). By age group, the 20s showed relatively higher rates of email use through smart phone (84.0%) and laptop computer (31.5%).

Figure 5-26 Devices for email use (Email users aged 6 or above, multiple response) (%)

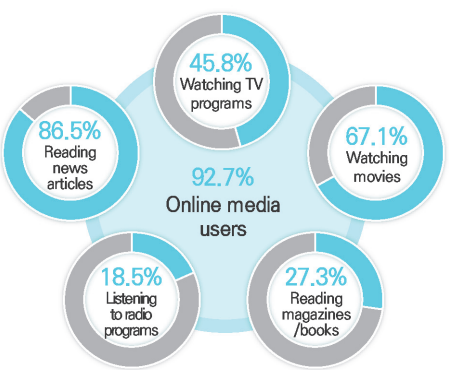


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

• Online Media

92.7% of the Internet users aged 6 or above used at least one or more of the five media types – TV, news (articles), radio, magazine/books and movies – on the Internet. Specifically, the number of users was the highest in online news (articles) at 86.5%, followed by movies at 67.1%, TV at 45.8%, magazine/books at 27.3% and radio at 18.5%.

Figure 5-27 Online media usage rate (Internet users aged 6 or above) (%)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

By gender, the online media usage rate was higher in male (94.1%) by 2.7% points than in female (91.3%) and almost all of the Internet users aged 20s or 30s (99.0%) were online media

users. 9 out of 10 Internet users aged 40s (97.9%) and 50s (94.1%) also used the online media.

Online TV users were 45.8% of the Internet users. There were more male users (46.9%) than female users (44.6%) with a 2.3%-point gap, and by age group, the usage rate was the highest in the 20s at 69.2%, followed by 30s at 59.7% and 40s at 47.1%. As for the frequency of watching online TV, 51.6% answered 'less than once a week', followed by 'once a week or more at 34.4%, and almost every day at 14.0%.

There was a large share of online news (articles) users at 86.5%. By gender, there were more male users (88.2%) than female users (84.6%) with a 3.6%-point gap. By age group, the usage rate was even at more than 90% throughout the groups from 20s to 50s. In terms of the frequency of using online news, 60.0% or the largest share responded 'almost every day', followed by 'once a week or more' at 28.1% and 'less than once a week' at 11.9%.

18.5% of the Internet users were online radio listeners. There was not much difference between male (18.4%) and female (18.6%), and users in their 20s and 30s showed relatively higher rates than other age groups, at 29.3% and 26.1% each. More than half of the online radio listeners, 54.1% listened to online radio 'less than once a week', and those who listen 'almost every day' were 11.9%.

27.3% of the Internet users read magazines or books online. By gender, the rate was 2.4%-point higher in male (28.4%) than female (26.0%), and by age, those in 20s had the highest rate at 47.6%. In terms of the frequency of reading online magazines or books, 59.7% of the Internet users said 'less than once a week', 30.8% said 'once a week or more' and 9.5%, 'almost every day'.

67.1% of the Internet users watched movies online. The rate was 4.2%-point lower in female (64.9%) than male (69.1%) and the rates in different age groups were 90.0% in 20s, 81.0% in 30s and 77.0% in age 6～19. In terms of frequency, the largest share of Internet users, 87.9%, said 'less than once a week', and 11.0% said 'once a week or more'.

• Games

The game industry in Korea hit the total sales volume of KRW 10.72 trillion in 2015, which was a 7.5%-point increase from 2014. Decreases in sales were found in online games and arcade

games, but there were significant increases in mobile and video games (22.3%-point and 33.2%-point increases respectively).

Table 5-3 Yearly game industry sales by game type (KRW 1M)

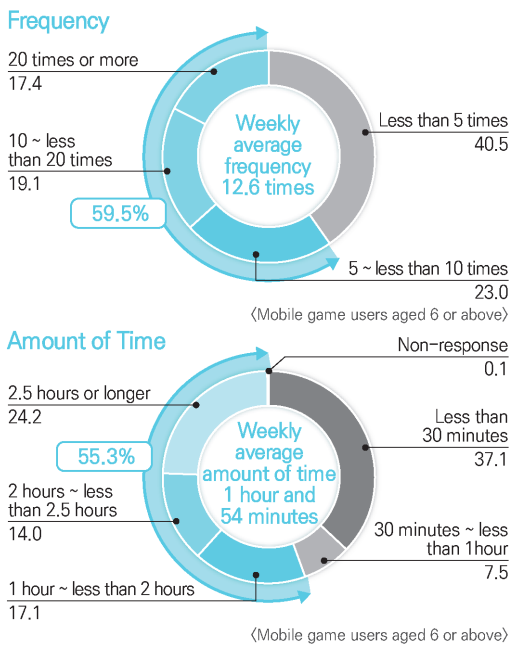
Category	Sub-category	2013	2014	2015	Share (%)	Growth (%)	CAGR (%)
Game Production and Publishing	Online Game	5,452,283	5,542,468	5,280,353	49.2	△4.7	△1.6
	Video Game	93,617	159,806	166,091	1.5	3.9	33.2
	Mobile Game	2,327,680	2,913,646	3,484,406	32.5	19.6	22.3
	PC Game	37,967	33,668	37,861	0.4	12.5	△0.1
	Arcade Game	82,492	52,848	47,428	0.4	△10.3	△24.2
	Subtotal	7,994,039	8,702,436	9,016,139	84.1	3.6	6.2
Game Distribution	Computer Game Room Operation	1,661,800	1,227,696	1,660,400	15.5	35.2	0.0
	Amusement Arcade Operation	63,844	40,489	45,745	0.4	13.0	△15.4
	Subtotal	1,725,644	1,268,185	1,706,145	15.9	34.5	△0.6
Total		9,719,683	9,970,621	10,722,284	100.0	7.5	5.0

Source: MCST/KOCCA, 2016 Report on Content Industry Statistics, 2017.3.

49.7% of the Internet users were using mobile games, and the rate was 11.2%-point higher in male (55.2%) than female (44.0%). The underage group of Internet users, aged 6～19, showed the highest rate of mobile game use at 73.0%, followed by the 20s at 71.2%, 30s at 59.0% and 40s at 44.1%.

59.5% of the mobile game users used mobile games '5 times a week or more', and the weekly average frequency of mobile game use was 12.6 times (1.8 times on daily average). The amount of time spent for mobile game use per week was '1 hour or longer' in 55.3% of the users, and the weekly average amount of time for mobile game use was 1 hour and 54 minutes (16 minutes on daily average).

Figure 5-28 Weekly average frequency and time for mobile game use (%)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The most enjoyed game types was ‘bubble shooting/ casual games’ at the usage rate of 48.8%, followed by card/go/Sudoku games at 32.4%, racing games 29.3%, and strategy/management simulation games at 28.7%. 71.1% of the mobile game users felt they are relieving stress through mobile gaming, and 57.8% felt a sense of accomplishment. On the other hand, there were less negative opinions regarding mobile games – that mobile games ‘disturb studies or work (30.1%) or ‘playing mobile games is a waste of time (24.7%)’. Only 9.1% of the mobile game users spent money on mobile games, which was KRW 11,438 on monthly average.

• E-Learning

E-Learning means learning through electronic means, ICT or radio/broadcasting technologies and is also called Internet learning, web learning, cyber learning, remote learning and electronic learning.

In 2016, the total sales of domestic e-learning providers increased 0.1% from 2015 to KRW 3.49 trillion. Compositions of the total e-learning sales are the service taking two-thirds at 70.3%, contents at 19.8% and solutions at 9.9%, all on a similar level to 2015.

Table 5-4 Total sales of e-learning providers (KRW 1M, %)

Type	2015		2016		Growth Rate	Average Sales
	Sales	Share	Sales	Share		
Subtotal	3,485,119	100.0	3,487,574	100.0	0.1	2,127.9
Contents	689,372	19.8	678,941	20.2	-1.5	1,732.0
Solution	346,644	9.9	333,649	9.9	-3.7	1,509.7
Service	2,449,103	70.3	2,474,984	69.8	1.1	2,412.3

Source: MOTIE/NIPA, 2016 E-Learning Industry Status Survey, 2017.5.

The domestic e-learning market volume in 2016 reached KRW 3.43 trillion, continuously growing from 2015 by KRW 171.8 billion. E-learning market demand from the formal educational institutions showed 1.4% increase from the previous year, and demand also increased in government/public organizations by 0.6%, individuals by 0.2% and businesses by 0.1%.

Table 5-5 E-learning market demand (KRW 1M, %)

Type	2012	2013	2014	2015	2016	Growth Rate(%)
Total	2,604,333	2,861,141	3,145,815	3,419,819	3,428,665	0.3
Individuals	1,102,586	1,256,430	1,364,896	1,577,820	1,581,560	0.2
Businesses	1,189,963	1,284,258	1,421,369	1,449,796	1,451,360	0.1
Formal educational institutions	136,722	144,327	161,234	169,494	171,798	1.4
Government/public organizations	175,062	176,126	198,316	222,709	223,947	0.6

Source: MOTIE/NIPA, 2016 E-Learning Industry Status Survey, 2017.5.

E-learning usage rate in individuals showed continuous growth since 2012 and reached 58.7%. By age group, the rate increase was 1.6% points and 2.0% points in the 40s and 50s each, signifying that the target of e-learning education is expanding from young students to all age groups and adult workers.

Table 5-6 E-learning trends in individuals (%)

Type		2012	2013	2014	2015	2016	Growth (%-point)
Total		53.3	57.1	57.6	58.2	58.7	0.5
Gender	Male	54.0	57.9	58.4	58.8	59.4	0.6
	Female	52.6	56.3	56.8	57.5	57.9	0.4
Age	3~9	43.2	44.3	46.1	46.4	47.6	1.2
	Teens	79.7	80.2	80.6	80.8	81.7	0.9
	20s	71.7	73.4	74.6	76.2	76.3	0.1
	30s	49.6	54.8	56.5	58.8	58.9	0.1
	40s	42.3	47.5	48.4	49.3	50.9	1.6
	50s	30.2	32.7	34.6	35.0	37.0	2.0

Source: MOTIE/NIPA, 2016 E-Learning Industry Status Survey, 2017.5.

The yearly average amount of money spent on e-learning was KRW 268K, where female users spend relatively more, KRW 266K, than male users, KRW 255K. The amount of spending was the highest in the age 20s user group, at KRW 345K per year on average.

The most used e-learning method was watching ‘educational broadcasting channels’ at 24.2%, followed by ‘lectures of Internet education providers’ at 23.7%. This shows that Internet and online lectures take up a substantial share of e-learning methods. The media used for e-learning access were Internet websites at 67.2%, educational broadcasting channels (EBS, JEI, cable TV) at 20.6%, mobile devices like mobile phone at 8.1%, and storage medium (CD or DVD) at 4.0%. In terms of learning areas, foreign languages were 29.0%, qualification test preparation 18.4%, elementary/middle/high school curriculums 12.5%, and job skills 12.2%. The rate of mobile learning experiences increased by 0.6% point from the previous year to 44.5%, where the preferred areas were foreign languages at 38.0%, qualification test preparation at 15.9%, job skills at 11.2%, IT at 10.2%, and culture/hobby at 7.5%.

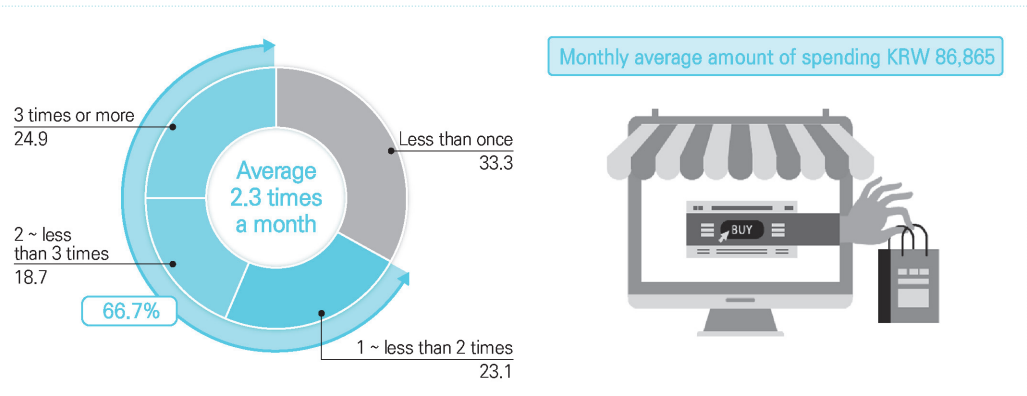
• Internet Shopping

57.4%, or more than half of the Internet users aged 12 or older, purchased products or services on the Internet within the last one year period (including reservations and ticketing). Of this share, 35.9% did so within the last one month period.

The rate of Internet shopping through mobile devices was higher, as 50.8% answered they did Internet shopping via mobile devices and 40.7% said they used computers to do so. By gender, more females (60.1%) did Internet shopping than males (54.8%), showing a 5.3%-point gap. By age group, the rate was the highest in age 20s at 90.4%, followed by 30s at 84.5%, 40s at 63.2% and age 12～19 at 48.7%.

66.7% of the Internet shopping users purchased products or services at least once a month or more, with the monthly average frequency of 2.3 times and the monthly average amount of spending of KRW 86,865. The Internet shopping users used credit cards the most at 74.1%, followed by online money transfer at 39.4%, debit card at 25.6%, micropayment on mobile phone at 24.8%, and simple payment at 21.9%.

Figure 5-29 Monthly average frequency and spending on Internet shopping (Internet shopping users aged 12 or older) (%)

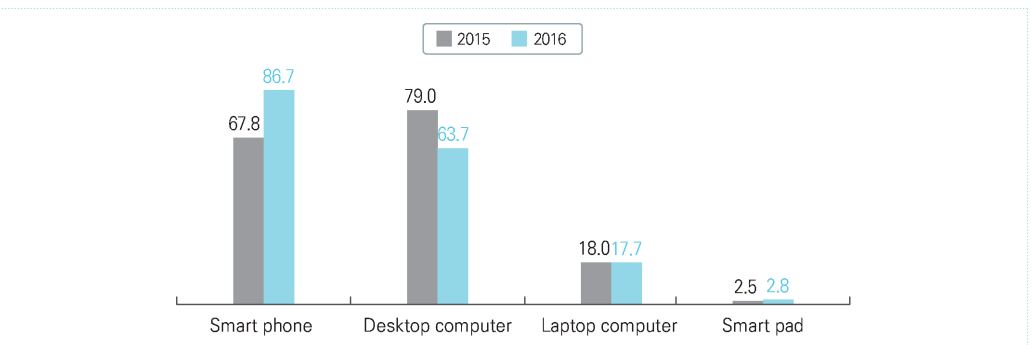


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The product and service items purchased the most through Internet shopping were ‘clothes, shoes, sports equipment and accessories’ at 77.0%, followed by ‘movies or performances’ at 45.6%, ‘books, magazines and news’ at 43.1%, and ‘cosmetics’ at 37.3%. Using smart phone for Internet shopping was 86.7%, an 18.9%-point increase from the previous year, whereas the desktop computer use decreased 15.3% points to 63.7%. This is a completely opposite result from the previous year, when the usage rate of ‘desktop computers (79.0%)’ was higher than ‘smart

phones (67.8%)'. There was not much difference in devices used by gender, but smart phone was used more in the age 20s group (91.3%) and desktop computer in the age 30s group (68.6%).

Figure 5-30 Devices used for Internet shopping (multiple response, %) – Internet shopping users aged 12 or older



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

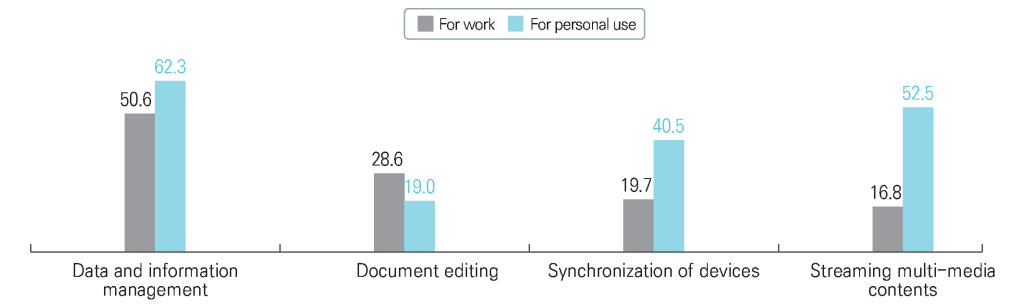
In terms of reasons for not using Internet shopping, 59.6% explained they preferred purchase in offline stores, 53.7% said they did not feel the need for Internet shopping. In addition, the complexity and inconvenience of the payment process, lack of reliability of products and services sold on the Internet, and lack of confidence in using the Internet shopping service took about 10% of the reasons.

• Internet Convenience Service

The cloud service usage rate for the recent one year period was 25.3%. More males (29.1%) than females (21.1%) used the cloud service, showing an 8.0%-point gap. By age group, the rate was the highest in the age 20s group at 47.5%, followed by 30s (38.9%) and 40s (24.4%).

Purposes of using the cloud service for work or business were 'storing data and information' at 50.6%, 'document editing' at 28.6% and 'synchronization of devices' at 19.7%; for personal use, the purposes were 'storing data and information' at 62.3%, 'streaming multi-media contents' at 52.5%, and 'synchronization of devices' at 40.5%. 79.9% of the cloud service users used smart phones to use the service, which was a 9.4%-point increase from the previous year, while using desktop computers stayed on a similar level at 69.0%.

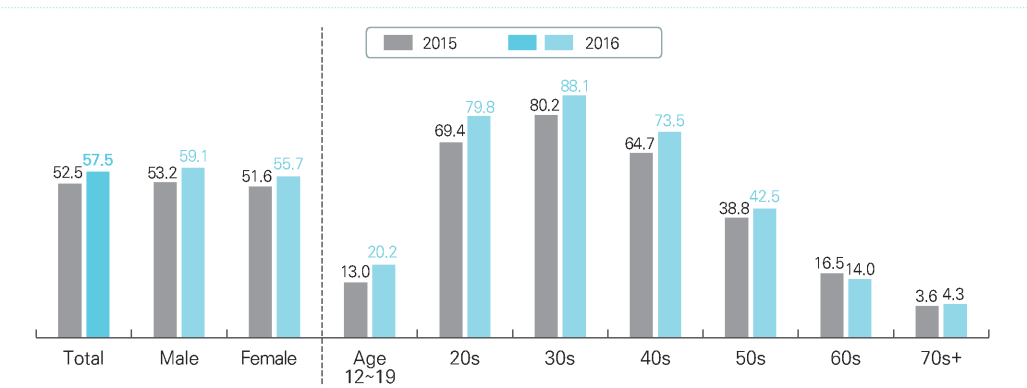
Figure 5-31 Purpose of cloud service use (multiple response, cloud service users aged 12 or older) (%)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

The Internet users who used the Internet banking within the last one year period was 57.5%, of which 34.9% used the service within the last one week period. Analysis of Internet banking usage rate by device showed there were more cases of using the Internet banking service with mobile devices – 50.9% used the service with mobile devices and 37.4% with computers. Internet banking usage rate in males was 59.1%, 3.4%-point higher than the female group. By age, the 30s had the highest usage rate at 88.1%, followed by 20s at 79.8% and 40s at 73.5%. 87.1% of the Internet banking users accessed the service via smart phone, which was an 11.5%-point increase from the previous year. Users who access Internet banking service through desktop computers were 56.9%, a level similar to the year before.

