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Ministry of Science and ICT

NIA NATIONAL INFORMATION
SOCIETY AGENCY



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Notice

The content of this white paper is based on a collection of opinions of experts from industry, academia, and research institutes, and it, therefore, may differ from the official position of the National Information Society Agency.

the Publisher Message from



Due to the many unprecedented restrictions in our everyday life, enforced by the COVID-19 pandemic, we have no choice but to adapt to life in the new normal. We are passing through a tunnel of transition in almost all areas of life, ranging from the personal sector, such as family and friends, to the public and even between countries.

The methods and speed of passing through this tunnel vary among individuals, companies, and countries. One thing is obvious, however: at the center of the transition is the internet-based digital. As is well noted, digital capabilities are the driving force behind differences in the methods and speed of passing through the tunnel, and they constitute national competitiveness.

The pattern of internet use is also constantly changing in accordance with the advancement of digital technology and digital capabilities. According to the survey conducted in 2021 on the

general use and facts on the internet, digital-based contactless activities have become normalized with the pandemic and increased use of QR codes, automated ordering, and delivery applications, along with internet banking and remote education.

Under the three grand topics of Internet Technology and Service, Life, and Infrastructure, 2021 Korea Internet White Paper has been written on the present status, issues, and future prospects of each topic, all based on experts' views gathered from both civic and public sectors.

It is my sincere hope that 2021 Korea Internet White Paper may serve as a valuable resource to enhance Korean companies and national digital competitiveness through insightful illumination of the digital trends and prospects of related aspects in the field of internet-based technology and industries and policies.

Finally, I would like to express my deepest thanks to all the contributing experts across diverse fields, as well as the authors and others who spared no time or effort for 2021 Korea Internet White Paper to be published.

Moon Yong-sik

President of National Information Society Agency

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History of the Internet in South Korea

The internet was first introduced in South Korea in 1982 with the implementation of the System Development Network (SDN). Since its commercial launch in 1994, Korean internet services have grown rapidly and by 2017 the number of internet users nationwide exceeded 45 million. In 2020, with the passing of the “Three Data Laws” and the “Framework Act on Intelligent Information”, the government has set a foundation to invigorate the data economy and to establish itself as the leader in world-class intelligent information.

- The first commercial internet service was launched (1994)
- The Ministry of Information and Communication was founded (1994)



Industry & Services

1981 – 1984

- 1982**
 - The first internet connection was made
- 1983**
 - The first information search service was launched
- 1984**
 - The first commercial email provider, Dacom, was founded



1985 – 1989

- 1985**
 - An email provider in Korean was launched
 - The first PC communication service was launched by Dacom
- 1987**
 - The email provider H-Mail was founded
 - The first PC banking service was launched
- 1988**
 - The first commercial PC communication service was launched by Chollian
 - The first private bulletin board, The FIRST, was launched
 - Brain, the first virus, began its attack nationwide and an antivirus solution was developed
 - The first EDI service was launched

1990 – 1995

- 1991**
 - The online service for issuing certified copies of resident registrations was launched
- 1994**
 - Korea Telecom launched its commercial Internet service
 - MUD, the first text-based game, was released
 - Governmental authorities began to launch official websites (Cheongwadae, etc.)
- 1995**
 - The “WWW” service was launched
 - The first internet café, Netscape, was opened
 - The first online newspaper, JoongAng Ilbo, and broadcasting services, KBS, were launched

Infrastructure

- 1982**
 - The SDN (TCP/IP) was implemented (Seoul National University - Korea Institute of Electronic Technology)
- 1983**
 - The SDN - EUNET/UUCPNET (technical and academic information exchange) network was connected
 - The public switched telephone network (PSTN) data service was launched
 - The overseas public data network was established
- 1984**
 - The SDN - CSNET (information science research) network was established
 - The first public information data network (PSDN) Dacom - Net was launched

- 1985**
 - The SDN - PACNET (Asian-Pacific academic research) network was connected
- 1986**
 - The first IP address, 128.134.0.0, was assigned in Korea
 - The national domain .kr was introduced
- 1988**
 - SDN - MHSNET (academic network) were connected
- 1989**
 - An educational network, KREN, and a research network, KREONet, were launched
 - The SDN - HANA (Korea Telecom) network was implemented

- 1990**
 - The SDN - HANA network was connected through IP-based internet to the US
- 1993**
 - The comprehensive administrative information network was opened
- 1994**
 - Commercial ISPs were introduced (Korea Telecom, Dacom, iNet, etc.)
- 1995**
 - PC - internet connection was established
 - The KIX was implemented, and its service was launched



Policy

- 1981**
 - The Korea Telecom Authority was established
- 1982**
 - The Korea Data Communication Corporation was established
 - The first basic plan for the computerization of administrative work was established
- 1983**
 - The Framework Act on Telecommunications was enacted, marking the first time the term “telecommunications” was used in legislation
 - The project plan for a national backbone computer network was established
- 1984**
 - The national backbone computer network conciliation committee was organized

- 1985**
 - The promotion plan for an administrative computer network was established
 - The first domestic computer network-related conference (PCCS) was held
- 1986**
 - The Act on the Expansion of Distribution and Promotion of Use of the Computer Network was enacted
- 1987**
 - The National Computerization Agency was established
 - The first basic plan for a national backbone computer network was established
 - The computer network conciliation committee was organized

- 1990**
 - Comprehensive measures for the information society were established
- 1992**
 - The second basic plan for a national backbone computer network was established
 - The Act on the Promotion of Information and Communications Network Utilization, Etc. was passed
- 1993**
 - A basic plan for the implementation of a high-speed information and communication infrastructure was established
- 1994**
 - The Ministry of Information and Communication was created
- 1995**
 - A comprehensive plan for the implementation of high-speed information and communication infrastructure was established
 - The Framework Act on the Promotion of Informatization was passed
 - The Korea Internet Safety Commission was founded

- The first commercial high-speed Internet service was launched (1998)
- The number of Internet users exceeded 10 million (1999)

- Korea ranked first in the world in implementation of high-speed networks (2001)
- The Information and Communications Network Act was passed (2001)
- The number of high-speed Internet subscribing households exceeded 10 million (2002)
- The e-Korea Vision 2006 was established (2002)
- The Broadband IT Korea Vision 2007 was established (2003)
- The IT839 Strategy was established
- The number of Internet users exceeded 30 million (2004)
- The commercial VoIP service was launched (2005)

- The world's first WiBro and HSDPA services were launched
- The basic plan for u-Korea was established (2006)
- The restrictive identity verification system was introduced (2007)
- The Korea Communications Commission was created (2008)
- The OECD Ministerial Meeting on the future of the Internet economy was held (2008)

1996 – 2000

1996

- The ISDN internet service was launched
- The first e-commerce and webzine services were launched
- The first graphic-based game, MUG, was released
- An information expo was held

1997

- The first online stock trading service was launched
- Free internet services, such as search engines and email, were launched
- The first Internet portal service, Netsgo, was introduced

1998

- **The first commercial high-speed internet service was launched by Thrurnet**

- The government's first public service website was launched

1999

- The ADSL service was launched by Hanaro Telecom
- The first online banking service was launched

2001 – 2005

2001

- The number of online banking users exceeded 10 million
- The internet content rating service was launched

2002

- The size of the Korean game market exceeded KRW 3 trillion

2003

- The VDSL service which provided speeds of 20 MBps was launched
- The first mobile banking service was launched
- Korean .kr services were launched

2005

- **The commercial VoIP service was launched**
- The number of mobile banking users exceeded 1 million

2006 – 2008

2006

- **The world's first WiBro and HSDPA services were launched**
- The value of online sales exceeded KRW 13 trillion
- The government launched a mobile app for issuing official certificates

2007

- The second stage .kr domain, QuickDom, service was launched
- The total value of e-commerce transactions exceeded KRW 500 trillion

2008

- The number of .kr domains exceeded 1 million
- The number of online banking users exceeded 50 million

1996

- The ISDN public network was opened

1997

- The dedicated line service was launched
- The first national high-speed internet service was launched
- The number of PC communication subscribers exceeded 3 million

1999

- **The number of Internet users exceeded 10 million**
- The IPv6 address was first assigned

2000

- The commercial ATM exchange network was opened
- The Korea ISP Association was founded

2001

- **Korea ranked first in the world in the implementation of high-speed networks (OECD)**

2002

- The number of high-speed internet subscribing households exceeded 10 million
- The penetration rate of high-speed Internet in Korea ranked the highest in the world

2003

- An Internet infringement accident occurred on January 25.

2004

- The number of internet users exceeded 30 million
- The BcN trial project was promoted

2005

- The ITU Digital Opportunity Index (DOI) ranked No 1 in the world.
- A trial in-flight Internet service was launched by Korean Air
- The international standard for 'WiBro' was established (IEEE)

2006

- Korea ranked No 1 in the world in the ITU Digital Opportunity Index (DOI)
- The FTTH (in-house optical cable) service was launched

2007

- Korea ranked No 1 in the world in the ITU Digital Opportunity Index (DOI)
- WiBro/Terrestrial DMB was selected as the international standard by the ITU

2008

- The number of high-speed internet subscribers exceeded 15 million
- The WiBro Wave2 service was commercialized, and its service coverage was expanded

1996

- The first basic plan for the promotion of informatization was established
- The Informatization Promotion Committee was created
- The Korea Information Security Agency Center was founded

1998

- The promotion plan for the advancement of the information and communication network was established
- Measures for the promotion of PC communications and Internet use were established

1999

- **Cyber Korea 21 was established**
- The Framework Act on Electronic Commerce and the Digital Signature Act were passed
- The Korea Network Information Center (KRNIC) was founded

2000

- The second stage of the high-speed information and communication network project was completed
- The Act on the Promotion of the Software Industry and the Act on the Management of Knowledge and Information Resources were passed
- The Personal Information Protection Guidelines were established
- The 11 initiatives for the e-Government were established
- The Korea IT Industry Promotion Agency was founded

2001

- **The Act on the Promotion of Information and Communications Network Utilization and Information Protection was enacted**

2002

- e-Korea Vision 2006 was established

2003

- Broadband IT Korea Vision 2007 was established

2004

- The IT839 strategy was established
- The basic plan for the implementation of a broadband convergence network (BcN) was established

2005

- The basic plan for the promotion of IPv6 distribution was established
- The government-run online name-verification system was introduced

2006

- **The basic plan for u-Korea was established**
- Measures to prevent the illegal use of others' names and hacking in online games were established
- The first Korea Internet Awards was held

2007

- The restrictive identity-verification system was introduced
- An alternative resident registration number system (i-PIN) was introduced
- The Korea IT International Cooperation Agency was founded

2008

- The Korea Communications Commission was created
- The OECD Ministerial Meeting on the future of the Internet economy was held
- The Internet Multimedia Broadcast (IPTV) Services Act was passed



- Korea ranked No 2 in the world in the ICT Development Index (2009)
- Korea ranked first place in both the UN e-Government Development Index and the Online Participation Index (2010)
- The number of smartphone owners exceeded 7 million (2010)

- Commercial LTE services were launched (2011)
- The 30th anniversary of the Internet in Korea was celebrated (2012)

- The number of Internet users in Korea exceeded 40 million
- IPv6 was commercialized
- Giga Internet was commercialized

2009 – 2010

2009

- The number of VoIP subscribers exceeded 6.5 million
- The number of mobile banking users exceeded 10 million

2010

- The number of IPTV real-time broadcasting service subscribers exceeded 3 million
- The number of smartphone owners exceeded 7 million
- The value of Wibro exports reached KRW 1 trillion

2011 – 2012

2011

- Commercial LTE services were launched by SKT/LG U+
- The 한국 domain service was launched
- The number of smartphone owners exceeded 20 million
- The number of online banking users exceeded 70 million
- The number of mobile banking users exceeded 20 million

2012

- The number of smartphone owners exceeded 30 million
- The number of IPTV service subscribers exceeded 6 million
- The number of LTE subscribers exceeded 15 million

2013 – 2014

2013

- The number of Internet users in Korea exceeded 40 million
- The number of domestic mobile messenger, KakaoTalk, users exceeded 120 million
- Domestic mobile messenger services began to enter the overseas markets (Line, etc.)

2014

- IPv6 was commercialized
- The number of IPTV service subscribers exceeded 10 million
- The number of LTE subscribers exceeded 36 million



2009

- Korea ranked the second highest in the world in the ICT Development Index
- The trial Giga Internet project was started
- A DDoS attack occurred on July 7

2010

- Korea ranked No 1 in the world in both the UN e-Government Development Index and Online Participation Index
- The infrastructure implementation project for the BcN was completed

2011

- Korea ranked No 1 in the world in the ICT Development Index (As of 2010)
- The LBS Business Support Center was founded
- Korea ranked No 1 in the world for number of wireless high-speed Internet subscribers per 100 persons (OECD)
- A DDoS attack occurred on March 4
- The assignment of IPv4 was terminated

2012

- The 30th anniversary of the Internet in Korea was celebrated
- The number of high-speed Internet subscribers exceeded 18 million

2013

- Korea ranked the No 1 in the world in the ICT Development Index (As of 2012)
- A DDoS attack occurred on March 20 (on financial institutions and broadcasting companies)
- The APT incident occurred on June 25 (with government and public institutions)
- Bidding for LTE frequency allocation was held

2014

- Giga internet was commercialized
- Korea ranked No 1 in the world in the UN e-Government Development Index for three consecutive years
- The dedicated IPv6 international line was connected
- Korea ranked the second highest in the world in the ICT Development Index



2009

- The Korea Internet and Security Agency was founded
- The mid- and long-term development plan for the broadcasting and communication network was established
- The first and second promotion plans for wireless Internet activation were established
- The 36th ICANN Regular Meeting was held in Seoul
- The comprehensive plan for cloud computing activation was established

2010

- The 118 Counseling Service was created
- The promotion plan for IPv6 transition was established
- The Internet Cooperation Forum was founded
- The comprehensive plan for the promotion of the online advertising market was established
- The Korea Internet Stars was founded

2011

- The promotion plan for promotion of NFC-based mobile smart life services was established
- The pan-governmental cloud computing policy council was created
- The Personal Information Protection Act was passed
- The certification system for mobile ad platforms was introduced

2012

- The Korea Internet Governance Alliance was founded
- Information Security Day was designated (the second Wednesday in July)

2013

- The Phishing Response Center was created
- The Ministry of Science, ICT, and Future Planning was established
- The amendment to the Information and Communications Network Act was passed
- The Internet Startup Alliance was founded
- Guidelines for Internet Search Services were announced

2014

- The ITU Plenipotentiary Conference was held in Busan
- The Korea Internet Governance Alliance was founded
- The IoT Innovation Center was opened
- The Comprehensive IPv6 Support Center was opened
- The collection of resident registration numbers was banned by the Personal Information Protection Act
- The TFT for the improvement of e-commerce regulations was organized

- The number of online banking users exceeded 110 million
- The number of wireless communication service subscribers exceeded 55 million
- Korea ranked the No 1 in the world in the ICT Development Index
- The mid- and long-term plans for an intelligent information society in response to the Fourth Industrial Revolution was announced