Figure 5-32 Internet banking usage rate by gender and age (Internet users aged 12 or older) (%)

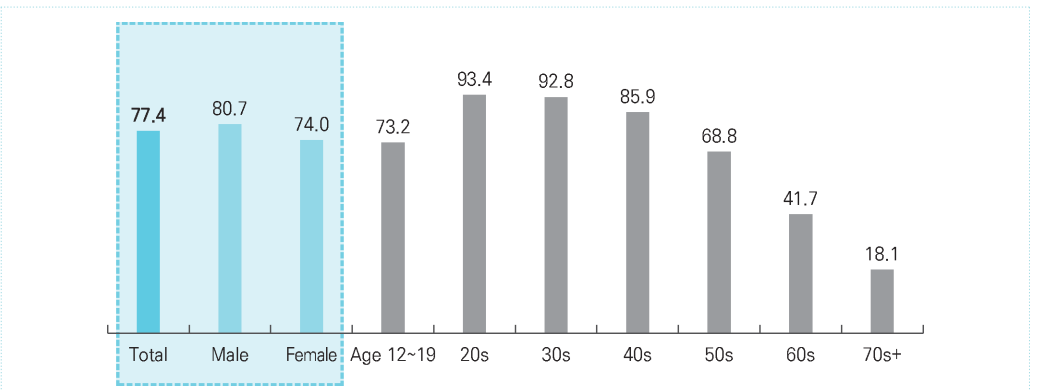


Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

77.4% of the Internet users aged 12 or older used location-based service such as maps, navigation and information search on the area of the user location. The age groups who showed the most active use of the location-based services were the 20s (93.4%) and 30s (92.8%). The most used service was 'map service' (67.3%), followed by navigation at 59.7%, information search at 54.8% and taxi service at 22.3%.

75.2% of the location-based service users felt their lives became more convenient with a diverse range of location-based services but 51.7% expressed concerns on privacy issues.

Figure 5-33 Location-based service usage rate by gender and age (Internet users aged 12 or older) (%)



Source: MSIT/KISA, 2016 Status Survey on Internet Use, 2017.3.

3. Information Culture and Environment

3.1 Overdependence or Addiction

• Status of Overdependence on the Internet

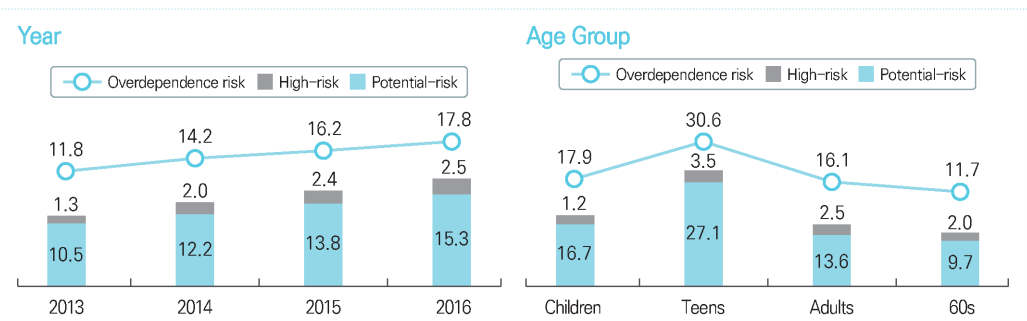
The Ministry of Science and ICT and the National Information Society Agency have conducted a survey on the status of Internet and smart phone overdependence risk groups and

their usage behaviors since 2004 for use in policy-making. The survey, conducted based on the 'Framework Act on National Informatization' was approved as the official national statistics (No. 120019). In 2016, the title of the survey was changed from 'Status Survey on Internet Addiction' to 'Status Survey on Overdependence on the Internet', and the scale of 'overdependence' was developed for children, teenagers, adults and the elderly, replacing the scale of 'addiction', which had been in use before. This way, the scales that had been used separately, such as the Internet scale (K-scale) and smart phone scale (S-scale), were all integrated as the 'smart phone overdependence scale. The survey target was also expanded in 2015 from age 3～59 to age 3～69, and accepting the recommendation from the Statistics Korea, the respondent unit changed from one person in a household to the whole household.

The overall Internet and smart phone overdependence level increased from 16.2% in 2015 to 17.8% (7.43 million) in 2016. By age group, the overdependence rate was 17.9% (591,000) in children, increasing 5.5% points from 2015; 30.6% (1.65 million) in teenagers, decreasing 1.0% point; and 16.1% in adults (4.83 million), increasing 2.6% points. The 60s age group was first survey this year and the rate was 11.7% (360,000). In overall, the rate increased 1.6% from 2015 but there were disparate changes in age groups, signifying that different levels of policies would be needed to tackle the issue.

The focus of the survey was the teenager group. In this age group, 1 out of 3 is in the risk group, of which 3.5% are in the high-risk group. In particular, 4.1% of female teens were in the

Figure 5-34 Risk of overdependenc*e on smart phone by year and age group (%)



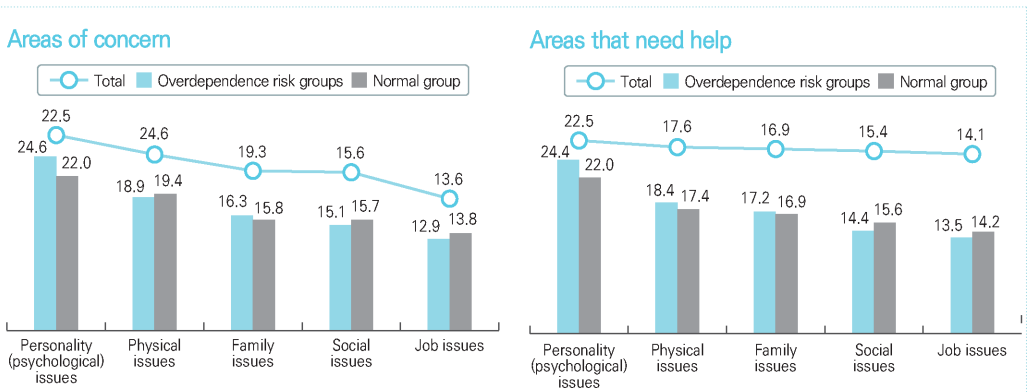
*The high-risk group consists of users having all issues of salience, control failure, and problematic results, while the potential-risk group consists of users having one or two issues of salience, control failure and problematic results

Source: NIA, Press Release - 2016 Status Survey on Overdependence on the Internet, 2016.

high-risk group and the portion of the high-risk group in middle school students was as large as 34.7%. It seems that policies will need to be more refined and specific as regard to finding solutions to the overdependence issue in female teens and middle school students.

The most used contents among smart phone users was messengers, with the usage rate at 94.5%, followed by games at 81.3%, web surfing at 73.7% and SNS at 65.0%. The content that raised the most concerns on negative effects was games at 35.4%, followed by messengers at 24.0%, web surfing at 21.1%, and movies/TV/videos at 15.1%. 22.5% of the users answered that 'they are the most concerned about their personality (psychological) issues' because of excessive smart phone use; 19.3% were concerned about physical issues; and 15.9% about family issues. These issues are likely to be interlinked so they need to be referred to when designing counseling or healing programs in the future.

Figure 5-35 Negative effects of smart phone use (%)



Source: NIA, Press Release - 2016 Status Survey on Overdependence on the Internet, 2016.

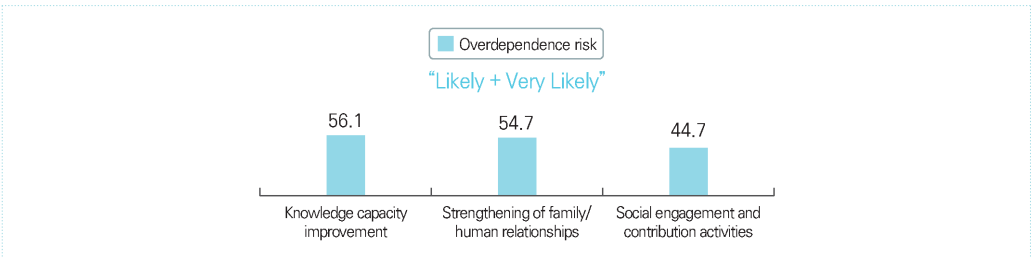
• Projects for Solving Internet Overdependence

Korea has been developing comprehensive plans every 3 years since 2010 for preventing and solving the issues of overdependence on the Internet and smart phone. 10 ministries involved in preventing and mitigating Internet and smart phone issues are working together to develop the plans; therefore, the plans are acknowledged as an excellent model in terms of expertise, extensity, and feasibility. The first-stage comprehensive plans (2010～2012) focused on solving

teens' pathological use of PC games, while the second-stage plans (2013～2015) included children as policy targets in addition to teens. Then, some changes were made to the third-stage plans established in 2016.

In the third-stage plans, the term 'overdependence' was used, which mitigated the meaning of treatment or ex post facto management. In other words, the clinical approach that addiction is a disorder that needs to be put under constant treatment and management was removed. Instead, the plans were developed based on an assumption that the working cycle might be prevention – counseling/healing – career support. Of course, the plans do not neglect psychological and physical issues like depression, distraction, insecurity, and ADHD (attention deficit hyperactivity disorder) – they just removed the bias in the viewpoint over-emphasizing that such addiction issues were pathological and instead, focused on the possibility that such habit of using smart phone excessively might also have good points. As the figure below illustrates, users recognize smart phone as a tool that facilitates improvement of knowledge capacity (56.1%), strengthening of human relationships (54.7%) and social engagement and contribution activities (44.7%). They think the use of smart phones also has positive sides even though it is criticized for the negative effects.

Figure 5-36 Positive effects of smart phone use (%)



Source: NIA, Press Release - 2016 Status Survey on Overdependence on the Internet, 2016.

Preventive education is a program conducted in order to reinforce the capability to cope with overdependence on smart phone and Internet. The program was targeted for 830,000 persons in 2016 but more than 1 million people actually joined the program, which was 122% of the targeted goal. The program consisted of the basic course – 'Life Cycle-based Lemon Class on Internet and Smart Phone Use (for children, teens and adults - about 1 hour)' – and the intensive course – 'WOW

Internet Mentoring for Teens (about 2 hours)'. 517 qualified lecturers were selected to provide preventive education throughout the country.

In the meanwhile, the obligatory education was also provided based on the Article 30 of the 'Framework Act on National Informatization'. The Act requires 10,695,491 persons in a total of 21,478 institutions – preschools, elementary/middle/high schools, universities and public institutions – to attend one session of educational program per year. In this regard, NIA provided online education targeted for 10,427,988 students in 21,162 schools (preschools ~ universities) and 267,503 workers in 316 public institutions.

Table 5-7 2016 preventive education by target and course (No. of persons)

Type	Children	Elementary School Lower Grades	Elementary School Higher Grades	Middle School	High School	Parents	Teachers	Adults	Others	Total
Lemon Class on Internet and Smart Phone Use	92,715	113,040	259,269	246,787	182,629	22,071	10,168	59,928	66	986,673
WOW Internet Mentoring	-	4,346	27,097	10,217	5,346	-	-	-	-	47,006
Total	92,715	117,386	286,366	257,004	187,975	22,071	10,168	59,928	66	1,033,679

Source: NIA, 2017.

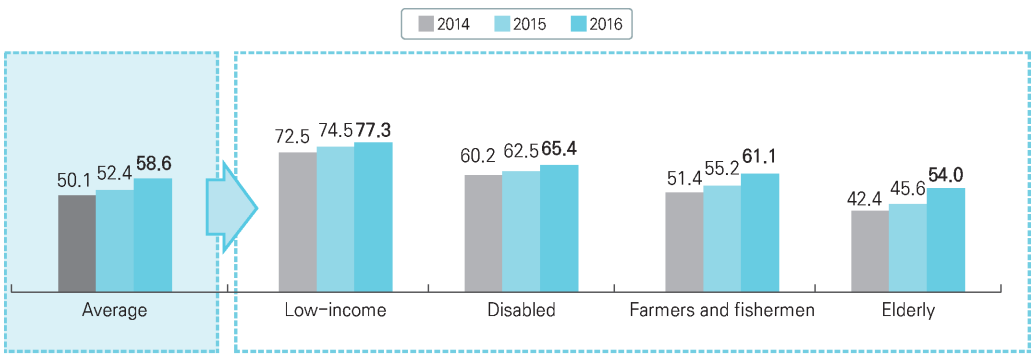
3.2 Digital Divide

• Digital Informatization Level in the Socially Disadvantaged

The average digital informatization level of the digital-disadvantaged groups[7] , as compared to the level of total population being 100%, was 58.6%, and the gap was closing in with the level improving from 50.1% in 2014 and 52.4% in 2015. The informatization level in the low-income class was relatively higher than others at 77.3%, while the elderly were on the lowest level at 54.4%. The average level of these socially disadvantaged groups was 58.6%.

7) NIA defines four digital-disadvantaged groups – the low-income, disabled, farmers and fishermen and the elderly.

Figure 5-37 Digital informatization level by each disadvantaged group and year (%)[8)]



Values represent the informatization level in the socially disadvantaged groups when the level of total population is assumed 100%.
The average values are weighted by population size of each disadvantaged group

Source: NIA, 2017.

In the meanwhile, the Internet usage rate in each disadvantaged group was also measured as part of the survey on the digital informatization level. While the rate in total population was 88.3%, it was 76% in the low-income group, the highest in the disadvantaged groups, and 59.3% in the elderly, the lowest. The smart phone penetration rate in households showed the same results in terms of rankings.

Table 5-8 Internet usage rate in the disadvantaged groups by year (%)

Type		2004	2006	2008	2010	2012	2013	2014	2015	2016
Total population		70.2	74.1	76.5	77.8	78.4	82.1	83.6	85.1	88.3
Socially Disadvantaged	Low-income	38.4	48.4	54.6	56.5	58.5	60.4	64.2	66.8	76.0
	Disabled	34.8	46.6	51.8	53.5	55.5	56.7	59.1	73.9	70.6
	Elderly	19.3	28.3	35.6	39.3	42.6	48.5	54.1	61.7	59.3
	Farmers/ Fishermen	16.9	29.4	35.2	37.5	40.2	42.2	47.1	56.2	59.9
	Average	24.9	35.1	41.7	44.3	46.8	50.8	55.4	63.6	63.4

'Internet usage rate' is the percentage of population who used the Internet within the last one month period.
Source: NIA, 2017.

8) The digital informatization level is measured by surveying the levels of digital access, capacity and use in the socially disadvantaged groups in comparison with the levels in the general population. The PC infomratization level in the disadvantaged groups was changed in 2016 to digital informatization level and surveyed; considering the issue of ageing society and taking in the recommendation from Statistics Korea, the minimum age for the elderly group was changed from 50 to 55.

Table 5-9 Smart phone penetration rate in the disadvantaged groups by year (%)

Type	2014	2015	2016
Disabled	51.3	62.6	66.8
Low-income	61.6	70.6	73.1
Elderly	40.6	49.3	57.2
Rural Residents	44.8	54.3	59.6
Average	45.5	54.9	61.2

Source: NIA, 2017.

• Digital Divide by Sector

Digital divide is composed of three sectors – digital access, digital capacity and digital use. The informatization level of each sector, when analyzed by year, showed a gradual increase year after year, from 50.1% in 2014 to 58.6% in 2016.

Table 5-10 Digital informatization level of each sector by year (%)[9)]

Type	2014	2015	2016
Digital access	72.3	73.7	84.5
Digital capacity	34.6	37.4	45.2
Digital use	47.7	51.6	59.0
Average	50.1	52.4	58.8

Source: NIA, 2017.

The informatization level of each sector improved in all disadvantaged groups. In particular, the information access sector had a dramatic increase, with the average level of informatization in the disadvantaged groups in 2016 reaching 84.5%; and the information capacity sector also showed constant improvement, reaching 59.0% in 2016.

9) Digital informatization level consists of 3 sectors – information access, information capacity and information use. Information access means the environment enabling Internet or smart phone use; information capacity means the ability to use the Internet, communicate through the Internet and maintain self-control in using the Internet; Information use means transactions and interactions through the Internet, and even political and social activities.

Table 5-11 Digital informatization level of each sector and group by year (%)

Sector/Year		Low-income	Disabled	Farmers & Fishermen	Elderly	Average
Access	2014	82.2	79.9	68.1	67.3	72.3
	2015	87.8	83.5	73.4	68.5	73.7
	2016	89.2	88.1	84.8	82.5	84.5
Capacity	2014	66.8	45.0	40.7	23.4	34.6
	2015	67.2	47.0	41.2	29.6	37.4
	2016	69.1	49.8	46.2	34.9	45.2
Use	2014	70.3	59.7	48.6	39.7	47.7
	2015	71.5	62.4	55.5	44.9	51.6
	2016	76.9	64.6	59.0	52.2	59.0

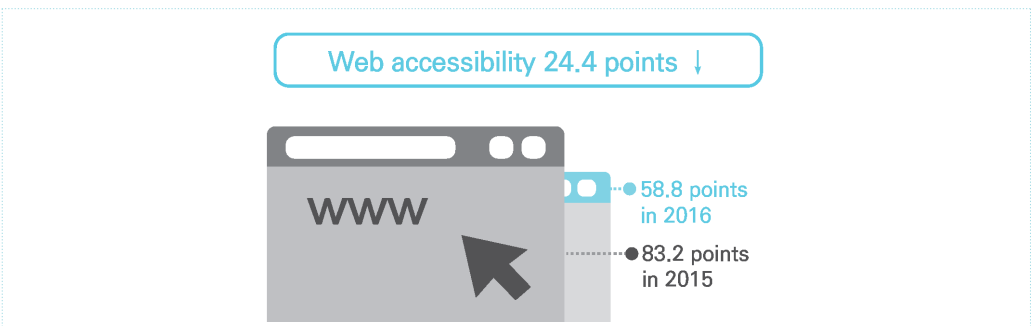
Source: NIA, 2017.

3.3 Information Accessibility (via Web and App)

• Website Accessibility

The web accessibility in 2016 fell 24.4 points from 83.2 points in 2015 to 58.8 points in 2016. Such decline in the average web accessibility scores was caused by the expansion of assessment scope from top 100 to top 1,500 websites on Rankey.com, and inclusion of high-ranking websites with vulnerabilities due to extraction of assessment indicators from each sector. In addition, a new scoring system was applied in 2016, weighting each assessment category.

Figure 5-38 Web accessibility of the last 2 years



Source: NIA, 2016 Status Survey on Information Accessibility, 2017. 2.

Analysis on the accessibility of websites found that among the total 12 categories, the websites of financial institutions had the highest score at 71.3 points, while the press and broadcasting had the overall accessibility level lagging behind with the lowest score of 50.0 points. The financial sector was higher than the total average by 12.5 points, and it is assumed that this is because the sector is used and complained about a lot by the disabled and therefore, regulated and supervised by the Financial Supervisory Service. The press and broadcasting sector was 8.8 points lower than the total average but the accessibility of terrestrial broadcasting stations, which often provide subtitles in videos, was relatively higher than that of daily newspapers and Internet news service providers.

Table 5-12 Website accessibility by category

Category	No. of websites	Score	Level
Financial institutions	79	71.3	Low
Life service/ Restaurants	82	64.2	
Welfare facilities	79	63.3	
Search engines/ Portals	33	62.0	
Medical institutions	65	60.3	
Communication	36	58.4	
Other utilities	46	58.3	
Entertainment	47	55.6	
Educational institutions	73	54.8	
Culture, Membership/ Mileage	46	54.7	
Shopping	212	52.5	
Press/ Broadcasting	199	50.0	
Total	997	58.8	

Source: NIA, 2016 Status Survey on Information Accessibility, 2017. 2.

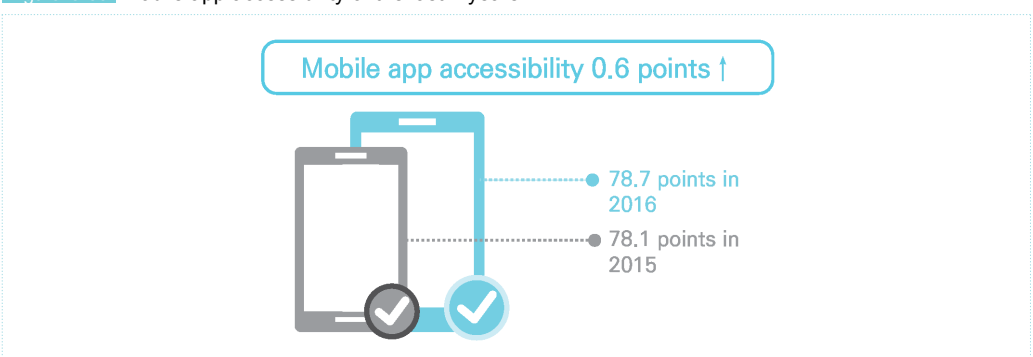
Among the 23 standard indicators used for assessing the level of website accessibility, the least followed standards were ‘providing alternative texts (indicator no. 1)’, followed by ‘ensuring keyboard use (no. 8)’, ‘ensuring shift of focus (no. 9)’, and ‘providing titles (no.15)’. The result was due to the private sector organizations’ lack of awareness on the importance of providing alternative texts to the massive amount of shopping, broadcasting and portal contents as well as their outsourced contents. Also, they were likely to have point deductions in both ‘ensuring

keyboard use' and 'ensuring shift of focus' – in particular, the focus was often covered up by their use of colorful and fancy scripts and aesthetic techniques.

• Mobile App Accessibility

The mobile app accessibility in 2017 was 78.7 points, a 0.6-point incline from 78.1 points in 2015. There was not much difference in mobile app accessibility between 2015 and 2016 because there was no change in the assessment targets or standard indicators. In terms of OS, the mobile app accessibility was 78.4 points for Android and 78.5 points for iOS, also showing almost no difference.

Figure 5-39 Mobile app accessibility of the last 2 years



Source: NIA, 2016 Status Survey on Information Accessibility, 2017. 2.

Analysis on the mobile app accessibility found that among the total 9 categories, the search engine/portal had the highest score at 84.4 points, while the shopping category had 72.2 points, needing improvement in overall. The search engine/portal category was 5.7 points higher than the total average, and it is assumed that this is because the mobile apps in this sector often have massive-scale information that makes it difficult to follow and maintain the accessibility standards, and therefore, they are under management of specialized organizations. As for Naver, for instance, it has a team called 'Nully' dedicated to improving accessibility and Daum is also seeking ways internally for accessibility improvement. Google has an accessibility specialist 'T.V. Raman' and has the guidelines of its own. The mobile app accessibility of the shopping

category was 72.2 points, which was 6.5 points lower than the total average. This was because the large number of products and constant product updates caused lower rates of alternative text provision.

Table 5-13 Mobile app accessibility by category

Category	No. of mobile app			Level
	Android	IOS	Score	
Search engine/ Portal	4	4	84.4	Moderate
Membership/ Mileage	5	5	81.5	
Financial institutions	11	10	81.2	
Entertainment	5	3	80.4	
Other utilities	10	8	80.3	
Communication	6	6	78.4	Low
Life service/ Restaurants	5	5	77.3	
Medical institutions	2	2	74.3	
Shopping malls	10	10	72.2	
Total	58	53	78.7	

Source: NIA, 2016 Status Survey on Information Accessibility, 2017. 2.

Among the 17 standard indicators used for assessing the level of mobile app accessibility, the least followed areas were alternative texts, compatibility with supplementary technologies, brightness contrast and focus shift. When applications did not use the basic UI (native component) provided by the mobile OS and instead have users create objects by themselves, they often did not provide alternative texts. As in the case of web accessibility, the result was due to the private sector organizations' lack of awareness on the importance of providing alternative texts to the massive amount of shopping, broadcasting and portal contents as well as their outsourced contents.

Global Data

1. International Indices on Informatization

1-1 E-Government Development Index and Rankings

(Unit : Point)

Country	Rank					Index (2016)
	2016	2014	2012	2010	Ranking Change	
United Kingdom	1	8	3	4	7(↑)	0.9193
Australia	2	2	12	8	—	0.9143
Republic of Korea	**3**	**1**	**1**	**1**	**2(↓)**	**0.8915**
Singapore	4	3	10	11	1(↓)	0.8828
Finland	5	10	9	19	5(↑)	0.8817
Sweden	6	14	7	12	8(↑)	0.8704
Netherlands	7	5	2	5	2(↓)	0.8659
New Zealand	8	9	13	14	1(↑)	0.8653
Denmark	9	16	4	7	7(↑)	0.8510
France	10	4	6	10	6(↓)	0.8456
Japan	11	6	18	17	5(↓)	0.8440
United States	12	7	5	2	5(↓)	0.8420
Estonia	13	15	20	20	2(↑)	0.8334
Canada	14	11	11	3	3(↓)	0.8285
Germany	15	21	17	15	6(↑)	0.8210
Austria	16	20	21	24	4(↑)	0.8208
Spain	17	12	23	9	5(↓)	0.8135
Norway	18	13	8	6	5(↓)	0.8117
Belgium	19	25	24	16	6(↑)	0.7874
Israel	20	17	16	26	3(↓)	0.7806
Slovenia	21	41	25	29	20(↑)	0.7769
Italy	22	23	32	38	1(↑)	0.7764
Lithuania	23	29	29	28	6(↑)	0.7747
Bahrain	24	18	36	13	6(↓)	0.7734
Luxembourg	25	24	19	25	1(↓)	0.7705

* UN publishes E-Government Development Index biannually.
Source UN, E-government Survey 2016, 2016. 7.

1-2 E-Participation Index and Rankings

(Unit : Point)

Country	Rank					Index (2016)
	2016	2014	2012	2010	Ranking Change	
United Kingdom	1	4	3	4	3(↑)	1.0000
Japan	2	4	6	6	2(↑)	0.9831
Australia	2	7	5	2	5(↑)	0.9831
Republic of Korea	**4**	**1**	**1**	**1**	**3(↓)**	**0.9661**
Netherlands	5	1	1	15	4(↓)	0.9492
New Zealand	5	19	11	4	14(↑)	0.9492
Spain	7	19	14	3	12(↑)	0.9322
Singapore	8	10	2	9	2(↑)	0.9153
Canada	8	14	7	8	6(↑)	0.9153
Italy	8	19	22	55	11(↑)	0.9153
Finland	8	24	6	30	16(↑)	0.9153
France	12	4	11	15	8(↓)	0.8983
United States	12	9	3	6	3(↓)	0.8983
Austria	14	40	42	21	26(↑)	0.8814
Mexico	14	45	25	32	31(↑)	0.8814
Poland	14	65	75	51	51(↑)	0.8814
Israel	17	12	4	30	5(↓)	0.8305
Serbia	17	81	60	135	64(↑)	0.8305
Lithuania	17	33	30	19	16(↑)	0.8305
Montenegro	17	49	48	76	32(↑)	0.8305
Morocco	17	17	17	86	—	0.8305
China	22	33	66	32	11(↑)	0.8136
Denmark	22	54	28	13	32(↑)	0.8136
Estonia	22	22	5	9	—	0.8136
Malta	25	71	56	34	46(↑)	0.7797
Croatia	25	97	53	25	72(↑)	0.7797

* UN publishes E-Participation Index biannually

Source UN, E-government Survey 2016, 2016. 7.

1-3 ICT Development Index and Rankings

(Unit : Point)

Country	Rank							Index (2017)
	2017	2016	2015	2014	2013	2012	Ranking Change	
Iceland	1	2	3	4	3	4	(↑1)	8.98
Republic of Korea	**2**	**1**	**1**	**2**	**1**	**1**	**(↓1)**	**8.85**
Switzerland	3	4	7	13	13	12	(↑1)	8.74
Denmark	4	3	2	1	3	4	(↓1)	8.71
United Kingdom	5	5	4	5	8	11	-	8.65
Hong Kong	6	6	9	9	10	10	-	8.61
Netherlands	7	10	11	11	12	8	(↑3)	8.49
Norway	8	7	5	3	2	2	(↓1)	8.47
Luxembourg	9	9	10	6	6	6	-	8.47
Japan	10	11	6	10	9	9	(↑1)	8.43
Sweden	11	8	8	7	7	7	(↓3)	8.41
Germany	12	13	16	19	16	18	(↑1)	8.39
New Zealand	13	12	14	17	19	17	(↓1)	8.33
Australia	14	16	17	18	18	19	(↑2)	8.24
France	15	17	12	8	5	5	(↑2)	8.24
United States	16	15	15	14	17	16	(↓1)	8.18
Estonia	17	14	13	12	11	15	(↓3)	8.14
Singapore	18	20	19	16	15	14	(↑2)	8.05
Monaco	19	18	20	21	22	25	(↓1)	8.05
Ireland	20	19	18	15	17	-	(↓1)	8.02
Austria	21	24	30	30	24	24	(↑3)	8.02
Finland	22	21	22	26	23	22	(↓1)	7.88
Israel	23	22	21	25	25	23	(↓1)	7.88
Malta	24	25	23	23	20	20	(↑1)	7.86
Belgium	25	23	25	24	21	21	(↑2)	7.81
Macao	26	29	27	27	39	42	(↑3)	7.80
Spain	27	27	28	20	24	-	-	7.79
Cyprus	28	31	-	-	-	-	(↑3)	7.77
Canada	29	26	26	28	27	27	(↓3)	7.77
Andorra	30	28	24	22	14	13	(↓2)	7.71

Source ITU. Measuring the Information Society Report 2016. 2016.11.

1-4 World Competitiveness Index and Ranking

(Unit : Point)

Country	Rank						Index (2017)
	2017	2016	2015	2014	2013	Ranking Change	
Singapore	1	1	1	1	1	-	100.000
Sweden	2	3	5	3	2	(↑1)	95.938
United States	3	2	2	2	3	(↓1)	95.410
Finland	4	6	3	4	4	(↑2)	95.026
Denmark	5	8	8	7	7	(↑3)	94.524
Netherlands	6	4	6	6	5	(↓2)	93.225
Hong Kong	7	11	14	13	9	(↑4)	92.135
Switzerland	8	7	7	5	6	(↓1)	91.998
Canada	9	5	4	8	10	(↓4)	91.671
Norway	10	9	11	9	8	(↓1)	90.790
United Kingdom	11	12	12	12	15	(↑1)	88.943
Taiwan	12	16	15	16	13	(↑4)	87.566
Israel	13	13	10	11	12	-	86.662
New Zealand	14	10	13	18	21	(↓4)	85.238
Australia	15	14	9	10	11	(↓1)	85.006
Austria	16	19	26	24	25	(↑3	84.121
Germany	17	15	17	14	16	(↓2	84.108
UAE	18	25	22	26	24	(↑7)	83.147
Republic of Korea	**19**	**17**	**18**	**21**	**14**	**(↓2)**	**82.961**
Luxembourg	20	21	16	19	18	(↑1)	82.874
Ireland	21	20	25	17	22	(↓1)	82.873
Belgium	22	18	19	25	23	(↓4)	80.771
Iceland	23	26	24	27	26	(↑3)	80.487
Malaysia	24	24	21	15	17	-	79.944
France	25	22	20	22	19	(↓3)	78.810
Estonia	26	27	27	23	27	(↑1)	78.458
Japan	27	23	23	20	20	(↓4)	78.094
Qatar	28	28	32	28	28	-	76.082
Lithuania	29	29	28	32	30	-	75.021
Spain	30	30	30	29	32	-	72.091

Source IMD, World Digital Competitiveness Ranking, 2017.

1-5 5 OUR Data Index and Rankings

(Unit : Point)

Rank	Country	Data Usability	Data Accessibility	Government Support for Data Reuse
1	**Republic of Korea**	**0.32**	**0.29**	**0.33**
2	France	0.28	0.31	0.26
3	Japan	0.30	0.24	0.26
4	United Kingdom	0.28	0.28	0.23
5	Mexico	0.26	0.25	0.28
6	Spain	0.23	0.27	0.27
7	Canada	0.24	0.27	0.18
8	Austria	0.12	0.32	0.24
9	Finland	0.20	0.23	0.24
10	Australia	0.14	0.25	0.27
11	Netherlands	0.23	0.24	0.18
12	United States	0.25	0.21	0.18
13	New Zealand	0.20	0.27	0.12
14	Norway	0.21	0.24	0.11
15	Greece	0.20	0.22	0.12
16	Ireland	0.17	0.21	0.15
17	Israel	0.20	0.20	0.13
18	Italy	0.19	0.23	0.10
19	Slovenia	0.17	0.17	0.14
20	Poland	0.11	0.21	0.16
21	Belgium	0.20	0.17	0.10
22	Estonia	0.14	0.26	0.05
23	Czech Republic	0.18	0.17	0.10
24	Switzerland	0.09	0.18	0.16
25	Germany	0.14	0.18	0.08
26	Slovakia	0.14	0.17	0.08
27	Portugal	0.11	0.20	0.08
28	Sweden	0.13	0.09	0.09
29	Chile	0.09	0.19	0.03
30	Libya	0.07	0.06	0.00
	OECD	0.18	0.22	0.15

Source OECD, Government at a Glance 2017, 2017.6.

1-6 Networked Readiness Index and Rankings

(Unit : Point)

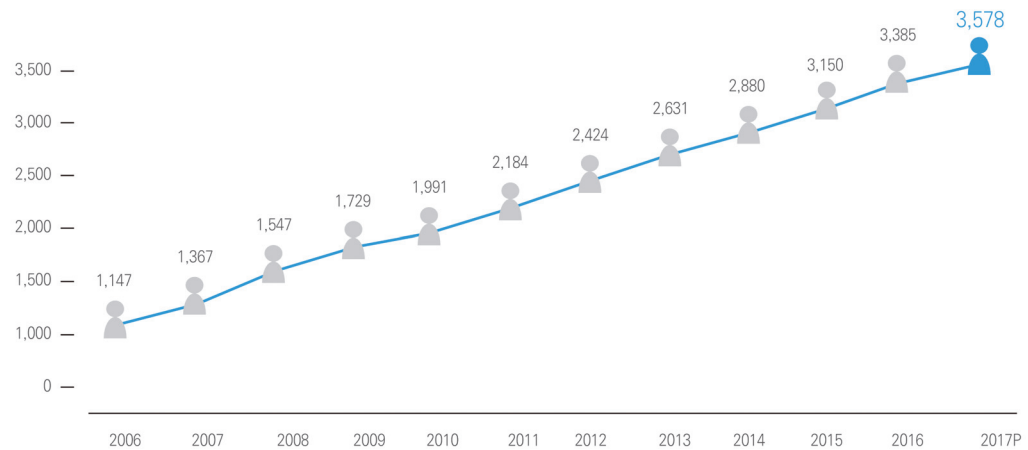
Country	Rank						Overall Index 2016	Subindex												
								Environment			Readiness				Usage				Impact		
	2016	2015	2014	2013	2012	Remark			Politics/ Regulations	Business/ Innovation	Infrastructure/ Digital Contents	Affordability	Skills		Individual	Business	Government		Economic	Social
Singapore	1	1	2	2	2		6.0	6.0	5.9	6.0	6.1	6.6	5.3	6.5	6.0	6.4	5.4	6.3	6.1	5.9	6.2
Finland	2	2	1	1	3		6.0	5.6	5.8	5.4	6.6	7.0	6.4	6.5	5.8	6.6	5.8	5.0	5.8	6.1	5.5
Sweden	3	3	3	3	1		5.8	5.3	5.5	5.2	6.3	7.0	6.2	5.8	5.9	6.7	6.0	5.0	5.8	6.1	5.6
Norway	4	5	5	5	7		5.8	5.5	5.8	5.4	6.4	7.0	6.1	6.0	5.8	6.2	5.9	5.4	5.6	5.4	5.7
United States	5	7	7	9	8		5.8	5.2	5.1	5.4	6.4	7.0	6.4	5.8	5.8	6.2	5.9	5.4	5.8	5.8	5.7
Netherlands	6	4	4	4	6		5.8	5.5	5.6	5.4	5.9	6.4	5.0	6.2	5.9	6.6	5.8	5.4	6.0	5.8	6.1
Switzerland	7	6	6	6	5		5.8	5.5	5.6	5.4	6.2	6.8	5.4	6.4	5.7	6.6	6.1	4.5	5.6	6.1	5.0
United Kingdom	8	8	9	7	10		5.7	5.6	5.7	5.5	5.9	6.3	5.7	5.8	5.7	6.6	5.2	5.4	5.6	5.3	5.9
Luxembourg	9	9	11	16	21		5.7	5.5	5.9	5.0	5.9	6.0	6.0	5.9	5.9	6.8	5.4	5.4	5.4	5.4	5.3
Japan	10	10	16	21	18		5.6	5.2	5.5	4.9	6.1	6.6	5.8	6.0	5.9	6.4	5.9	5.4	5.3	5.1	5.5
Denmark	11	15	13	8	4		5.6	5.3	5.3	5.3	6.1	6.4	6.1	5.9	5.8	6.9	5.7	4.7	5.2	5.1	5.3
Hong Kong	12	14	8	14	13		5.6	5.6	5.4	5.8	6.2	6.0	6.4	6.1	5.3	6.3	4.9	4.7	5.3	5.2	5.5
Republic of Korea	**13**	**12**	**10**	**11**	**12**		**5.6**	**4.7**	**4.3**	**5.1**	**6.1**	**7.0**	**5.8**	**5.6**	**5.8**	**6.5**	**5.4**	**5.6**	**5.6**	**5.1**	**6.0**
Canada	14	11	17	12	9		5.6	5.4	5.4	5.5	6.2	7.0	5.6	6.1	5.2	5.7	4.9	5.1	5.4	5.2	5.6
Germany	15	13	12	13	16		5.6	5.2	5.4	5.0	6.1	6.6	5.6	6.1	5.6	6.2	5.8	4.8	5.3	5.4	5.2
Iceland	16	19	19	17	15		5.5	5.2	5.1	5.3	6.4	7.0	6.3	6.0	5.5	6.6	5.1	4.7	5.1	4.8	5.4
New Zealand	17	17	20	20	14		5.5	5.6	5.9	5.4	5.9	6.8	4.6	6.2	5.5	6.1	5.0	5.4	5.0	4.6	5.4
Australia	18	16	18	18	17		5.5	5.2	5.4	5.1	6.2	7.0	5.6	6.0	5.4	6.3	4.8	5.0	5.2	4.7	5.7
Taiwan	19	18	14	10	11		5.5	4.8	4.2	5.3	6.4	7.0	6.5	5.8	5.5	6.0	5.5	5.0	5.2	5.0	5.4
Austria	20	20	22	19	19		5.4	5.0	5.2	4.7	6.3	6.6	6.7	5.7	5.4	5.9	5.6	4.8	5.0	4.9	5.2
Israel	21	21	15	15	-		5.4	5.0	4.7	5.4	5.5	5.5	5.5	5.5	5.5	5.6	5.8	5.3	5.7	5.9	5.5
Estonia	22	22	21	22	24		5.4	5.0	5.0	5.1	6.0	6.5	5.6	5.9	5.4	6.3	4.4	5.4	5.2	4.6	5.9
UAE	23	23	24	25	30		5.4	5.2	5.1	5.4	5.0	5.9	3.4	5.8	5.6	6.2	4.6	6.2	5.2	4.3	6.1
Ireland	24	25	26	27	25		5.3	5.4	5.5	5.4	5.7	6.0	5.2	6.1	5.2	5.9	4.9	4.9	5.0	5.0	5.0
Belgium	25	24	27	24	22		5.3	5.1	5.2	5.1	6.1	6.4	5.5	6.4	5.2	6.0	5.2	4.6	5.0	4.9	5.1

Source WEF. The Global Information Technology Report 2016. 2016.7.