- Korea's penetration rate of smartphones ranked the highest in the world at 87.8%
- The development strategy for blockchain technology was established
- The 5G network was commercialized for the first time in the world
- The number of Kakao Bank users reached 12 million
- The world's first AI consultative organization, GPAI, was founded

- Rules for information protection during work-from-home, remote work, and remote learning were announced

2015 – 2016

2015

- The number of online banking users exceeded 110 million
- The number of high-speed Internet subscribers exceeded 20 million
- The number of LTE subscribers exceeded 41 million
- The value of the Korean game market exceeded KRW 10 trillion

2016

- The number of wireless service subscribers in Korea exceeded 55 million
- Go match between AlphaGo and Lee Sedol was held
- Among the elderly, aged 60 or older, the rate of internet use reached 51.4% and the number of internet users exceeded 5 million
- The first internet-only bank in Korea, KBank, was founded, and its number of customers exceeded 300,000
- The value of mobile e-commerce transactions reached KRW 35.5 billion, surpassing the value of PC shopping
- Gachon University Gil Medical Center opened its AI Cancer Center

2017 – 2019

2017

- Internet-only banks were opened
- Korea's penetration rate of smartphones ranked the highest in the world at 87.8%
- The daily average count of simple money transfer services was 682.5, increasing by 375.8% from the previous year

2018

- The number of internet-only bank customers reached 7 million, and their total amount of loans reached KRW 8 trillion
- The number of Toss subscribers exceeded 10 million (October), and it became Korea's first Fintech unicorn company (December)

2019

- Korea's penetration rate of smartphones ranked the highest in the world
- The rate of video service use reached 81.2%
- The volume of the domestic O2O service market reached KRW 2.9 trillion

2020 – 2021

2020

- The number of 5G mobile communication subscribers exceeded 10 million
- Korea introduced the world's first free city-bus Wi-Fi services
- The rate of online banking use reached 76.5%

2021

- Naver metaverse platform "ZEPETO" exceeded 250 million people
- The volume of domestic metaverse industry market exceeded \$870 million



2015

- Korea ranked first in the OECD Open-Useful-Reusable Data Index
- Korea ranked first again in the ICT Development Index
- The plan for the distribution of 700MHz frequencies was confirmed
- The internet speed in Korea ranked No 1 in the world for seven consecutive quarters
- The Korean team won first place in the DARPA Robotics Challenge
- The Korean team won first place in the hacking competition DEF CON

2016

- Korea ranked No 1 the world in the ICT Development Index for two consecutive years
- A network for a trial 5G service was implemented for the first time in the world
- The internet speed in Korea ranked No 1 for 13 consecutive quarters
- The dedicated network for IoT (LPWA) was implemented across the nation
- The commercialization of IPv6 in the domestic mobile networks was completed
- The open Fintech platform was created jointly by financial institutions

2017

- The number of internet users (age 3+) exceeded 45.28 million, and the rate of internet use exceeded 90.3%

2018

- The 10-Giga internet was commercialized

2019

- The world's first 5G service was commercialized (April)
- The volume of the domestic O2O service market reached KRW 2.9 trillion

2020

- The 6G R&D Strategy was announced
- Korea ranked second in the world in the UN e-Government Development Index
- The Open Cloud Platform Center was created



2015

- The K-ICT Strategy was established
- The Cloud Computing Act was passed
- The Act on Promotion of Information Security Industry was passed

2016

- The mid- and long-term plans for an intelligent information society in response to the Fourth Industrial Revolution were announced
- The requirement for Information Security Management System (ISMS) certification was extended to medical and educational institutions
- The Fintech Security and Authentication Technology Support Center was created
- The Cybersecurity Alliance for Mutual Progress (CAMP) was founded
- Mobile app accessibility guidelines 2.0 (KS X 3253:2016) were established as Korea Communications Standard (KCS)
- The robo-advisor testbed was launched
- The development strategy of the IoT for home appliances was announced

2017

- The Fourth Industrial Revolution Committee was founded

2018

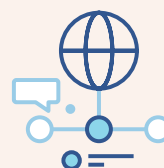
- The development strategy for blockchain technology was established

2019

- The government announced its Plan for Boosting Data and AI Economy
- The ICT Regulatory Sandbox was created
- The plan for reinforcing competitiveness in materials, components, and equipment was announced

2020

- The revised bills for three data-related laws were passed in the National Assembly
- The revised bill for the Framework Act on Intelligent Informatization was passed
- The comprehensive plans for the Korean New Deal – Digital New Deal were announced
- The digital service contract system was launched



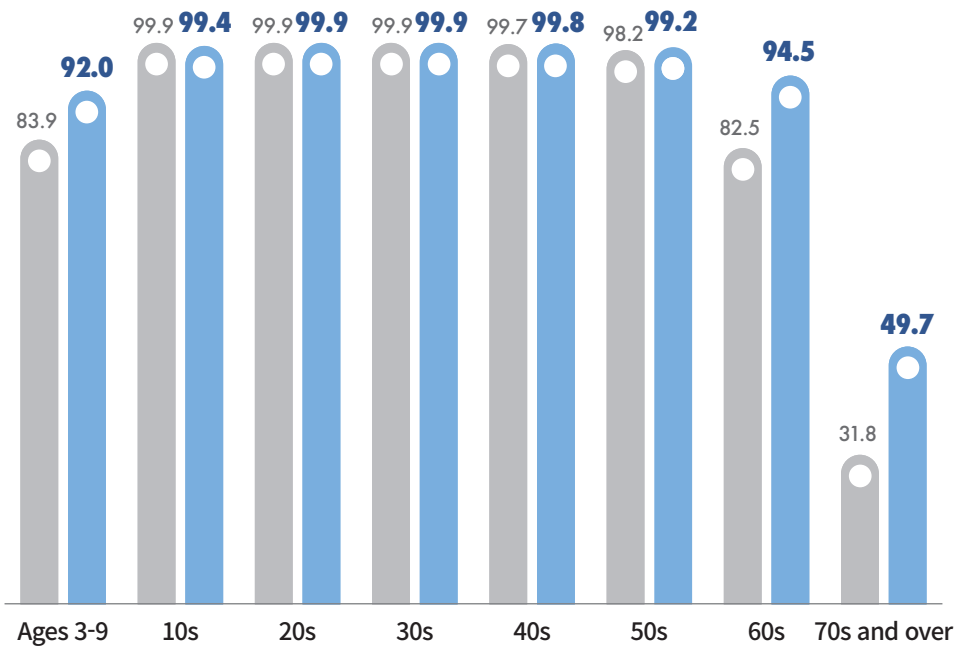
How much do Koreans use the internet?