2. Internet

2-1 Worldwide Internet Users

(Unit : Million persons)



Source ITU, ITU Statistics, 2017.
http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

2-2 OECD Fixed broadband subscriptions

(Unit : Person)

Rank	Country	No. of Subscribers Per 100 Persons							Total No. of Subscribers
		DSL	Cable	Fibre	Satellite	Fixed wireless	Other	Total	
1	Switzerland	25.0	14.8	9.6	0.2	0.0	0.6	50.1	4,198,150
2	Denmark	18.3	12.8	11.0	0.0	0.3	0.0	42.4	2,430,002
3	Netherlands	16.5	19.4	6.0	0.0	0.0	0.0	41.9	7,135,000
4	France	32.5	5.2	3.3	0.0	0.5	0.0	41.4	27,683,000
5	Norway	12.0	12.2	15.5	0.1	0.8	0.0	40.5	2,120,360
6	**Republic of Korea**	**2.3**	**8.1**	**30.0**	**0.0**	**0.0**	**0.0**	**40.4**	**20,555,683**
7	Germany	29.1	8.7	0.7	0.0	0.0	0.0	38.6	31,867,148
8	United Kingdom	30.9	7.5	0.0	0.0	0.1	0.0	38.5	25,250,011
9	Iceland	25.2	0.0	12.6	0.0	0.2	0.0	38.1	128,023
10	Belgium	18.3	19.4	0.1	0.0	0.0	0.1	37.8	4,265,026
11	Sweden	9.7	6.8	20.4	0.0	0.1	0.1	37.1	3,679,768
12	Canada	12.2	19.4	3.7	0.0	1.5	0.0	36.8	13,347,882
13	Luxembourg	23.9	3.7	7.0	0.0	0.0	0.2	34.8	203,100
14	Greece	33.4	0.0	0.1	0.1	0.0	0.0	33.5	3,616,705
15	New Zealand	23.0	1.4	7.0	0.1	1.5	0.0	32.9	1,554,206
16	United States	8.2	19.7	3.7	0.6	0.4	0.2	32.8	106,327,000
17	Portugal	8.9	10.8	10.5	0.0	2.4	0.0	32.7	3,372,571
18	Finland	13.7	7.5	9.6	0.0	0.1	0.3	31.2	1,712,000
19	Japan	2.3	5.4	22.9	0.0	0.0	0.0	30.6	38,743,212
20	Spain	13.6	5.8	10.7	0.1	0.4	0.0	30.5	14,163,442
21	Australia	19.3	4.3	5.8	0.3	0.4	0.0	30.1	7,374,000
22	Estonia	10.5	7.1	10.5	0.0	0.6	0.5	29.2	384,787
23	Ireland	19.9	7.8	0.2	0.1	1.0	0.0	29.0	1,360,309
24	Czech Republic	8.6	5.3	4.9	0.0	9.9	0.0	28.8	3,038,394
25	Austria	18.5	9.4	0.5	0.0	0.3	0.0	28.7	2,510,500
26	Hungary	8.0	14.0	5.3	0.0	1.3	0.0	28.7	2,814,523
27	Slovenia	11.3	8.5	8.0	0.0	0.3	0.1	28.3	583,540
28	Israel	18.2	8.2	0.0	0.0	0.0	0.0	26.5	2,263,051
29	Latvia	6.6	0.9	16.6	0.0	0.6	1.7	26.5	519,154
30	Italy	20.1	0.0	0.8	0.0	1.4	3.4	25.7	15,563,279
31	Slovakia	9.0	3.0	7.0	0.0	5.4	0.1	24.6	1,336,541
32	Poland	6.5	7.0	1.5	0.0	2.1	1.2	18.3	7,042,470
33	Chile	5.1	8.6	1.1	0.0	0.1	1.1	15.9	2,904,580
34	Turkey	9.9	0.9	2.5	0.0	0.0	0.1	13.4	10,499,692
35	Mexico	6.3	4.6	2.1	0.0	0.2	0.1	13.3	16,277,627
OECD Average		12.9	9.8	6.4	0.2	0.5	0.3	30.1	386,824,736

Source OECD,OECD Broadband Potal,2016.12.
www.oecd.org/internet/broadband/oecdbroadbandportal.htm

2-3 OECD Mobile broadband subscriptions

(Unit : Person)

Rank	Country	No. of Subscribers Per 100 Persons				Total No. of Subscribers
		Data and voice subscriptions	Data-only subscriptions	Total (where breakdown not available)	Total	
1	Japan	95.3	57.1		152.4	193,237,268
2	Finland	108.3	38.6		146.9	8,070,000
3	Australia	104.0	24.9		128.8	31,544,000
4	United States			126.3	126.3	409,173,000
5	Denmark	100.0	23.2		123.2	7,058,216
6	Sweden	101.4	21.0		122.3	12,140,358
7	Estonia	67.4	54.8		122.2	1,607,838
8	**Republic of Korea**	**108.4**	**1.2**		**109.6**	**55,713,362**
9	Iceland	71.5	33.8		105.3	353,903
10	New Zealand	29.0	75.1		104.2	4,916,375
11	Ireland	92.7	7.6		100.3	4,697,555
12	Switzerland	90.8	7.4		98.2	8,221,700
13	Norway	87.7	8.6		96.2	5,038,159
14	United Kingdom	81.9	7.6		89.5	58,706,343
15	Spain	85.6	3.6		89.2	41,471,985
16	Netherlands	81.2	6.9		88.2	15,017,000
17	Italy	74.6	13.0		87.6	53,076,750
18	Austria	53.3	33.5		86.8	7,585,400
19	Luxembourg	75.1	7.5		82.6	482,000
20	Czech Republic	71.6	9.2		80.8	8,534,191
21	France	74.4	5.4		79.8	53,361,000
22	Poland	60.1	19.3		79.4	30,499,198
23	Latvia	62.8	16.5		79.3	1,555,566
24	Slovakia	68.7	10.5		79.2	4,300,524
25	Germany	71.6	4.9		76.5	63,094,865
26	Chile	66.7	4.0		70.7	12,914,417
27	Israel			68.9	68.9	5,886,054
28	Canada	63.3	5.6		68.8	24,973,809
29	Belgium	61.0	5.4		66.4	7,480,397
30	Turkey	64.5	1.6		66.1	51,736,914
31	Portugal	57.3	5.5		62.7	6,477,160
32	Slovenia	58.5	4.2		62.7	1,294,534
33	Mexico	60.4	0.5		60.9	74,512,528
34	Greece	48.8	4.2		52.9	5,709,261
35	Hungary	40.8	4.0		44.8	4,397,417
OECD Average				99.3	99.3	1,274,839,047

Source OECD, OECD Broadband Potal,2016.12.
www.oecd.org/internet/broadband/oecdbroadbandportal.htm

2-4 Top 10 Countries with IPv4 Addresses (Unit : EA)

Rank	Country	No. of IPv4 Addresses
1	United States	1,612,962,304
2	China	338,095,616
3	Japan	203,255,552
4	United Kingdom	121,967,128
5	Germany	119,350,144
6	**Republic of Korea**	**112,427,008**
7	Brazil	82,959,104
8	France	80,228,400
9	Canada	70,268,160
10	Italy	54,014,272
Total		2,795,551,496

Note : As of November 2016
Source KISA, ISIS (Internet Statistics System), 2017

2-5 Top 10 Countries with IPv6 Addresses (Unit : EA)

Rank	Country	No. of IPv6 Addresses
1	United States	42,626
2	China	21,134
3	Germany	15,936
4	United Kingdom	14,882
5	France	11,354
6	Japan	9,413
7	Australia	8,856
8	Italy	7,087
9	EU	6,343
10	**Republic of Korea**	**5,251**
Total		142,882

Note: As of November 2016
Source KISA, ISIS (Internet Statistics System), 2017

2-6 AS Numbers by Country (Unit : EA)

Rank	Country	No. of AS Numbers
1	United States	25,627
2	Russia	5,961
3	Brazil	5,307
4	United Kingdom	2,484
5	Poland	2,395
6	Australia	2,297
7	Germany	2,296
8	Ukraine	2,092
9	India	2,092
10	Canada	1,978
11	China	1,351
Other Countries		29,369
Special Purpose		1,023
* Not allocated		4,294,883,024

Note: As of November 2016
Source KISA, ISIS (Internet Statistics System), 2017.

2-7 ccTLD Addresses in Major OECD Countries (Unit : EA)

Rank	Country	TLD	1Q 2017
1	Germany	.de	16,122,229
2	United Kingdom	.uk	10,012,729
3	Netherlands	.nl	5,684,155
4	Australia	.au	3,078,080
5	Italy	.it	2,965,450
6	France	.fr	2,877,051
7	Poland	.pl	2,703,816
8	Canada	.ca	2,551,966
9	United States	.us	2,325,191
10	Switzerland	.ch	2,034,509
11	Spain	.es	1,841,237
12	Belgium	.be	1,557,443
13	Japan	.jp	1,454,636
14	Sweden	.se	1,447,751
15	Denmark	.dk	1,331,404
16	Czech Republic	.cz	1,282,790
17	Austria	.at	1,271,509
18	**Republic of Korea**	**.kr**	**1,086,355**
19	Mexico	.mx	818,540

Source KISA, ISIS (Internet Statistics System), 2017.

Domestic Data

1. Internet

1-1 Broadband Internet Subscribers

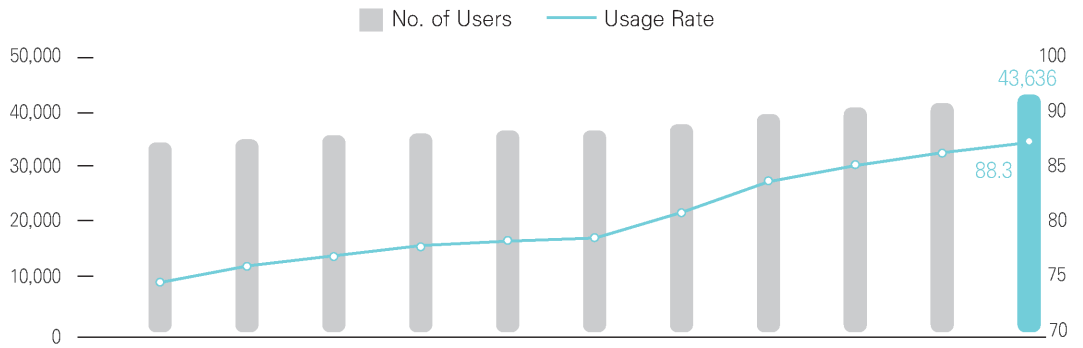
(Unit: persons)

Provider	2010	2011	2012	2013	2014	2015	2016	2017.7
KT	7,423,607	7,822,844	8,036,639	8,066,628	8,129,482	8,328,419	8,516,496	8,665,250
SK Broadband	3,599,169	3,293,524	3,068,041	2,842,115	2,749,600	2,691,735	2,672,905	2,743,380
SKT (Resale)	402,738	898368	1,326,082	1,726,990	2,060,893	2,344,322	2,534,590	2,621,546
LGU+	2,773,468	2,809,690	2,743,151	2,928,157	3,014,196	3,483,244	3,611,199	3,736,106
Cable TV System Operators	2,826,497	2,857,414	2,960,554	3,060,328	3,157,512	3,110,211	3,160,330	3,186,687
Others	198,594	177,682	118,194	113,296	87,251	66,488	60,163	52,673
Total	**17,224,073**	**17,859,522**	**18,252,661**	**18,737,514**	**19,198,934**	**20,024,419**	**20,555,683**	**20,995,642**

Note: As of December every year
Source MSIT, 'Status of Wired/Wireless Telecommunication Service Statistics', 2017.7.

1-2 Internet Users and Usage Rate

(Unit: 1,000 persons, %)



Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No. of Users (aged 3 or older)	34,910	35,590	36,190	36,580	37,010	37,180	38,120	40,080	41,118	41,940	**43,636**
Usage Rate	74.1	75.5	76.5	77.2	77.8	78.0	78.4	82.1	83.6	85.1	**88.3**

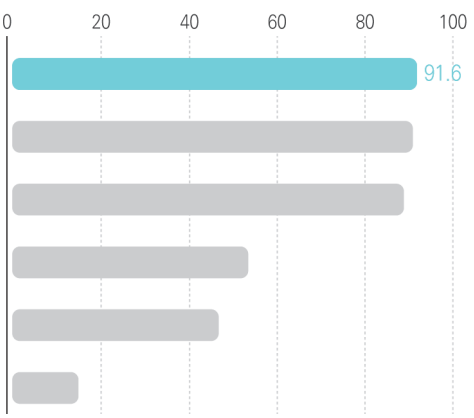
Note: 1) Wireless Internet users on mobile communication networks were also included from the 2004 survey, and the definition of 'Internet users' was changed from 'people using the Internet once a month or more on average' to 'those who had used the Internet at least once during the last one month period'.
2) The scope of the survey was extended to Internet users aged 3 and above in 2006. (Internet users aged 7 and above [2001~2001] and aged 6 and above [2002~2005]).

Source MSIT/KISA, 2016 Status Survey on Internet Use, 2016.12.

1-3 Purpose of Using the Internet

(Unit: %)

Purpose	Multiple Response
Communication (email, SNS, chatting, Internet phone, etc.)	**91.6**
web radio, web TV, online game, etc.	89.1
Obtaining information	86.1
Website operation	47.2
Education/ Learning (online education, learning through Wikipedia)	43.6
Job/ Work (job search, online participation for work)	17.6

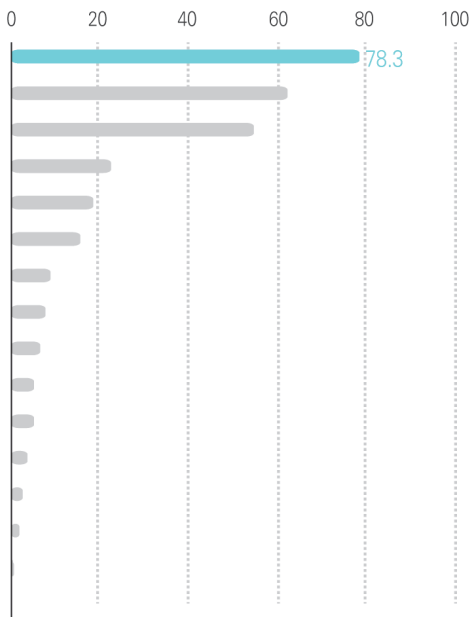


Source MSIT/KISA, 2016 Status Survey on Internet Use, 2016.12.

1-4 Smart Phone Application Use

(Unit: %)

Type	Usage Rate
Communication (chatting, SNS)	**78.3**
Photo and video	62.2
News	54.4
Game	22.7
Music and media	18.7
Navigation and map	16.2
Shopping	8.9
Local information (restaurants)	7.8
Weather information (weather,	6.7
Knowledge (dictionary, encyclopedia)	5.2
Public transport information (bus, rail, air)	5.2
Health and sports	3.7
Productivity (memo, calendar)	2.7
E-book, reading, webtoon	2.0
Travel (hotel booking)	0.5
Others	0.1

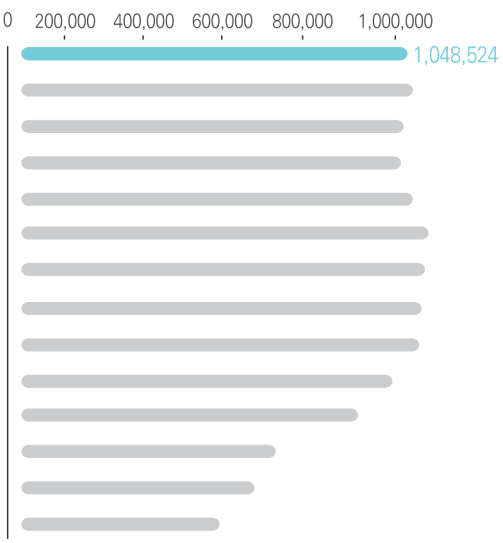


Source MSIT/KISA, 2016 Status Survey on Internet Use, 2016.12.