Internet use rate by age group

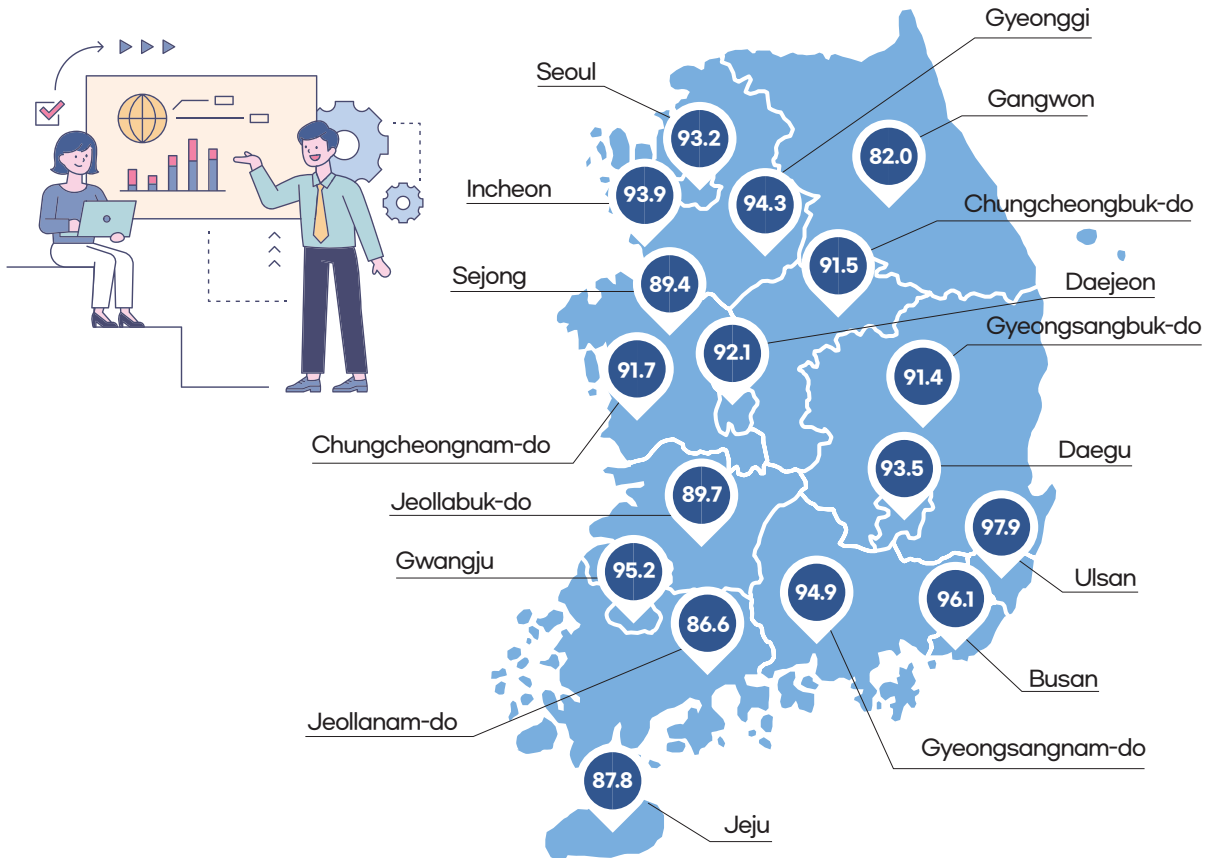
● 2017 ● 2021

The internet use rate among the elderly (in their 60s and older) has increased over the past five years.



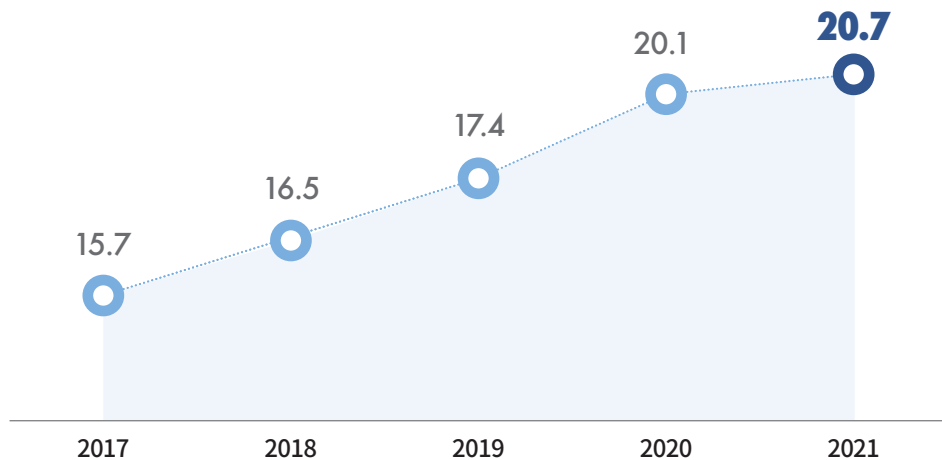
Internet use rate by region Ages 3 and over

In 12 out of 17 cities/provinces in Korea, the internet use rate is 90% or higher.



Hours of internet use Internet users aged 3 and over

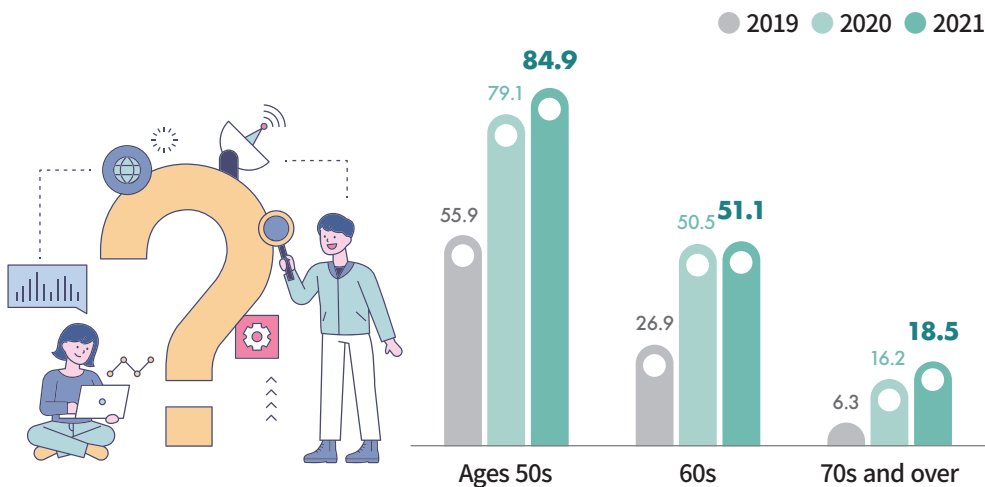
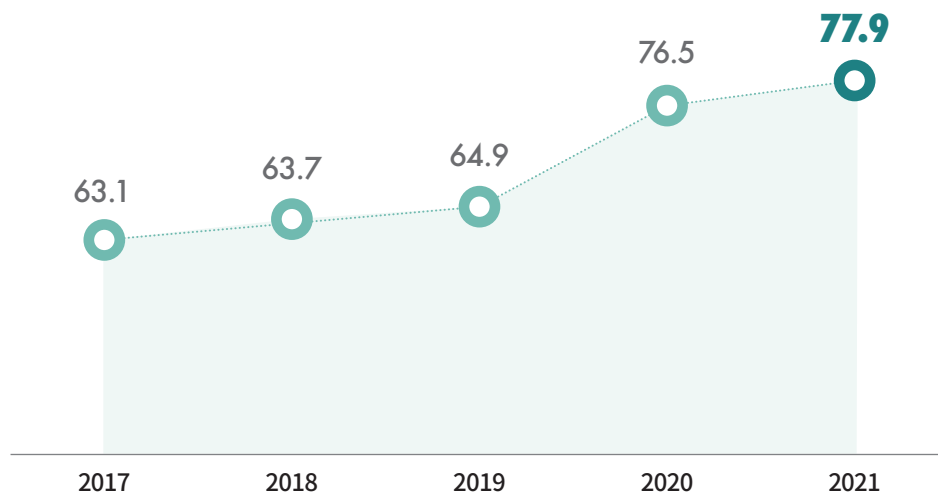
The hours of internet use increased by 5.0 hours compared to 2017.



What kinds of services do internet users seek out?