1-5 .kr Domains

(Unit: EA)

Year	No. of Domains
2017	**1,048,524**
2016	1,049,445
2015	1,033,152
2014	1,031,455
2013	1,049,661
2012	1,094,431
2011	1,088,468
2010	1,076,899
2009	1,064,179
2008	1,001,206
2007	930,485
2006	705,775
2005	642,770
2004	557,340

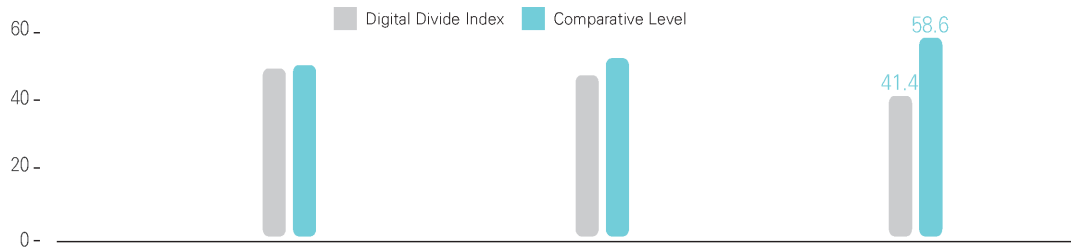


Source KISA, ISIS (Internet Statistics System), 2017

2. Digital Divide and Overdependence on the Internet

2-1 Digital Divide Index in the Disadvantaged Groups

(Unit : Points, %)



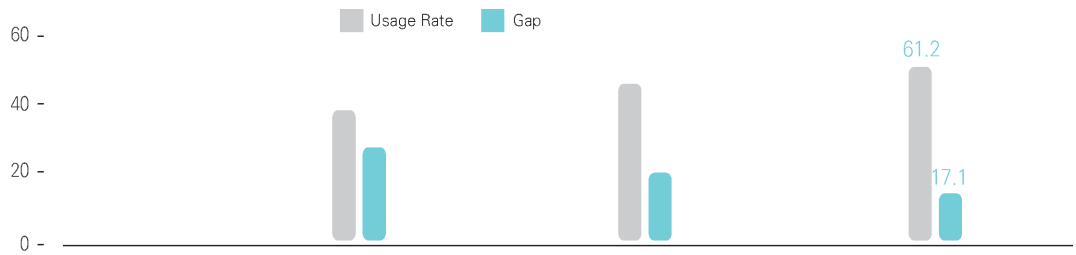
Type	2014		2015		2016	
	Index	Level	Index	Level	Index	Level
Accessibility	27.7	72.3	26.3	73.7	**15.5**	**84.5**
Capacity	65.4	34.6	62.6	37.4	**54.8**	**45.2**
Utilization	52.3	47.7	48.4	51.6	**41.0**	**59.0**
Total	49.9	50.1	47.6	52.4	**41.4**	**58.6**

Note: 1) Divide Index = Informatization level of the general public (100) subtracted by informatization level of the socially disadvantaged groups; The Index value ranges from 0 to 100, where the closer to 100, larger the gap.
2) Digital Divide survey started in 2016 (when the Information Divide survey discontinued)

Source NIA, 2016 Digital Divide Status Survey, 2016.12.

2-2 Smart Phone Penetration Rate in the Disadvantaged Groups

(Unit : %, %P)



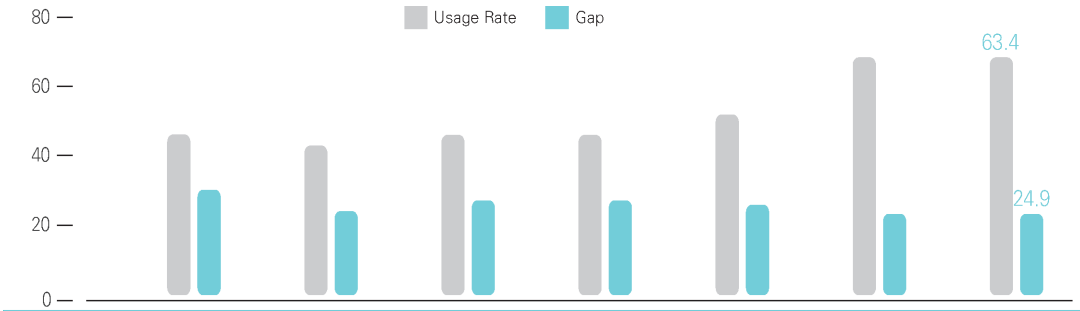
Type		2014		2015		2016	
		Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap
Total Population		78.3	-	82.5	-	**85.0**	-
Socially Disadvantaged Groups	Disabled	51.3	27.0	62.6	15.7	**66.8**	**11.5**
	Elderly	40.6	37.7	49.3	29.0	**57.2**	**21.1**
	Low-income	61.6	16.7	70.6	7.7	**73.1**	**5.2**
	Farmers/Fishermen	44.8	33.5	54.3	24.0	**59.6**	**18.7**
	Average	45.5	32.8	54.9	23.4	**61.2**	**17.1**

Note: 1) 'Gap represents the difference in the mobile penetration rates between the total population and the socially disadvantaged groups. 'Average' is weighted by the size of each disadvantaged group.
2) Based on Internet usage rate of total population published by KISA.
3) The reference age of the elderly group is changed from 50 to 55 from 2016.

Source NIA, 2016 Digital Divide Status Survey, 2016.12.

2-3 Internet Usage Rate in the Socially Disadvantaged Groups

(Unit : %, %P)



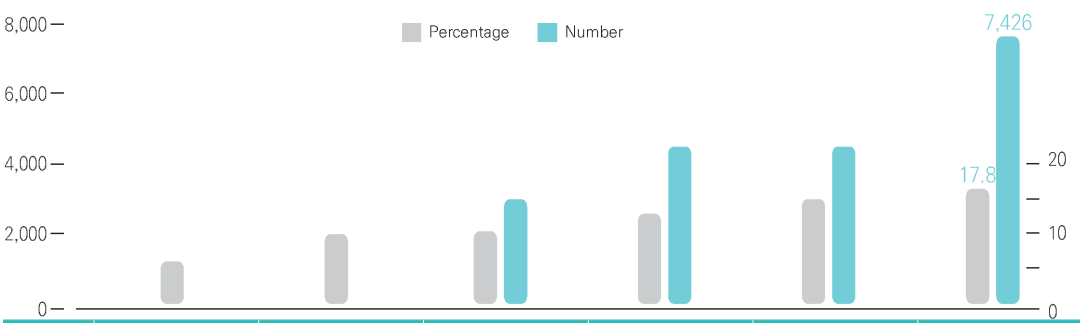
Type		2010		2011		2012		2013		2014		2015		2016	
		Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap	Usage Rate	Gap
Total Population		78.3	-	78.3	-	78.7	-	82.1	-	83.6	-	85.1	-	**88.3**	-
Socially Disadvantaged Group	Disabled	53.5	24.8	54.4	23.9	55.5	23.2	56.7	25.4	59.1	24.5	66.8	18.3	**70.6**	**17.7**
	Elderly	39.3	39.0	41.4	37.2	42.6	36.1	48.5	33.6	54.1	29.5	61.7	23.4	**59.3**	**29.0**
	Low-income	56.5	21.8	57.4	20.9	58.5	20.2	60.4	21.7	64.2	19.4	73.7	11.4	**76.0**	**12.3**
	Farmers/ Fishermen	37.5	40.8	38.9	39.4	40.2	38.5	42.2	39.9	47.1	36.5	56.2	28.9	**59.9**	**28.4**
	Average	44.3	34.0	45.6	32.7	46.8	31.9	50.8	31.3	55.4	28.2	63.6	21.5	**63.4**	**24.9**

Note: 1) 'Gap represents the difference in the Internet usage rates between the total population and the socially disadvantaged groups. 'Average' is weighted by the size of each disadvantaged group.
2) Based on Internet usage rate of total population published by KISA.

Source NIA, 2016 Digital Divide Status Survey, 2016.12.

2-4 Percentage and Number of Risk Groups in Overdependence on the Internet (or Smart Phone)

(Unit : %, 1,000 Persons)



Group	2011		2012		2013		2014		2015		2016	
	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Total	**8.4**	-	**11.1**	-	**11.8**	**2,998**	**14.2**	**4,561**	**16.2**	**5,810**	**17.8**	**7,426**
Children	-	-	-	-	-	-	-	-	12.4	127	17.9	591
Teens	11.4	-	18.4	-	25.5	1,117	29.2	1,562	31.6	1,704	30.6	1,649
Adults	7.9	-	9.1	-	8.9	1,881	11.3	2,999	13.5	3,979	16.1	4,826
60s	-	-	-	-	-	-	-	-	-	-	11.7	360

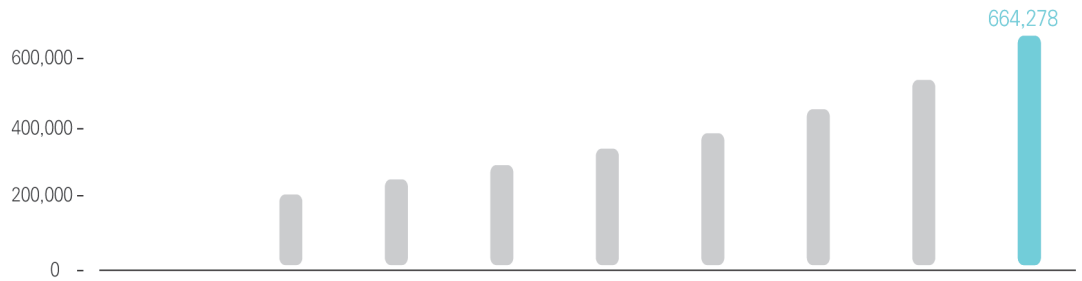
Note: The number of Internet (smart phone) users (population) of each group is 3,303K for children, 5,394K for teens, 59,977K for adults, and 3,086K for the 60s.

Source NIA, 2016 Digital Divide Status Survey, 2016.12.

3. E-Commerce

3-1 Online and Mobile Shopping

(Unit: KRW 100M, %)

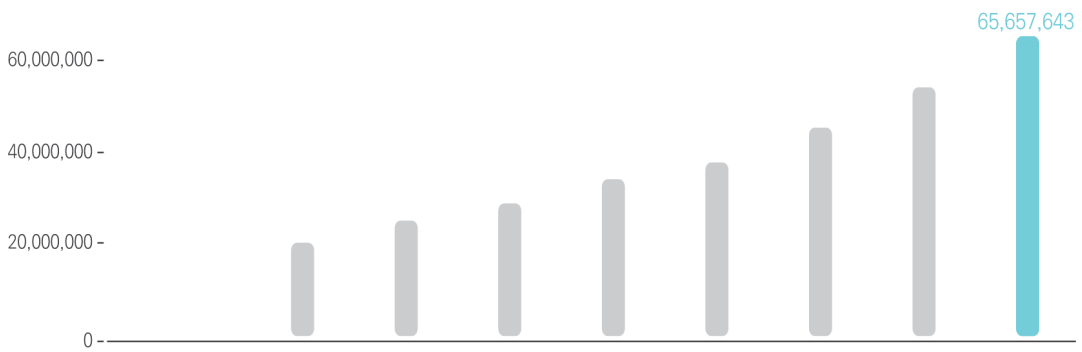


Type		2009	2010	2011	2012	2013	2014	2015	2016
Online Shopping	Total Transaction	206,430	252,030	290,720	340,680	384,980	453,020	538,887	**664,278**
	Mobile Transaction	-	-	-	-	65,600	148,700	244,645	**323,948**
% to the previous year		13.8	22.1	15.4	17.2	13	17.7	19.0	**21.6**

Source Statistics Korea, January 2017 Online Shopping Trend, 2017.3.

3-2 Cyber Shopping Mall Transaction Volume

(Unit: KRW 1M)

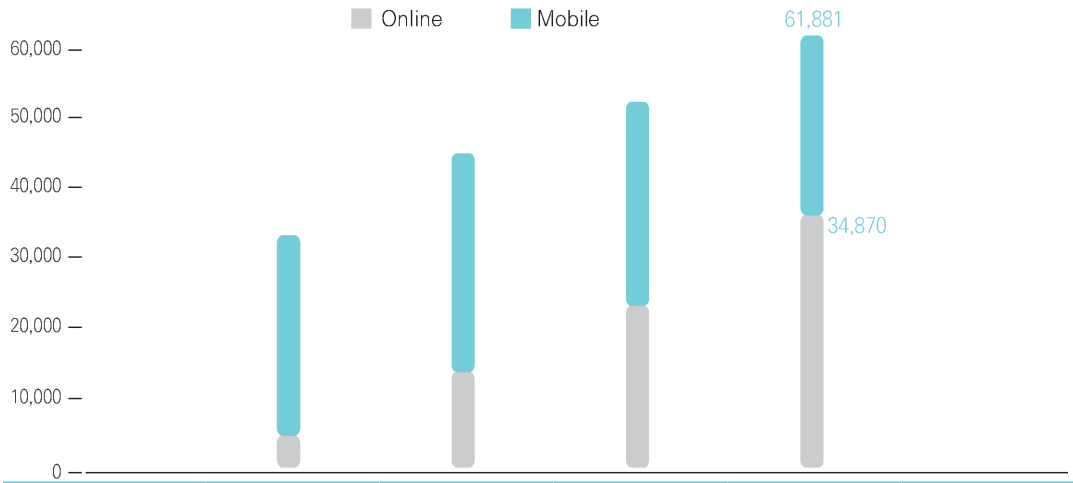


Type		2009	2010	2011	2012	2013	2014	2015	2016
Total Transaction		20,642,979	25,202,992	29,072,463	34,068,139	38,494,203	45,302,487	54,055,617	**65,657,643**
Coverage of Goods	General Malls	15,444,725	19,041,708	21,835,828	25,858,234	29,803,602	34,788,971	41,828,32	**51,460,005**
	Specialized Malls	5,198,254	6,161,284	7,236,635	8,209,905	8,690,601	10,513,516	12,227,292	**14,197,638**
Operation Type	Online-only Malls	14,005,549	16,960,836	18,991,029	22,130,632	24,623,810	28,678,572	34,471,859	**40,407,163**
	On-Offline Hybrid Malls	6,637,430	8,242,156	10,081,434	11,937,507	13,870,393	16,623,915	19,583,757	**25,250,483**

Source Statistics Korea, January 2017 Online Shopping Trend, 2017.3.

3-3 Online Shopping Volume by Category of Goods

(Unit: KRW 100M, %)

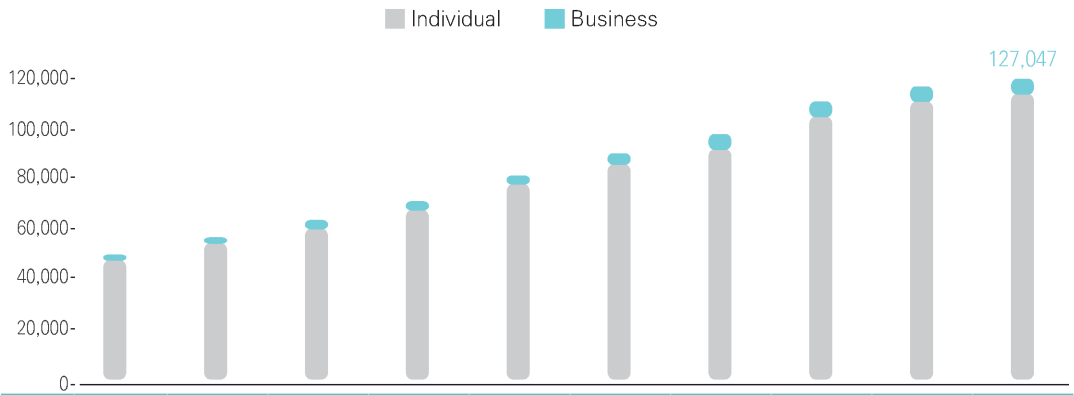


Category	2013		2014		2015		2016		Growth (%)	
	Online	Mobile	Online	Mobile	Online	Mobile	Online	Mobile	Online	Mobile
Total Volume	**38,498**	**6,560**	**45,302**	**14,870**	**53,934**	**24,427**	**61,881**	**34,870**	**15.4**	**30.2**
Computer and peripherals	3,084	-	3,414	498	3,605	870	3,898	1,162	14.6	35.7
Home appliances, electronics and communication appliances	4,105	-	4,962	1,356	5,880	2,235	6,507	3,075	11.8	28.7
Software	60	-	58	5	60	8	72	16	25.5	32.0
Books	1,196	-	1,280	221	1,151	279	1,305	404	8.0	14.8
Office supplies and stationery	515	-	471	62	460	108	550	178	16.9	40.0
Music CDs, video, and musical instruments	153	-	163	32	169	54	237	97	19.7	20.7
Clothes	6,281	-	5,111	2,088	5,839	3,225	7,039	4,638	10.0	23.6
Shoes	-	-	847	339	940	511	977	665	6.8	24.8
Bags	-	-	622	217	785	401	1,017	691	23.1	47.2
Fashion and accessories	-	-	766	280	899	461	1,216	783	26.8	43.9
Sports and leisure supplies	1,639	-	1,899	591	2,088	891	2,117	1,141	4.7	20.7
Cosmetics	2,100	-	2,669	1,038	3,527	1,902	5,136	3,452	31.9	54.2
Supplies for children or infants	1,947	-	2,227	1,012	2,709	1,616	3,050	2,132	4.6	16.5
Food and food materials	3,289	-	3,611	1,299	4,844	2,497	5,794	3,681	31.2	48.2
Farm or fishery product	1,132	-	1,171	345	1,443	657	1,550	922	27.6	45.3
Life and automobile supplies	4,279	-	4,056	1,505	5,372	2,739	6,352	4,041	21.0	38.9
Furniture	-	-	1,119	313	1,295	510	1,586	771	30.2	41.4
Pet supplies	-	-	198	64	260	130	310	201	24.6	45.7
Travel and reservation service	6,419	-	8,383	2,724	9,969	3,901	10,275	4,994	10.0	17.8
Various services and others	2,300	-	2,276	879	2,637	1,430	2,895	1,826	2.2	7.0

Source Statistics Korea, January 2017 Online Shopping Trend, 2017.3.

3-4 Internet Banking Service Registered Customers

(Unit: 1,000 persons or businesses)



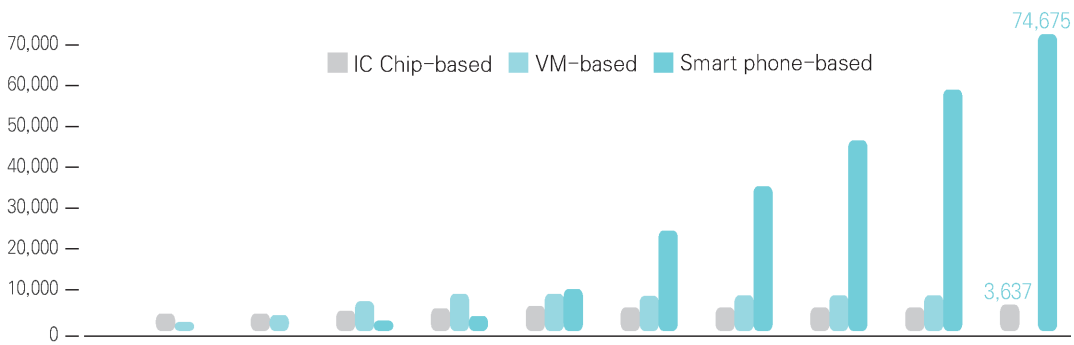
Type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017.6
Individuals	49,912	56,047	62,952	70,625	81,384	89,788	96,825	109,760	114,755	**118,859**
Businesses	2,683	3,159	3,550	4,192	5,046	5,704	6,363	7,093	7,783	**8,188**
Total	52,595	59,206	66,502	74,817	86,430	95,492	103,188	116,853	122,538	**127,047**

Note: 1) Customers registered as of each year-end.

Source Bank of Korea, 2016 Domestic Internet Banking Service Use, 2017.2.
Bank of Korea, 2017-2Q Domestic Internet Banking Service Use, 2017.8.

3-5 Mobile Banking Service Registered Customers

(Unit: 1,000 persons)



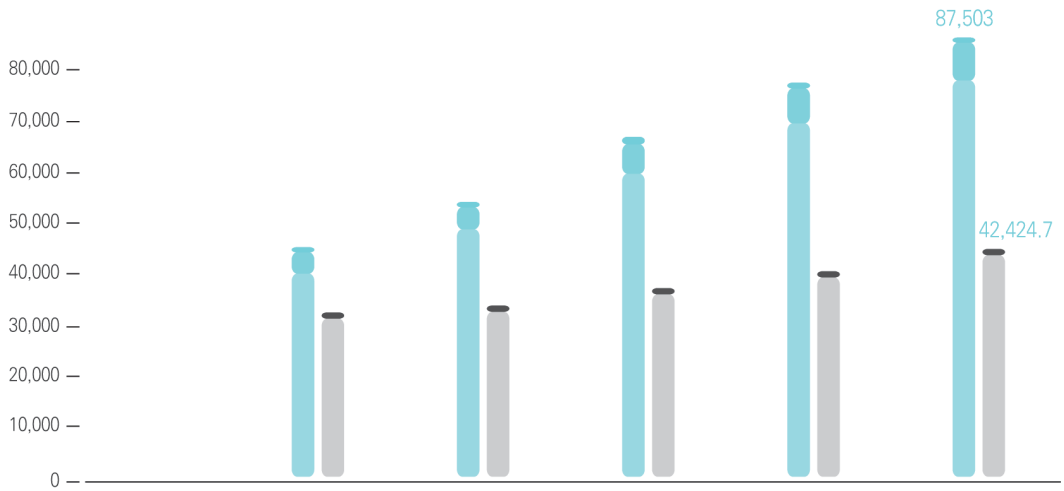
구분	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
IC chip-based	4,412	4,694	4,627	4,579	4,434	4,376	4,328	3,645	3,622	**3,687**
VM-based	597	3,783	6,528	8,561	8,928	8,749	8,421	8,260	8,149	
Smartphone-based	-	-	13	2,609	10,358	23,966	37,185	48,203	64,791	**74,675**
Total	5,009	8,477	1,168	15,748	23,720	37,092	49,934	60,107	76,561	**78,362**

Note: 1) Customers registered as of each year-end.
2) IC chip-based and VM-based service closed in September 2016 and at the end of 2015.

Source Bank of Korea, 2016 Domestic Internet Banking Service Use, 2017.2.

3-6 Internet Banking Service Use (Daily Average)

(Unit: 1,000 Cases, KRW 1B, %)



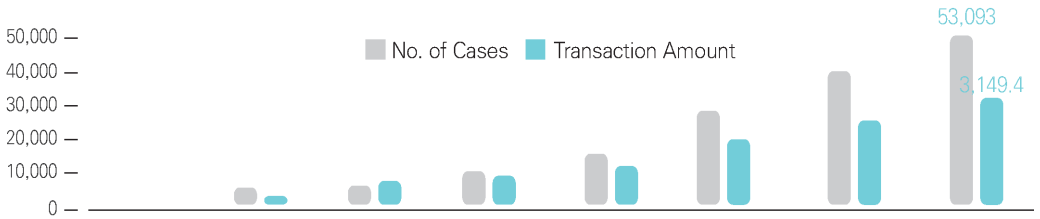
Type	2012	2013	2014	2015	2016
No. of Cases	45,728 (17.2)	54,285 (18.7)	66,437 (22.4)	78,022 (17.4)	**87,503** **(12.2)**
■ Viewing Service	40,473 (18.1) 〈88.5〉	48,378 (19.5) 〈89.1〉	60,102 (24.2) 〈90.5〉	70,967 (18.1) 〈91.0〉	**79,256** **(11.7)** **〈90.6〉**
■ Fund Transfer	5,253 (10.8) 〈11.5〉	5,906 (12.4) 〈10.9〉	6,333 (7.2) 〈9.5〉	7,053 (11.4) 〈9.0〉	**8,245** **(16.9)** **〈9.4〉**
■ Loan Application	1.7 (14.9) 〈0.0〉	1.7 (2.7) 〈0.0〉	1.6 (-3.3) 〈0.0〉	1.9 (17.0) 〈0.0〉	**2.5** **(27.8)** **〈0.0〉**
Transaction Amount	33,234.0 (4.1)	33,659.7 (1.3)	36,853.7 (9.5)	40,286.9 (9.3)	**42,424.7** **(5.3)**
■ Fund Transfer	33,223.9 (4.2)	33,647.3 (1.3)	36,839.3 (9.5)	40,249.6 (9.3)	**42,384.6** **(5.3)**
■ Loan Application	10.1 (-58.9)	12.3 (21.6)	14.5 (17.1)	37.3 (158.1)	**40.0** **(7.3)**

Note: 1) Excluding electronically-processed secured receivable loans and corporate procurement loans.
2) The 2014 figures were revised to reflect data corrections by some banks.
3) Figures in ( ) show growth rate from the previous year; Figures in 〈 〉 show ratio of Internet banking to total transactions.

Source Bank of Korea, 2016 Domestic Internet Banking Service Use, 2017.2

3-7 Mobile Banking Service Use (Daily Average)

(Unit: 1,000 cases, KRW 1B, %)



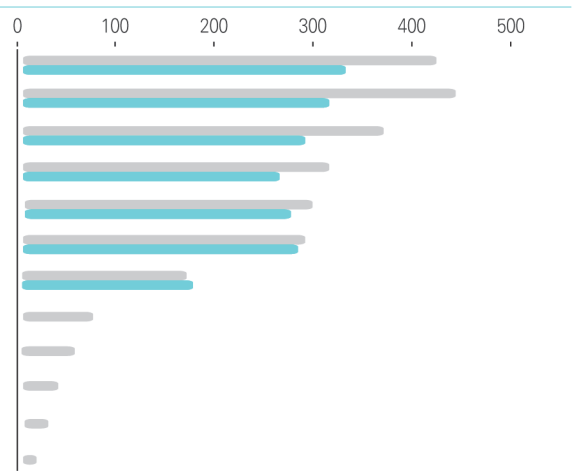
Type	2010	2011	2012	2013	2014	2015	2016
No. of Cases	7,697 (106.0)	7,697 (106.0)	12,946 (68.2)	21,583 (66.7)	31,158 (44.4)	42,393 (36.1)	**53,093** **(25.2)**
Smart Phone Banking	5,910 (551.6)	5,910 (551.6)	12,792 (116.4)	21,303 (66.5)	30,985 (45.5)	42,220 (36.3)	**52,897** **(25.3)**
Viewing Service	6,931 (107.9) 〈90.0〉	6,931 (107.9) 〈90.0〉	11,618 (67.6) 〈89.7〉	19,573 (68.5) 〈90.7〉	28,447 (45.3) 〈91.3〉	38,950 (36.3) 〈91.9〉	**48,817** **(25.3)** **〈91.9〉**
Fund Transfer	766 (90.1) 〈10.0〉	766 (90.1) 〈10.0〉	1,328 (73.2) 〈10.3〉	2,010 (51.4) 〈9.3〉	2,711 (34.9) 〈8.7〉	3,443 (27.0) 〈8.1〉	**4,276** **(24.2)** **〈8.1〉**
Transaction Amount	652.6 (57.0)	652.6 (57.0)	961.5 (47.3)	1,413 (47.0)	1,823.6 (29.7)	2496.2 (36.2)	**3,149.4** **(26.2)**
Smart Phone Banking	372.7 (698.1)	372.7 (698.1)	861.1 (131.1)	1,369 (59.0)	1,797.6 (31.3)	2,445.8 (36.1)	**3,120.6** **(27.6)**

Note: 1) Fund transfer includes loan service-related transfer.
2) Figures in ( ) show growth rate from the previous year; Figures in 〈 〉 show percentage in total transactions.
Source Bank of Korea, 2016 Domestic Internet Banking Service Use, 2017.2.

3-8 Electronic Cash Use (Daily Average)

(Unit: 1,000 cases, KRW 1M, %)

Type	No. of Cases	Amount
2005	422	327
2006	438	309
2007	352	288
2008	306	262
2009	289	249
2010	258	241
2011	162	167
2012	68	-
2013	37	-
2014	23	-
2015	16	-
2016	**10**	**-**

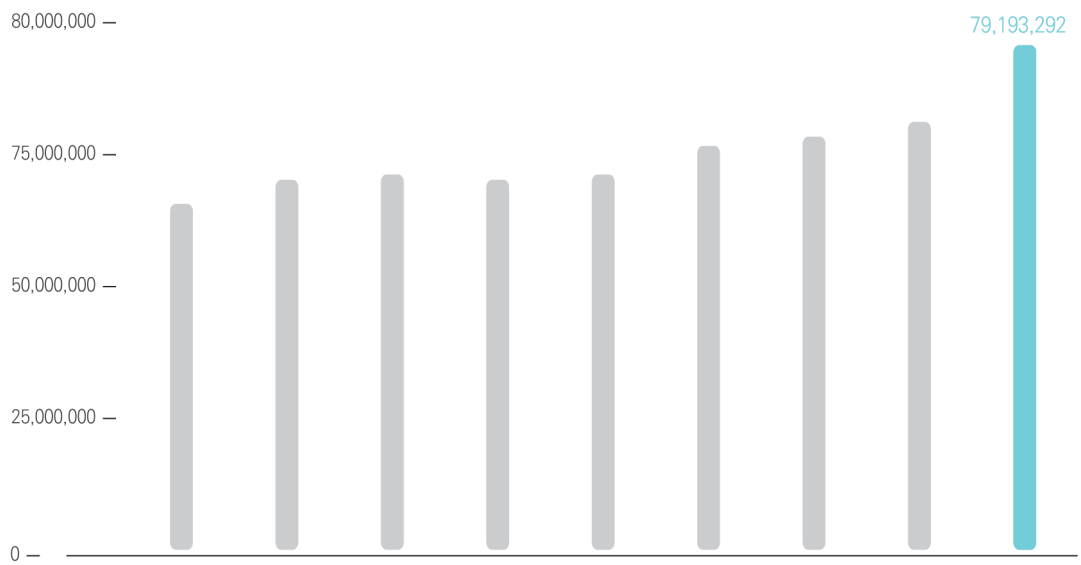


Note: A user can charge a specific amount in the IC card, and spend within the charged amount only at e-Cash affiliated stores (K-Cash, MYbi, VisaCash).
Source Bank of Korea, 2016 Payment Settlement Report, 2017.3.

4. ICT Service

4-1 Wired/Wireless Communication Service Subscribers

(Unit : Person)



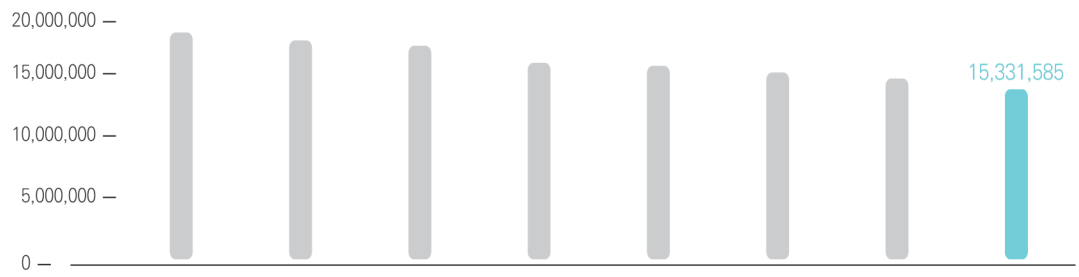
Type	2009	2010	2011	2012	2013	2014	2015	2016	2016.8
Local Phone	20,089,979	19,273,484	18,632,501	18,261,220	17,620,453	16,939,308	16,341,489	15,745,961	**15,331,585**
Mobile	47,944,222	50,767,241	53,306,257	54,674,215	54,674,227	59,402,363	59,711,078	61,879,255	**63,500,021**
Wireless Pager	21,066	18,917	18,339	18,384	29,164	31,522	32,653	34,829	**34,814**
TRS	352,092	377,540	382,110	384,181	367,758	331,677	309,893	286,314	**267,621**
Wireless Data	62,334	61,933	55,563	52,247	51,198	49,919	49,919	44,673	**44,654**
GM-PCS	3,857	5,193	14,696	19,472	23,498	21,866	19,872	16,695	**14,597**
Total	68,473,550	70,504,308	72,409,466	73,409,719	73,756,298	75,533,129	77,743,868	78,007,727	**79,193,292**

Note: 1) Subscribers as of the end of December each year.
2) Number of mobile subscribers is the sum of mobile phone subscribers (including tablet PC, wireless data modem, and M2M) and Wibro subscribers

Source MSIT, September 2017 Status of Wireless Communication Service Subscribers, 2017.11.

4-2 Local Phone Subscribers

(Unit : Person)



Provider	2010	2011	2012	2013	2014	2015	2016	2017.8
KT	16,634,607	15,699,702	15,121,001	14,355,457	13,712,765	13,149,712	12,691,098	**12,333,866**
SK Broadband	2,255,391	2,478,728	2,649,703	2,748,628	2,731,880	26,868,657	2,556,125	**2,470,714**
LGU+	383,486	454,071	490,516	516,368	494,663	505,120	498,738	**527,005**
Total	50,767,241	53,306,257	53,306,257	55,664,227	58,158,837	58,935,081	60,286,771	**62,014,415**

Note: 1) KT: Figures are sums of general phone (excl. business phone), group phone, DID and ISDN subscribers.
2) SK Broadband: Figures are sums of general phone (excl. business phone), intra-office phone and ISDN subscribers.
3) LGU+: General line (1 line and 2 lines) · Relay line: DID/DOD (No. of channels), DOD-only (No. of channels)
*The DID-only relay line is excluded from subscriber data (KT, Hanaro and Dacom).

Source MSIT, August 2017 Wired Communication Service Statistics, 2017.9.

4-3 Mobile Subscribers

(Unit : Person)

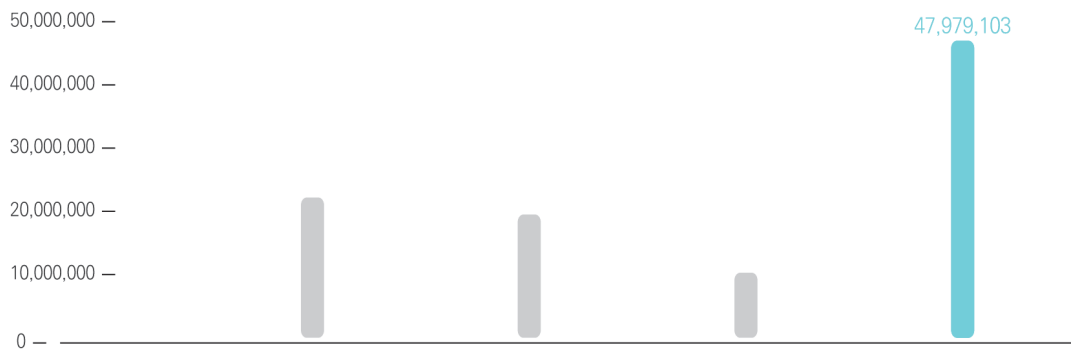
Provider	2010	2011	2012	2013	2014	2015	2016	2016.8
SKT	25,705,049	26,608,046	27,076,523	27,490,284	26,584,306	26,249,537	26,427,514	**6,715,145**
KT	16,040,527	17,307,292	16,501,639	17,299,899	15,221,076	15,273,122	26,427,514	**15,799,050**
LGU+	9,021,665	9,390,919	11,096,053	10,874,044	11,769,565	11,491,544	11,742,787	**12,176,937**
MVNO	-	-	-	-	4,583,890	5,920,878	6,840,589	**7,323,283**
Total	50,767,241	53,306,257	53,306,257	55,664,227	58,158,837	58,935,081	60,286,771	**62,014,415**

Note: 1) Subscribers as of the end of December each year. Number of mobile subscribers is the sum of mobile phone subscribers (including tablet PC, wireless data modem, and M2M) and Wibro subscribers.
2) KT's 2G service data is excluded, as it closed the service on 19 March 2012.

Source MSIT, September 2017 Status of Wireless Communication Service Subscribers, 2017.11.

4-4 Smart Phone Subscribers

(Unit : Person)



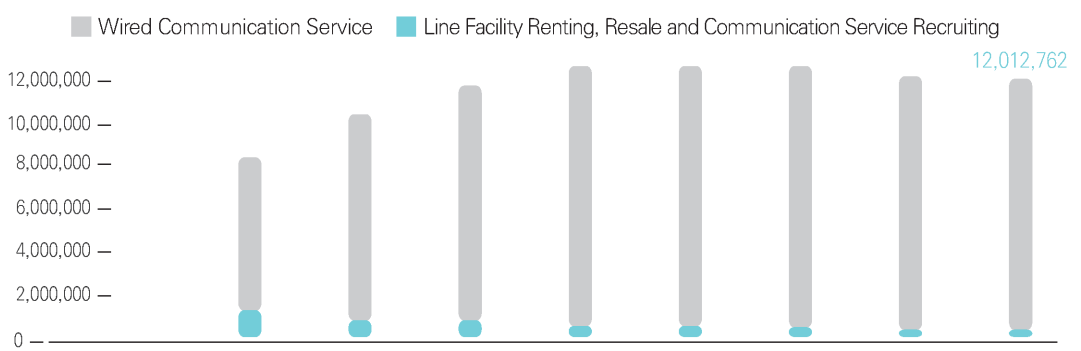
Year	SKT	KT	LG U+	Total
2012	15,978,717	10,250,998	6,497,534	**32,727,249**
2013	18,286,407	11,287,956	7,942,209	**37,516,572**
2014	19,494,535	12,416,813	8,648,963	**40,560,311**
2015	20,622,367	13,407,355	9,638,077	**43,667,799**
2016	21,876,776	14,277,198	10,264,500	**46,418,474**
2017.8	22,637,446	14,605,878	10,735,779	**47,979,103**

Note: 1) Subscribers as of the end of December each year.
2) Subscribers to tablet PCs not having the function of voice communication are excluded.

Source MSIT, September 2017 Status of Wireless Communication Service Subscribers, 2017.11.

4-5 VoIP Subscribers

(Unit : Person)



Type	2010	2011	2012	2013	2014	2015	2016	2017.8
Wired Communication Service	8,413,313	10,634,546	11,687,839	12,578,131	12,378,330	12,432,880	12,221,896	**11,997,571**
Line Facility Renting, Resale and Communication Service Recruiting	729,015	90,660	48,838	40,720	45,148	25,328	18,252	**15,191**
Total	9,142,328	10,725,206	11,736,677	12,618,851	12,423,478	12,458,208	12,215,859	**12,012,762**

Source MSIT, August 2017 Wired Communication Service Statistics, 2017.9.

4-6 Pay TV Subscribers

(Unit : No. of Terminals)

구분	2008	2009	2010	2011	2012	2013	2014	2015
Paid Broadcasting Total	19,419,782	22,062,740	23,360,754	24,286,901	25,260,078	27,762,285	29,826,754	**28,266,499**
Cable TV	15,013,227	15,053,855	14,858,247	14,777,993	14,798,725	14,737,884	14,611,459	**13,732,042**
Paid Subscription	14,802,694	14,755,798	14,665,374	14,523,816	14,568,926	-	14,605,340	-
Free Subscription	210,533	298,057	192,873	254,177	229,799	-	6,119	-
Cable CATV	216,573	176,106	180,648	179,864	123,112	104,900	97,389	**84,328**
Satellite Broadcasting	2,338,378	2,457,408	2,825,963	3,261,662	3,790,820	4,181,022	4,261,123	**3,091,938**
Satellite DMB	1,851,604	2,001,460	1,850,030	1,173,535	-	-	-	-
IPTV	-	2,373,911	3,645,866	4,893,847	6,547,421	8,738,479	10,856,783	**11,358,191**

Note: 1) The number of pay TV subscribers as of December 2015 excludes contractors for integrated reception system maintenance, free subscribers with purposes other than sales, and subscribers in exceptional locations where only satellite broadcasting service is provided; therefore, the number may be different from the number of subscribers of before 2014.