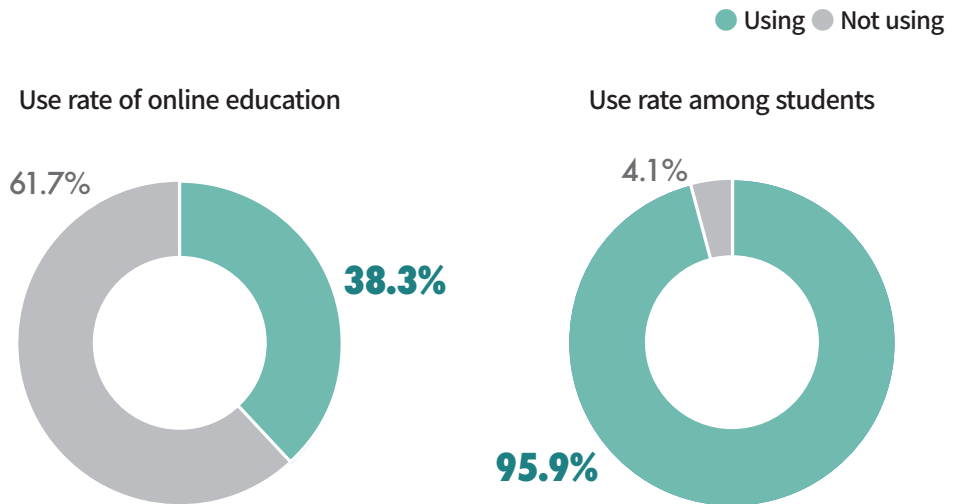
Use rate of internet banking Internet users aged 12 and over

The use of internet banking drastically increased after the COVID-19 outbreak.



Use rate of online education Internet users aged 3 and over

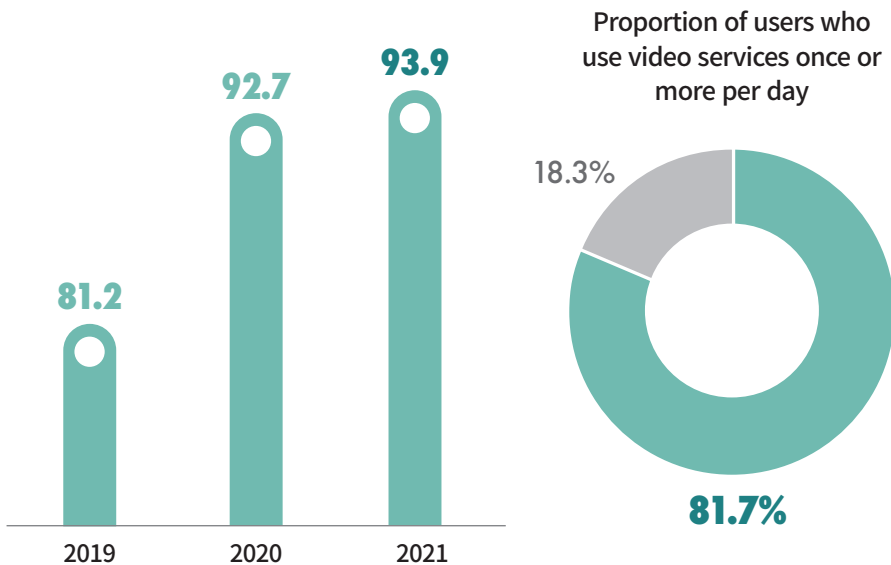
The use of online education is 38.3% among all citizens, while it is 95.9% for students.



Use rate of video services Internet users aged 3 and over

The use rate of video services has continuously increased over the past three years.

The proportion of users who use video services once or more per day is 81.7%.



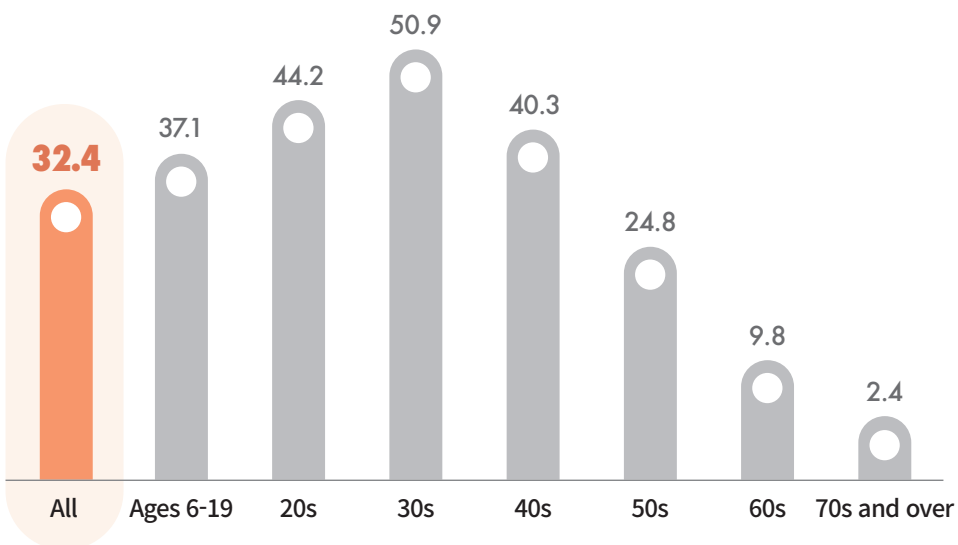
Where are people using new internet technologies?



Use rate of AI services by age group Internet users aged 6 and over who used the internet within the past year

The use rate of AI services among all citizens is 32.4%.

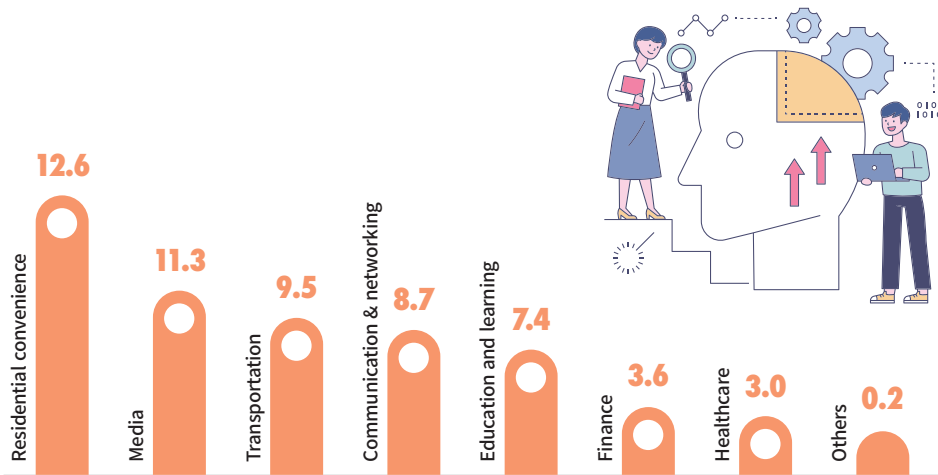
Individuals in their 30s represent the age group that uses AI services the most.