2) In the case of cable TV and satellite broadcasting services, the subscriber data is based on the number of television sets equipped with receivers (terminals) for receiving service signals. Therefore, the number of subscribers includes those who have TV sets with not only a single but two or more receiver terminals. Regarding IPTV service, the number of subscribers is measured based on the number of IPs, and thus includes the users of terrestrial broadcasting, multi-channel broadcasting, data broadcasting and VOD services through broadband Internet and IP set-top box.

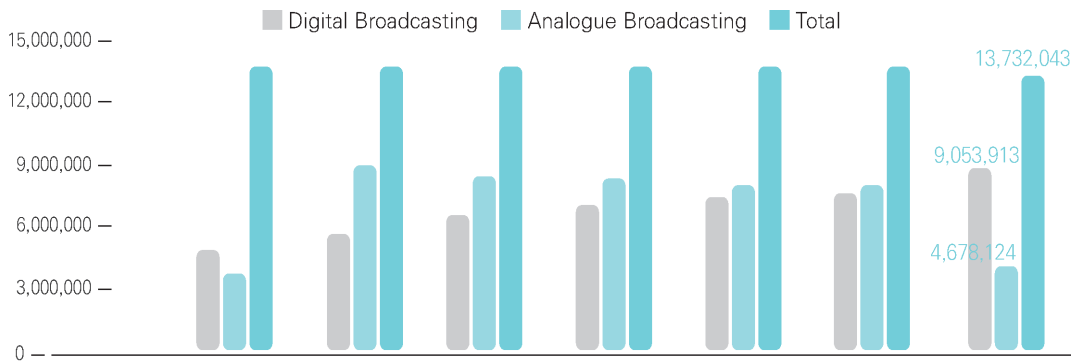
3) Satellite DMB service was launched in May 2005 and was discontinued in August 2012.

4) Since 2013, statistics of cable TV subscribers have been published as the total of both paid and free cable broadcasting services.

Source KCC, 2016 Broadcasting Industry Survey Report, 2017.1.

4-7 Cable TV Subscribers

(Unit : No. of Terminals/Equipment)



Type		2012.12	2013.6	2013.12	2014.3	2014.12	2015.3	2015.12
Total	Basic Subscription	4,662,183	4,882,495	5,285,325	5,344,570	5,689,065	5,768,580	**5,292,987**
	Tier Subscription	9,906,743	9,728,483	9,452,559	9,400,622	8,916,275	8,762,122	**8,439,055**
	Subtotal	14,568,926	14,611,428	14,737,884	14,745,192	14,605,340	14,530,702	**13,732,042**
	Free Viewing	229,799	231,937	-	-	6,119	6,206	-
	Total	14,798,725	14,843,365	14,737,884	14,745,192	14,611,459	14,536,908	**13,732,042**
Analogue Broadcasting	Basic Subscription	484,847	405,941	244,677	222,953	165,748	152,391	**1,65,337**
	Tier Subscription	8,946,670	8,537,322	8,343,035	8,101,183	7,311,325	7,128,329	**4,512,787**
	Subtotal	197,749	8,943,263	8,587,712	8,324,136	7,477,073	7,280,720	**4,678,124**
	Free Viewing	9,629,266	198,717	-	-	165,748	4,173	-
	Total	4,177,336	9,141,980	8,587,712	8,324,136	7,481,306	7,284,893	**4,678,124**
Digital Broadcasting	Basic Subscription	960,073	4,477,004	5,040,648	5,121,617	5,523,317	5,616,189	**5,127,650**
	Tier Subscription	5,137,409	1,191,161	1,109,524	1,299,439	1,604,950	1,633,793	**3,926,268**
	Subtotal	5,137,409	5,668,165	6,150,172	6,421,056	7,128,267	7,249,982	**9,053,918**
	Free Viewing	32,505	33,220	-	-	1,886	2,033	-
	Total	5,169,459	5,701,385	6,150,172	6,421,056	7,130,153	7,252,015	**9,053,918**

Note: 1) The number of Cable TV operators as of the end of 2015 is 90, as Daegu Cable TV Broadcasting was merged with t-Broad Daegu in October 2015.

2) In the case of cable TV and satellite broadcasting services, the subscriber data is based on the number of television sets equipped with receivers (terminals) for receiving service signals. Therefore, the number of subscribers includes those who have TV sets with not only a single but two or more receiver terminals.

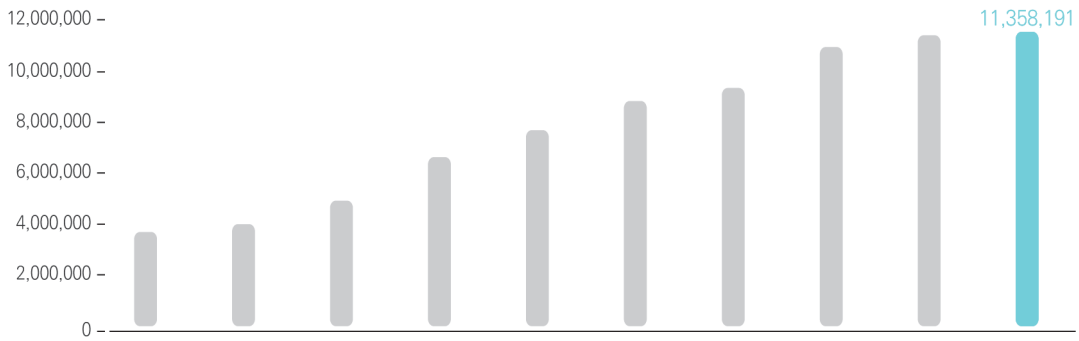
3) Basic subscription - subscription to the basic service which can receive all channels transmitted by the operator, except pay channels; Tier subscription - subscription to packaged (universal/ minimum) service arranged by the operator considering the characteristics of channels and user preferences.

4) Figures for digital broadcasting are the sums of digital terrestrial broadcasting subscribers (SVSB method) and digital cable broadcasting (QAM method).

Source KCC, 2016 Broadcasting Industry Survey Report, 2017.1.

4-8 IPTV Subscribers

(Unit : Person)

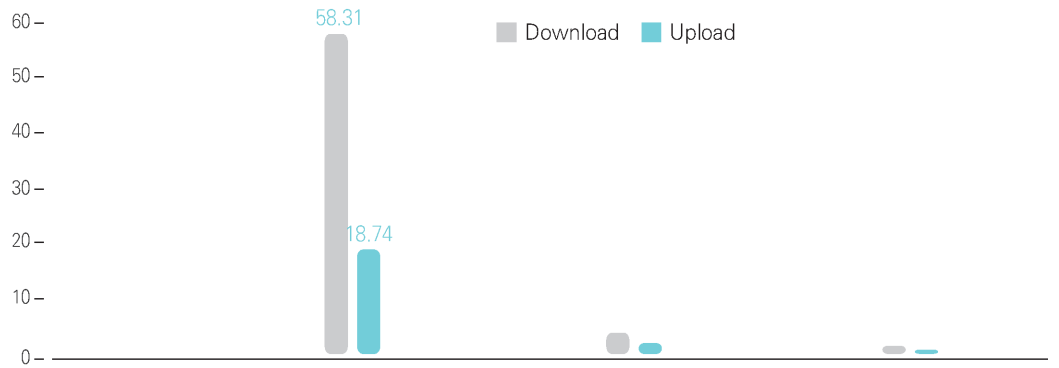


Type	2010.12	2011.3	2011.12	2012.12	2013.6	2013.12	2014.3	2014.12	2015.3	2015.12
Real-time IPTV	3,430,403	3,800,268	4,819,309	6,302,275	7,374,946	8,707,640	9,221,323	10,835,416	11,331,924	11,358,191
pre-IPTV (VOD)	215,463	183,080	74,538	245,146	221,578	30,839	27,232	21,367	19,302	-
Total	3,645,866	3,983,348	4,893,847	6,547,421	7,596,524	8,738,479	9,248,555	10,856,783	11,351,226	11,358,191

Source KCC, 2016 Broadcasting Industry Survey Report, 2017.1.

4-9 LTE Service Quality in Vulnerable Areas

(Unit : Mbps)



Type	LTE		3G		Ev-Do reA	
	Download	Upload	Download	Upload	Download	Upload
Total	**58.31**	**18.74**	**3.57**	**1.54**	**1.07**	**0.43**
Mountain Trails	83.25	20.58	5.15	1.74	1.34	0.43
Marine Routes	40.32	15.77	2.53	1.39	0.88	0.40
Islands	58.95	20.46	3.62	1.56	1.10	0.44
Coastal Roads	67.21	21.09	2.85	1.49	1.01	0.53

Note: The average transmission speed of the 3 operators is used as data of the vulnerable areas, where service stability is more important
Source MSIP, 2016 Communication Service Quality Assessment, 2016.12.

4-10 Communication Service Quality

(Unit : Average Mbps, (Grade))

Service	Technology	Indicator	2011	2012	2013	2014	2015	2016
Wireless Internet	All LTE	Download	-	-	-	-	117.51	120.09
		Upload	-	-	-	-	26.84	41.83
	3Band-LTE-A	Download	-	-	-	-	163.01	-
		Upload	-	-	-	-	26.84	-
	Broadband LTE-A	Download	-	-	-	114.4	108.39	-
		Upload	-	-	-	26.9	26.84	-
	Broadband LTE	Download	-	-	56.6(S)	77.8	67.55	-
		Upload	-	-	20.2(S)	26.9	26.84	-
	LTE-A	Download	-	-	47.2(S)	-	-	-
		Upload	-	-	15.5(S)	-	-	-
	LTE	Download	-	S	30.9(S)	-	-	-
		Upload	-	S	17.3(S)	-	-	-
	3G	Download	1.89	A	4.6(S)	5.1	4.75	5.09
		Upload	1.00	S	1.8(S)	1.9	1.9	1.97
	Ev-Do reA	Download	0.70	-	1.1(A)	1.1	0.88	1.07
		Upload	0.44	-	0.5(S)	0.5	0.38	0.47
	WiFi	Download	11.30	A	15.2(A)	26.9	91.87	144.73
		Upload	9.36	A	15.2(S)	33.3	85.24	141.47
	WiBro	Download	6.11	S	5.9(S)	6.8	5.92	9.19
		Upload	2.78	A	2.3(A)	2.6	2.34	5.88
Wired Internet	High-speed (Own Network)	Download	93.7	S	S	99.8	99.3	99.06
		Upload	83.1	S	S	99.8	99.4	70.4
	Giga-level	Download	-	-	-	-	923.04	895.7
		Upload	-	-	-	-	949.48	916.08
VoIP	2G	Call Success Rate (own)	-	-	-	-	97.32	98.30
		Call Success Rate (other)	-	-	-	-	95.12	94.44
	3G	Call Success Rate (own)	98.54(S)	S	99.0(S)	99.2	99.84	99.76
		Call Success Rate (other)	-	-	98.6(S)	98.5	99.42	99.48
	VoLTE	Call Success Rate (own)	-	-	-	99.8	99.97	99.77
		Call Success Rate (other)	-	-	-	-	-	99.67

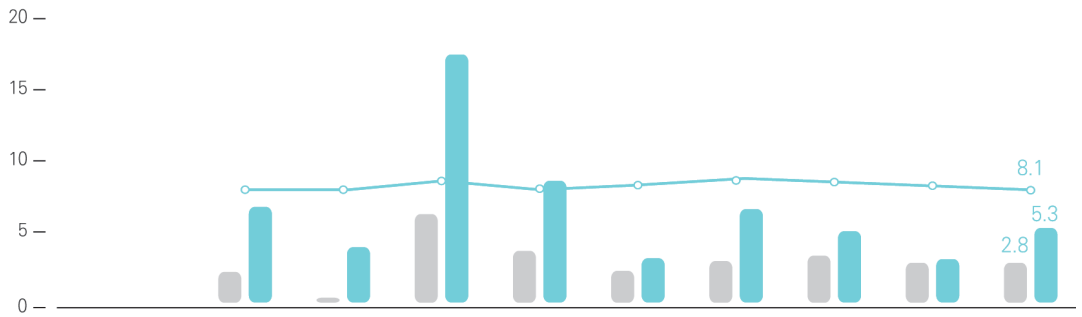
Note: 1) Integrated assessment of a diverse range of LTE services of each operator is carried out and published from 2016 in order for users to understand the overall quality of LTE services.
2) Operators' self-assessment values are applied for 2015 VoIP data for comparison with the results of previous years' assessment.
3) Quality grading system was applied in 2012; Grade and average speed data were both provided in 2013; Grading system discontinued in 2014.
4) Wireless Internet -3G data of 2011 includes Ev-Do reA (excluded from 2013)

Source MSIP, 2016 Communication Service Quality Assessment, 2016.12.

5. ICT Industry

5-1 ICT Industry Growth and Share

(Unit : %)

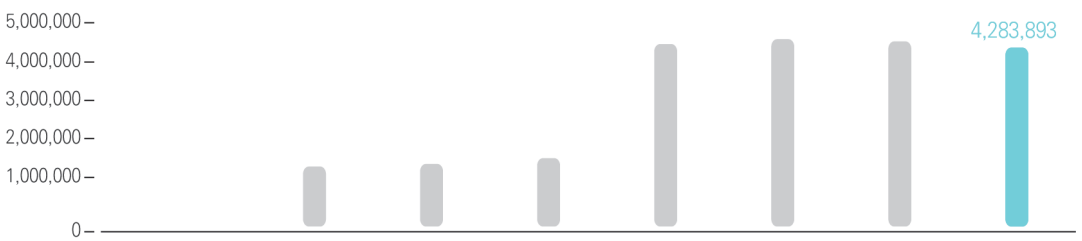


Type	2008	2009	2010	2011	2012	2013	2014	2015	2016(p)
GDP Growth Rate	2.3	0.3	6.3	3.7	2.3	2.9	3.3	2.8	**2.8**
ICT Industry Growth Rate	6.8	3.9	17.7	8.6	3.1	6.6	5.1	3.1	**5.3**
ICT Industry Share in GDP	8	8	8.7	8.1	8.5	8.7	8.4	8.2	**8.1**

Note: 2016 data are estimates.
Source Bank of Korea, 2015 National Accounts (Final) and 2016 National Accounts (Provisional), 2017.3.

5-2 ICT Industry Production Volume

(Unit : KRW 100M)

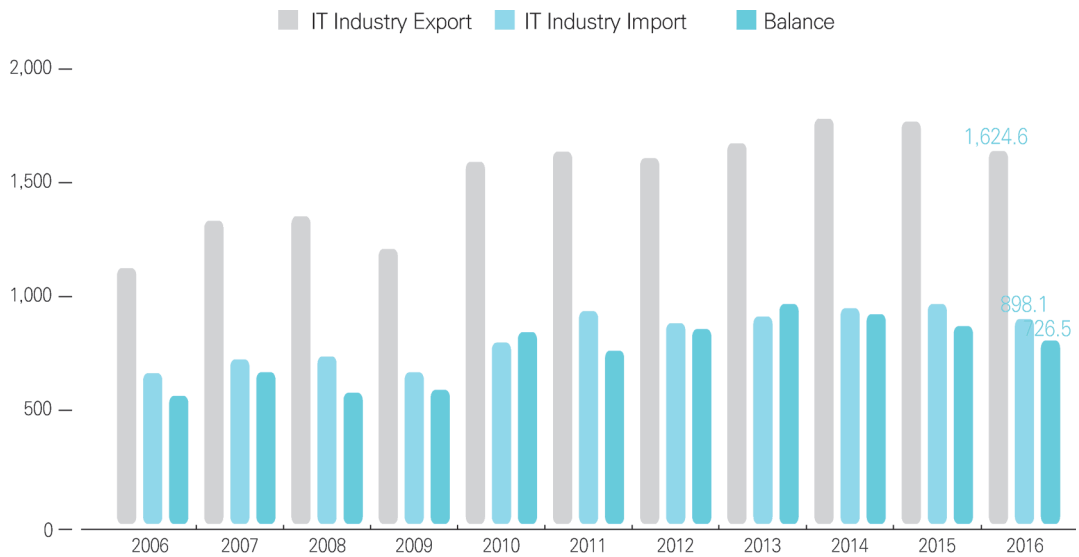


Type	2010	2011	2012	2013	2014	2015	2016(P)
ICT/Broadcasting Service	140,909	148,879	159,626	698,749	721,291	745,724	**719,715**
ICT/Broadcasting Equipment	927,512	876,158	971,085	3,256,839	3,294,597	3,241,618	**3,062,676**
Software and Digital Contents	122,565	134,810	198,817	454,573	483,447	394,492	**501,502**
Total	1,190,986	1,159,847	1,329,528	4,410,161	4,499,335	4,381,834	**4,283,893**

Note: 1) Production of ICT/broadcasting equipment concerns manufacturers with 10 or more employees.
2) Beginning in 2012, some items (hosting service and co-location service) of value added communication service were categorized as software and digital contents service.
Source MSIT/KAIT, September 2017 ICT Product Survey, 2017.11.

5-3 IT and Total Industry Export and Import

(Unit : USD 100M, %)

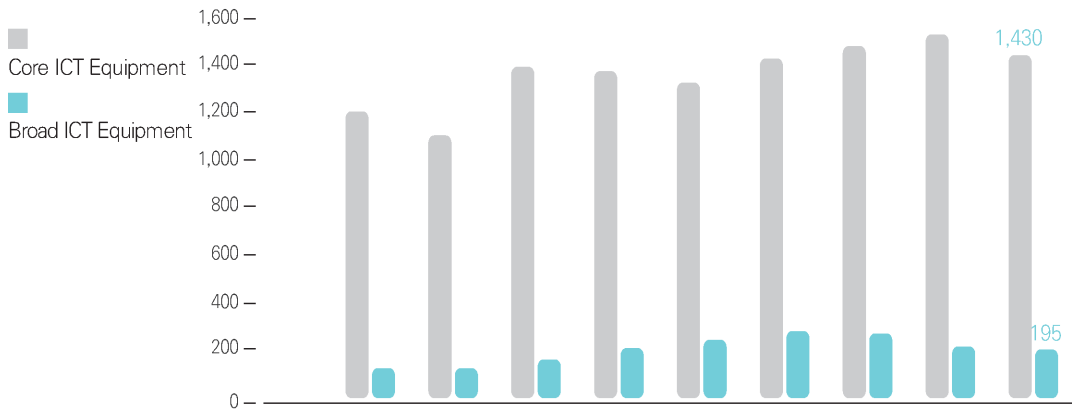


Type	Export			Import			Balance	
	Total Industry	IT Industry	Growth	Total Industry	IT Industry	Growth	Total Industry	IT Industry
2007	3,714.9	1,301.0	9.2	3,568.5	697.3	7.8	146.4	603.7
2008	4,220.1	1,311.6	0.8	4,352.7	735.2	5.4	- 132.7	576.4
2009	3,635.3	1,209.5	- 7.8	3,230.8	620.2	- 15.6	404.5	589.3
2010	4,663.8	1,539.4	27.3	4,252.1	756.2	21.9	411.7	783.2
2011	5,577.7	1,569.7	2.0	5,244.4	815.2	7.8	333.1	754.5
2012	5,478.7	1,552.4	- 0.9	5,195.8	779.5	- 4.4	282.9	772.8
2013	5,597.2	1,694.2	9.1	5,155.3	808.0	3.7	441.9	886.2
2014	5,726.6	1,738.5	2.6	5,255.1	875.7	8.3	471.5	862.9
2015	5,271.6	1,728.9	- 1.9	4,368.0	913.2	3.6	903.5	815.6
2016	**4,954.0**	**1,624.6**	**- 6.0**	**4,061.9**	**898.1**	**- 1.7**	**892.3**	**726.5**

Source MSIP, ICT Export and Import Status, 2017.8.

5-4 ICT Equipment Export

(Unit : USD 1M)

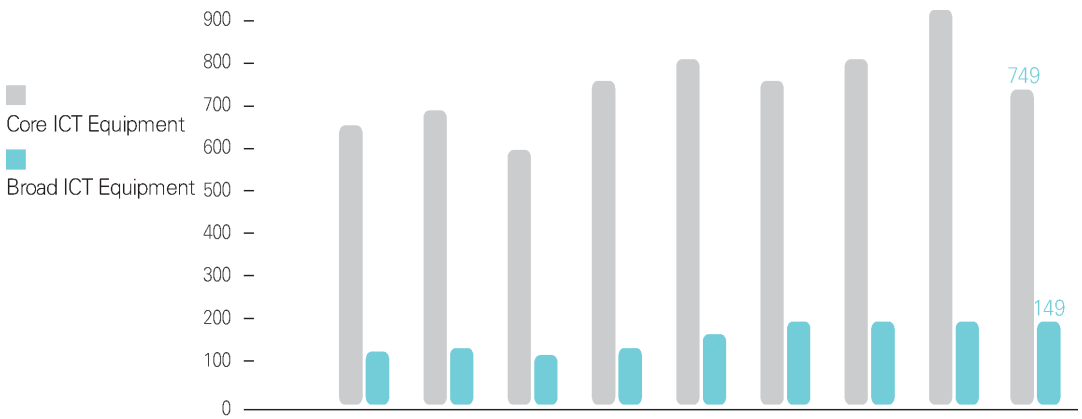


Type		2008	2009	2010	2011	2012	2013	2014	2015	2016
Core ICT Equipment	Electronic Components	637	627	913	891	912	968	1,003	1,041	**990**
	PCs and Peripherals	97	70	77	76	77	71	70	70	**88**
	Communication and Broadcasting Equipment	360	310	278	278	229	276	297	329	**300**
	Video and Audio Equipment	90	80	105	107	92	104	96	74	**52**
	Magnetic Optical Equipment	11	11	15	16	8	7	8	7	**-**
	Subtotal	1,195	1,098	1,388	1,368	1,318	1,426	1,474	1,521	**1,430**
Broad IT Equipment	Medical Precision and Optical Instruments	27	26	39	53	64	84	89	86	**17**
	Domestic Appliances	40	37	45	48	47	50	52	45	**43**
	Office Appliances and Machinery	5	4	4	5	5	5	4	4	**3**
	Electronic Machinery	44	45	63	92	119	129	119	72	**134**
	Subtotal	116	112	151	198	235	268	264	207	**195**
Total		1,311	1,210	1,539	1,566	1,553	1,694	1,738	1,728	**1,625**

Note: Numbers under 100M are rounded and omitted.
Source MSIP, ICT Export and Import Status, 2017.8.

5-5 ICT Equipment Import

(Unit : USD 100M)

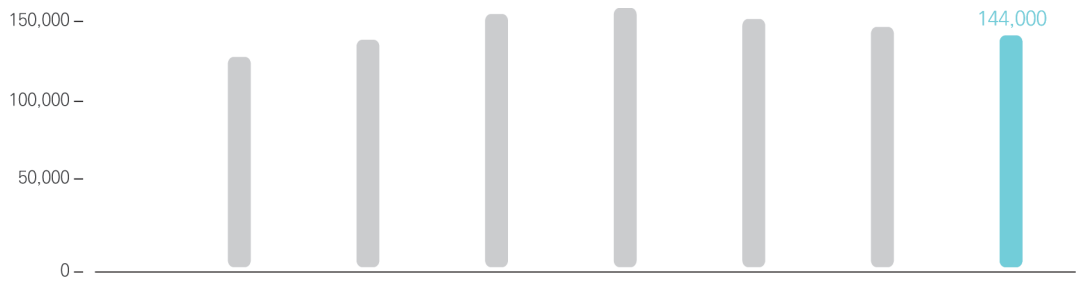


Type		2008	2009	2010	2011	2012	2013	2014	2015	2016
Core ICT Equipment	Electronic Components	415	435	373	444	466	467	490	509	**476**
	PCs and Peripherals	86	85	72	93	93	90	91	90	**99**
	Communication and Broadcasting Equipment	56	66	55	69	95	63	68	137	**147**
	Video and Audio Equipment	29	32	26	29	27	28	27	27	**27**
	Magnetic Optical Equipment	15	14	10	17	15	6	4	2	**-**
	Subtotal	601	632	536	652	696	654	680	765	**749**
Broad IT Equipment	Medical Precision and Optical Instruments	64	69	54	71	80	85	85	97	**16**
	Domestic Appliances	9	9	8	9	11	13	15	19	**23**
	Office Appliances and Machinery	3	2	2	1	1	1	1	0	**1**
	Electronic Machinery	21	23	21	23	26	27	30	31	**53**
	Subtotal	97	103	85	104	118	126	131	148	**149**
Total		698	735	621	756	814	780	811	913	**898**

Note: Numbers in total are rounded and may not match up with the sum of equipment types.
Source MSIP, ICT Export and Import Status, 2017.8.

5-6 Annual Average Household Communication Cost

(Unit : KRW, %)

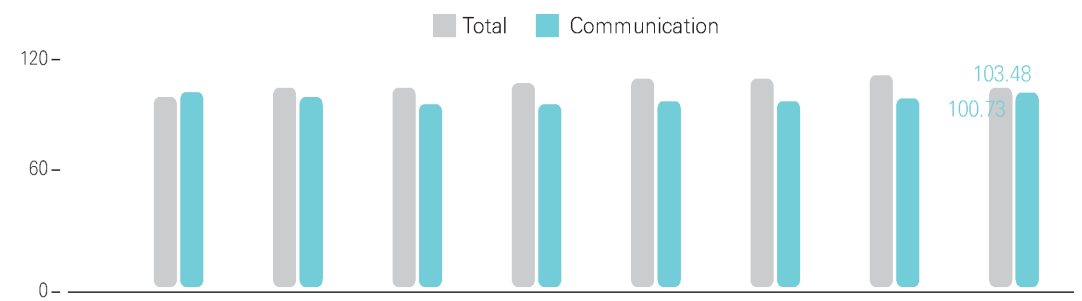


Type		2010	2011	2012	2013	2014	2015	2016
Total Household Spending		2,286,874	2,392,666	2,457,441	2,480,725	2,551,057	2,563,100	**2,549,700**
Communication Cost	Total	138,646	142,909	152,359	152,792	150,350	147,700	**144,000**
	Post	214	253	242	238	287	341	**-**
	Equipment	1,750	2,613	6,743	9,456	23,766	22,700	**19,200**
	Service	136,682	140,044	145,374	143,098	126,297	124,700	**124,500**
Share of communication cost in total spending		6.06	5.97	6.20	6.16	5.89	5.50	**5.64**

Note: 1) Numbers in total are rounded and may not match up with the sum of equipment types.
2) The method of surveying equipment cost was improved in 2014, thus correcting the problem caused by erroneous recognition of equipment (terminal) cost as a service cost. Care should be taken when comparing equipment and service costs before and after 2014.

Source Statistics Korea, 2016-4Q and Annual Household Survey, 2017.2.

5-7 Communication (Equipment and Service) Price Index vs Total Consumer Price Index



Type	2010	2011	2012	2013	2014	2015	2016	2017.8
Total	100.0	104.0	106.3	107.7	109.0	109.81	110.66	**103.48**
Communication	100.1	98.4	95.8	95.8	95.59	95.53	95.60	**100.73**

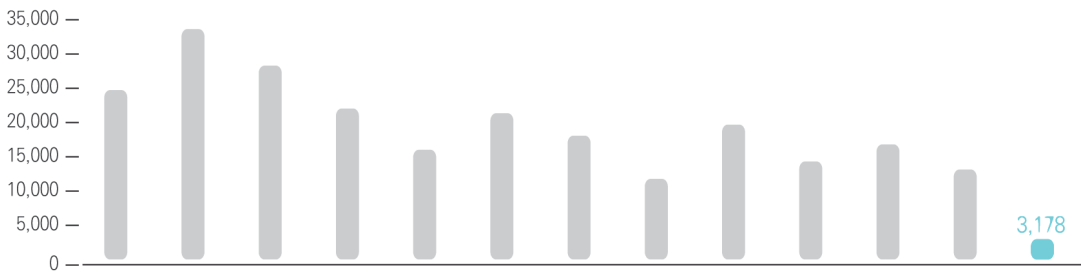
Note: 1) Consumer Price Index measures price fluctuations and does not represent the absolute price levels.
2) Year 2015 is the reference year for Consumer Price Index data of August 2017.
3) Since 2015, Consumer Price Index values are two decimal digit numbers.

Source Statistics Korea, August 2017 Consumer Price Status, 2017.9

6. Information Security

6-1 Hacking

(Unit : Cases, %)



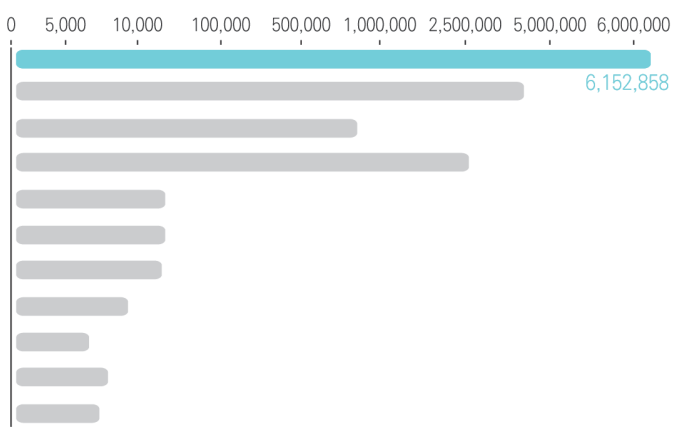
Type	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016(상)
No. of Reports Filed	24,297	33,633	26,808	21,732	15,940	21,230	16,295	11,690	19,570	10,398	15,545	13,890	**3,178**
Growth Rate	-7	38	-20	-19	-27	33	-23	-28	67	46.9	-49.5	25	**-63**

Note: No data update since August 2016.
Source Statistics Korea, 'No. of Hacking Reports', 2016.8.

6-2 Virus and Malware Infection

(Unit : Cases)

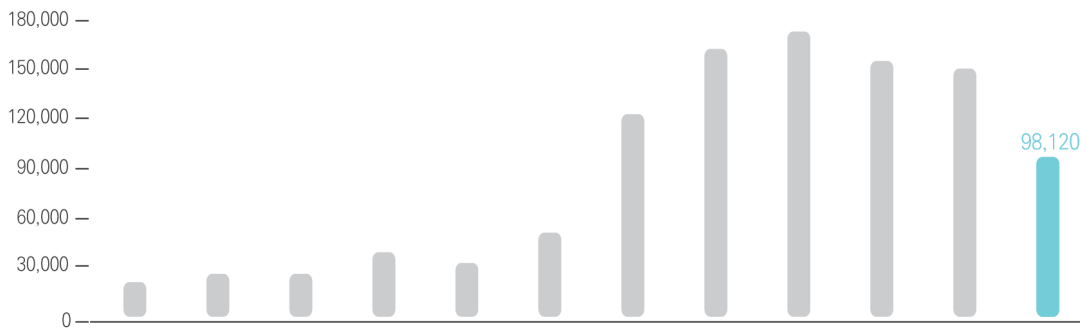
Year	No. of Infections	Growth
2016(1H)	**6,152,858**	**1,665,897**
2015	4,486,961	3,722,936
2014	764,025	-1,651,021
2013	2,415,046	2,393,647
2012	21,399	-352
2011	21,751	3,821
2010	17,930	7,535
2009	10,395	1,926
2008	8,469	2,473
2007	5,996	-1,793
2006	7,789	-8,304



Note: 1) The number of reported cases of damage caused by malware infection is the number of cases confirmed by major domestic vaccine providers through products for individual users.
2) Data are the number of virus reports until 2012, and number of detected malware infections from 2013.
3) The reason for rapid increase in the number of worm/virus detections from 2015 2H was the vaccine providers' version upgrade, which led to the increase of detected cases.
4) No data update since August 2016.
Source Statistics Korea, 'Worm/Virus Damage Status', 2016.8

6-3 Personal Information Infringement

(Unit : Cases)



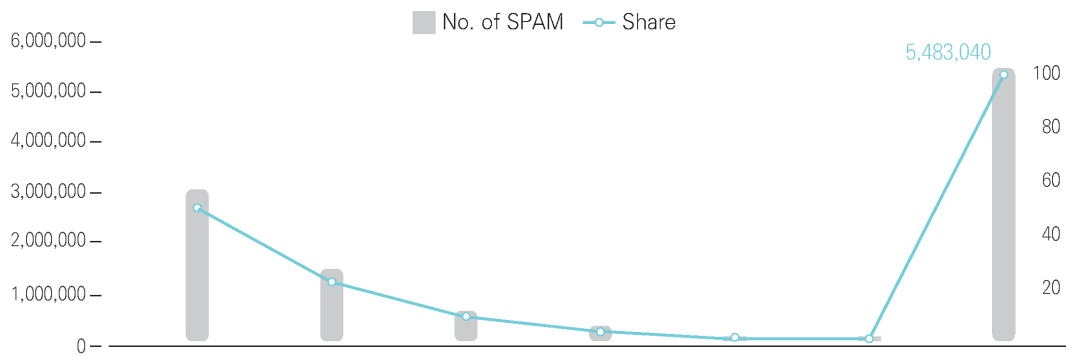
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No. of Reports	18,206	23,333	25,965	39,811	35,167	54,832	122,215	166,801	177,736	158,900	152,151	**98,210**

Source Statistics Korea, 'Personal Information Infringement Data', 2017.10.

6-4 SPAM Distribution via Mobile and Email

A. Text SPAM by Ad Message Type (As of 2017-1H)

(Unit : Cases, %)



Type	Illegal Loan	Communication Service Subscription	Finance	Adult	Election	Others*	Total
No. of SPAM	3,042,829	1,422,517	588,218	274,389	67,378	87,709	**5,483,040**
Share	55.5	25.9	10.7	5.0	1.2	1.6	**100**

Source KCC, 2017-1H SPAM Distribution Status, 2017.9.

B. Daily Average Amount of SPAM Received on Mobile

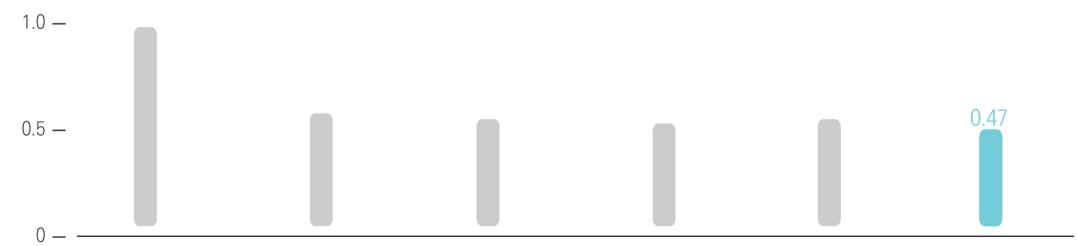
(Unit : Cases)

Rank	2014-1H		2014-2H		2015-1H		2015-2H		2016-1H		2016-2H		2017-1H	
	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount
1	LGU+	0.23	LGU+	0.18	LGU+	0.14	LGU+	0.08	LGU+	0.11	SKT	0.08	KT	0.08
2	KT	0.22	KT	0.17	KT	0.12	KT	0.09	KT	0.09	KT	0.06	SKT	0.06
3	SKT	0.18	SKT	0.12	SKT	0.10	SKT	0.09	SKT	0.09	LGU+	0.06	LGU+	0.06
Average	0.21		0.16		0.12		0.09		0.09		0.07		0.06	

Source KCC, 2017-1H SPAM Distribution Status, 2017.9.

C. Daily Average Amount of SPAM Received on Email

(Unit : Cases)

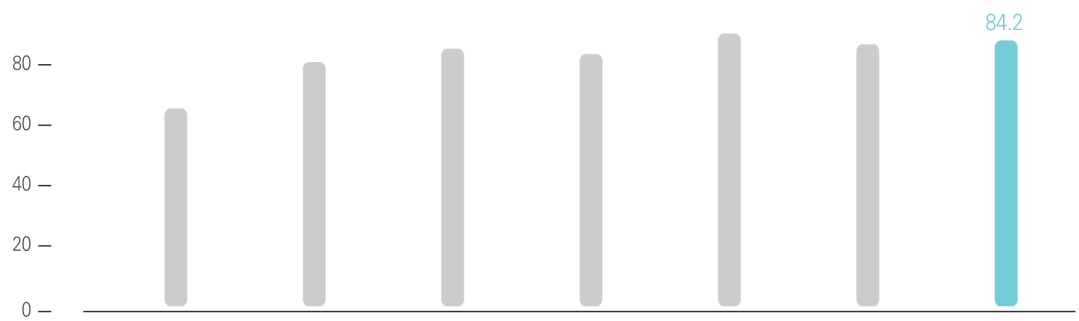


Rank	2014-2H		2015-1H		2015-2H		2016-1H		2016-2H		2017-1H	
	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount	Operator	Amount
1	Daum Kakao	1.79	Daum Kakao	1.17	Daum Kakao	0.85	Daum Kakao	0.76	Nate	0.75	Kakao	1.21
2	Nate	0.39	Nate	0.28	Nate	0.73	Nate	0.32	Kakao	0.62	Naver	0.02
3	Naver	0.06	Naver	0.05	Naver	0.18	Naver	0.30	Naver	0.05	Nate	0.01
Average	0.92		0.54		0.52		0.49		0.51		0.47	

Source KCC, 2017-1H SPAM Distribution Status, 2017.9.

D. Mobile Service Operators' Protection Rate against SPAM

(Unit : %)



Type	2014-1H	2014-2H	2015-1H	2015-2H	2016-1H	2016-2H	2017-1H
Average Protection Rate	63.3	78.2	81.8	80.9	87.6	83.8	84.2

Source KCC, 2017-1H SPAM Distribution Status, 2017.9.