Areas of AI service experiences

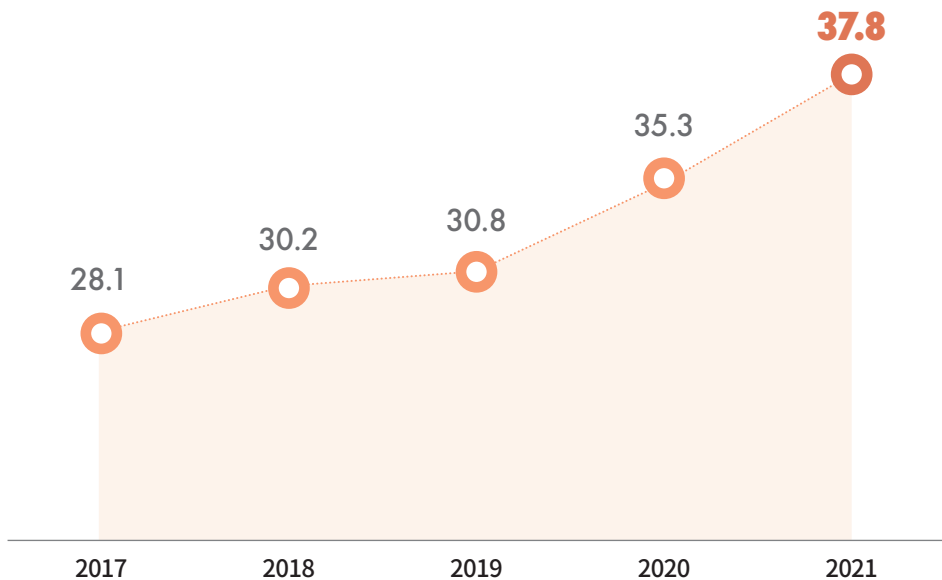
Internet users aged 6 and over who used the internet within the past year

The area of AI services that Koreans use most is residential convenience.



Use rate of cloud services Internet users aged 12 and over

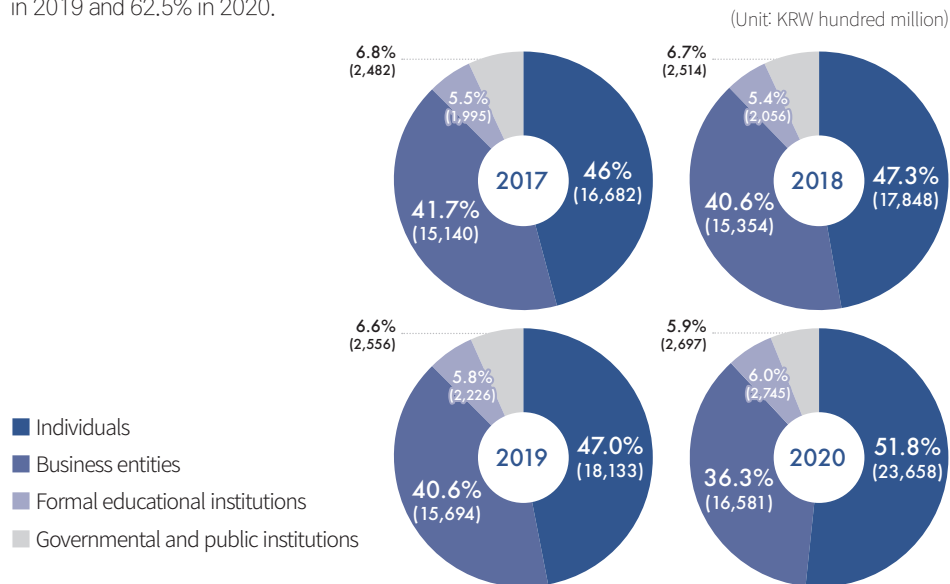
The use rate increased 9.7%p compared to 2017.



Trends in the market size for online education and e-learning



Following the growing demand for e-learning for individuals and for formal educational institutions, the use rate has been continuously increasing annually from 59.0% in 2018 to 59.2% in 2019 and 62.5% in 2020.

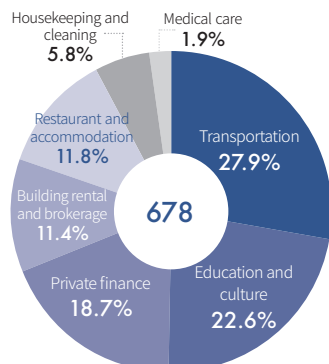


Source: National IT Industry Promotion Agency, 2020 e-learning Industry Factual Survey Report, 2021

Status of O2O service enterprises



After the COVID-19 outbreak, a variety of connections necessary for maintaining our daily lives moved online, making O2O a universal aspect of our lives and not just a distinct service anymore.



Number of companies by service area in 2020

- Entertainment, sports, culture, and education services: 189
- Transportation services: 153
- Personal beauty, finance and insurance, and other services: 127
- Restaurant and accommodation services: 80
- Building rental, brokerage, and maintenance services: 77
- Washing, cleaning, and housekeeping services: 39
- Medical and health services: 13

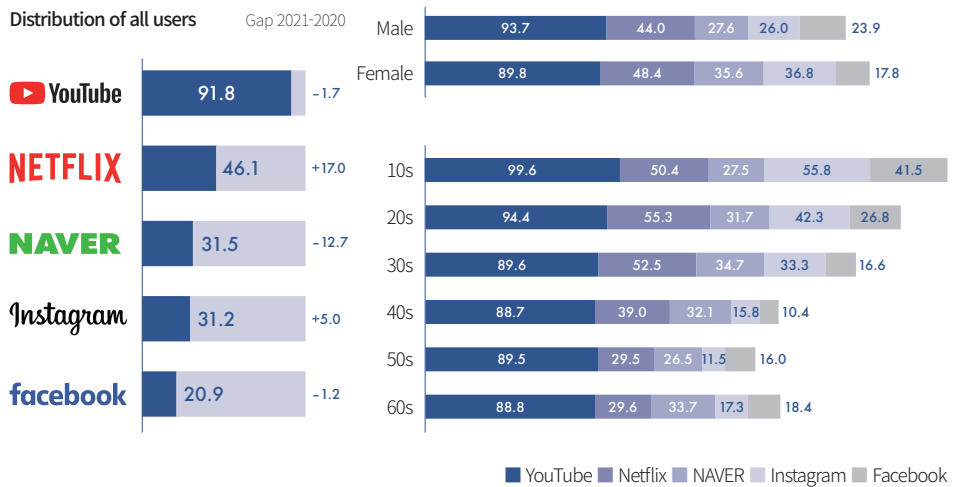
Source: Ministry of Science and ICT, 2020 Online/Offline Integrated (O2O) Service Industry Research, 2021

Distribution of online-video viewers



In 2021, platform services for communication through video content remained strong.

(Unit: %)



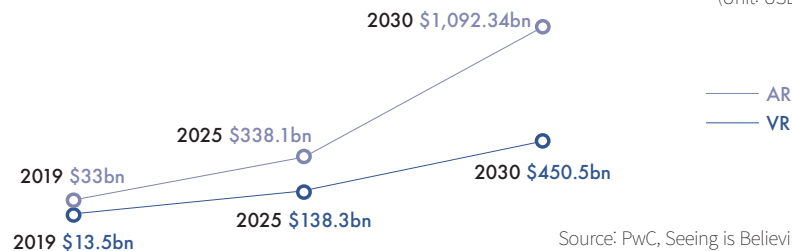
Source: Nasmedia, 2021 Internet User Survey, 2021

Prospects of the global metaverse-related technology market [AR·VR]



The size of AR and VR (metaverse-related technologies) is expected to continue showing a growing trend, which started in 2019.

(Unit: USD billion)



Source: PwC, Seeing is Believing, 2019

Demand prospects for new digital-technology personnel (2020~2024)



Companies are utilizing ICT technologies as a key tool for digital transformation, beyond simple use. As a consequence, the demand for software professionals is skyrocketing not only among ICT companies but also among general companies.

(Unit: Thousand persons)

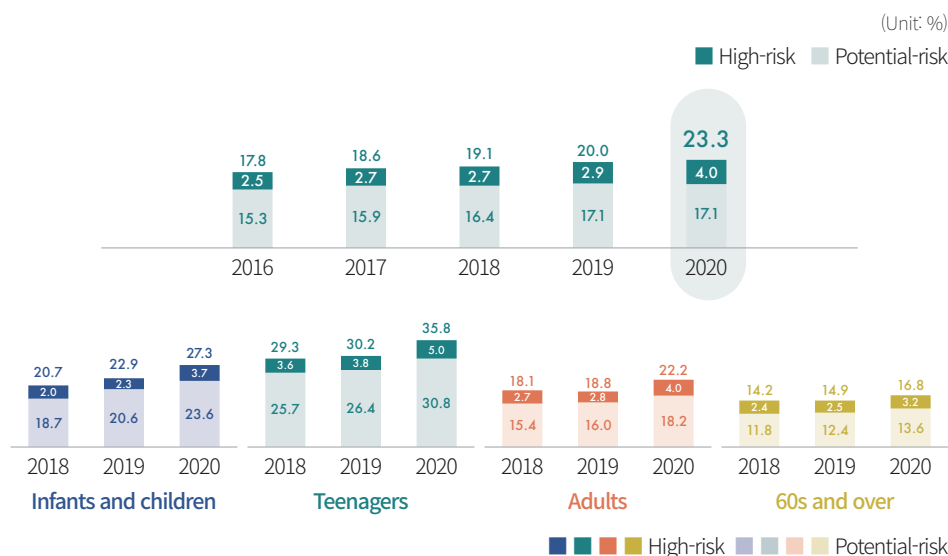
Category	AI	Big data	Cloud	5G	IoT	Sum
All	41.3	56.8	17.0	42.4	19.7	177.2
High	18.0	16.3	1.9	19.9	10.0	66.1
Intermediate	20.6	28.8	13.2	22.5	7.5	92.6
Beginner	2.7	11.7	1.9	0.1	2.2	18.6

Source: Korea Research Institute for Vocational Education and Training,
Demand Prospect of New Digital-Technology Labor Forces, 2020

Status of smartphone-overdependence risk grouped by year and by target



According to the survey in 2020, 23.3% of smartphone users fell into the overdependence risk group (high-risk group + potential-risk group). This is a drastic increase from 20.0% in 2019.

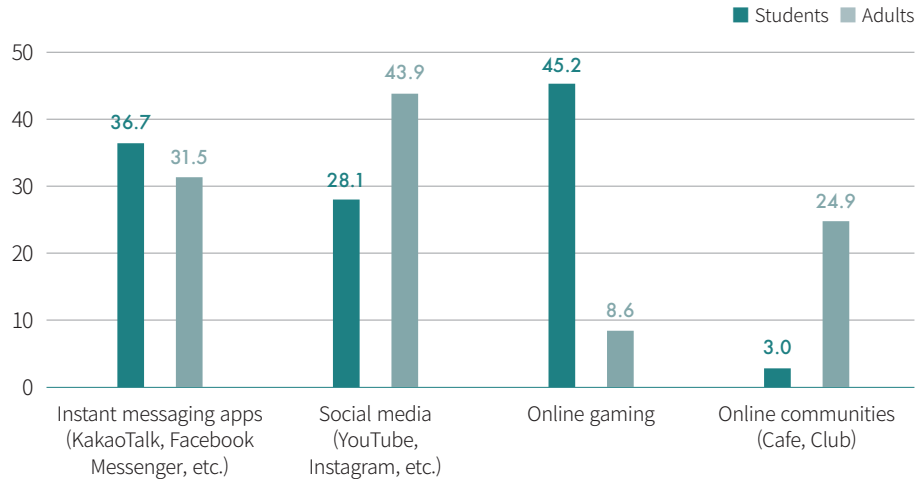


Source: Ministry of Science and ICT, National Information Society Agency,
2020 Smartphone-Overdependence Factual Survey, 2021

Where online violence occurs



After the COVID-19 outbreak, the duration of use for online services, such as watching free online videos, doing online searches, playing games, and browsing social media, increased, and these are spaces where online violence frequently occurs.

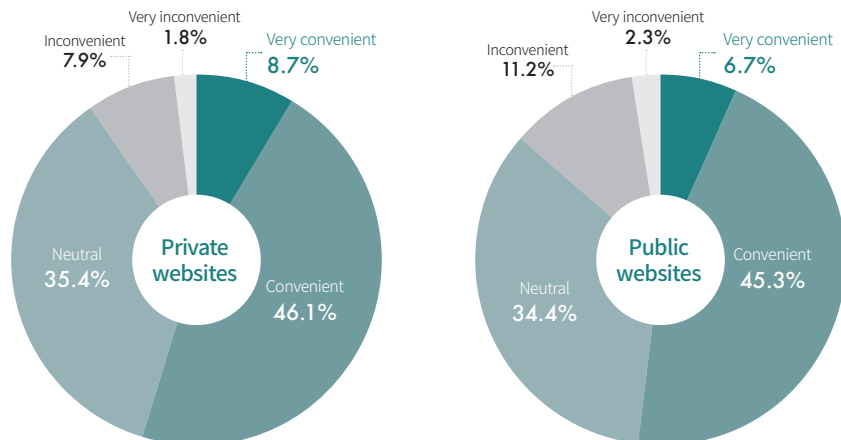


Source: Korea Communications Commission and National Information Society Agency, 2020 Online Violence Factual Survey, 2020

Results of Survey on Improvement of Internet Use Environment, compared to the previous results



It was shown that, thanks to the Korean government's efforts regarding plugin improvement, users recognized actual improvements in the internet use environment to an extent.



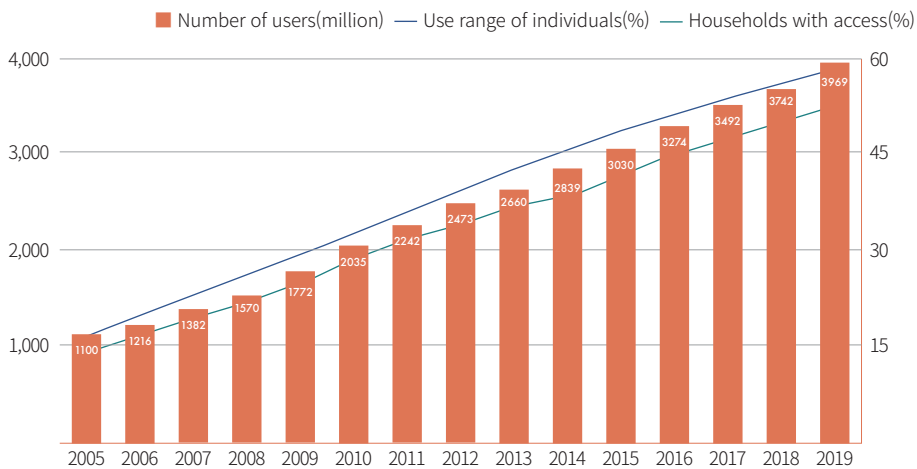
※ ▲ Private websites: "Convenient" 54.8%, "Still inconvenient" 9.7%,
 ▲ Public websites: "Convenient" 52.0%, "Still inconvenient" 13.5%

Source: Korea Internet & Security Agency, 2020 Survey on Improvement of Internet Use Environment in Korea, 2020

Number of households with access to the internet, number of users, and use rate (2005-2019)



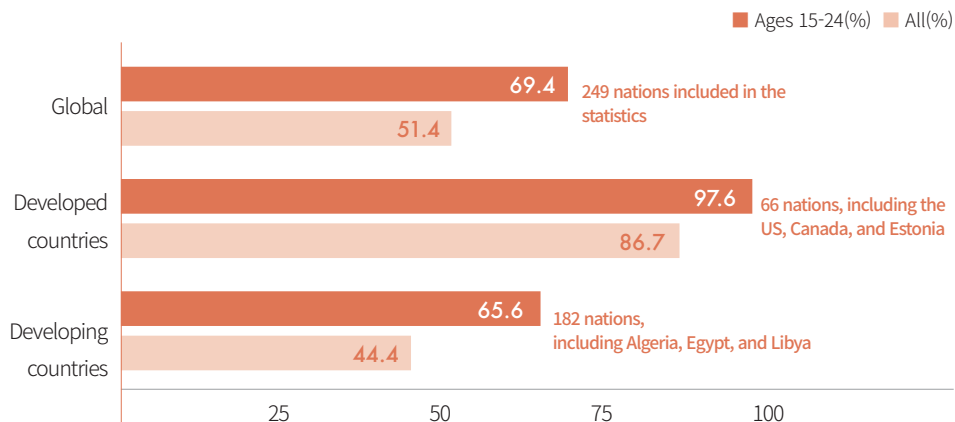
According to the statistics from November 2020, gathered by the International Telecommunication Union, 51.4% of the global population (roughly 3.97 billion persons), uses the internet.



Internet use rate by generation



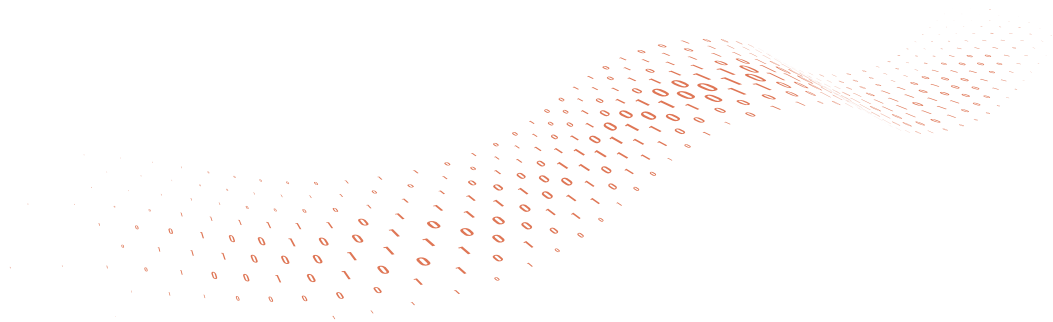
It was found that the internet use rate for Generation Z, with its members born in 1997 or later and now falling between 15 and 24 years of age, is significantly higher than for the total population.



* Classification of nations is done by the ITU according to the classification criteria by the UN.

* According to the nation-classification criteria (M49) for UN statistics, the classification between developed and developing countries was deleted in December 2021.

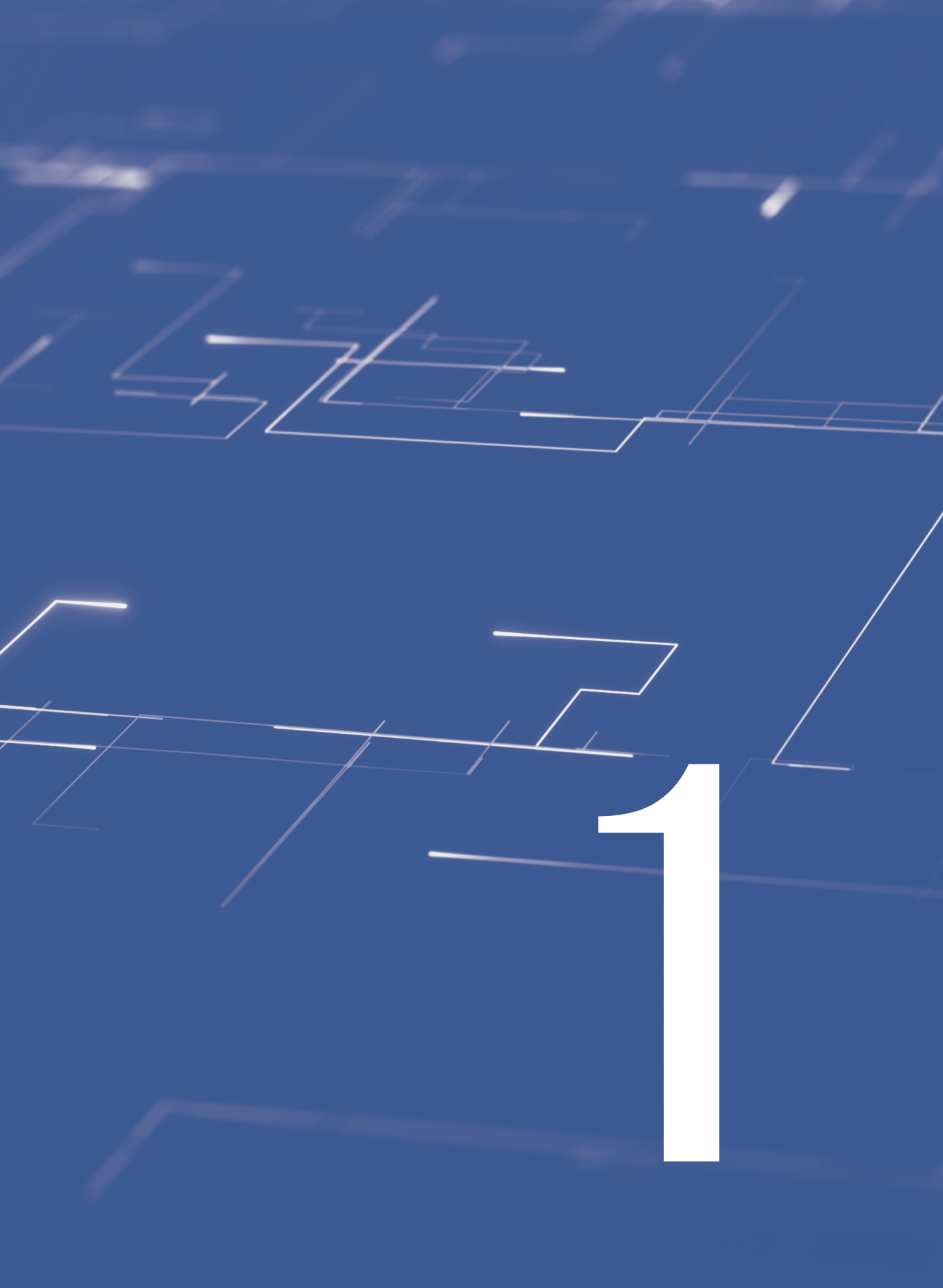
2021
KOREA
INTERNET
WHITE
PAPER



Technology and Service

Chapter 1 **Internet Convergence Technology**

Chapter 2 **Service**

The background is a solid blue color with a pattern of thin, white, geometric lines. These lines are arranged in a way that suggests a perspective view of a grid or a series of interconnected planes, creating a sense of depth and architectural structure. The lines are mostly horizontal and vertical, with some diagonal lines intersecting them.

1

Chapter 1

Internet Convergence Technology



Section 1 **Artificial Intelligence**

Section 2 **Cloud**

Section 3 **Internet of Things**

Section 4 **Blockchain**

Section 5 **Metaverse**

Section 1 **Artificial Intelligence**

Deep learning, which started gaining notice with its technical achievements by industry and academia just about five or six years ago, has become a keyword for the Fourth Industrial Revolution. Governments of nations around the world are mapping out their strategies to lead AI technologies in step with the Fourth Industrial Revolution era.

1. Trends by nation

A. Rapid industrial growth caused by the COVID-19 pandemic

Looking at the number of AI-related institutions by nation, the US and China rank first and second, respectively, followed by the UK, India, and Korea. In almost all nations, the private sector takes the lead, but in China, governmental institutions and research institutes are leading R&D activities for AI. AI technologies are mostly employed in manufacturing, construction, whole and retail sales, IT, and professional activities, and their portions are similar to the portions of major industries in each nation.

2. R&D in academia

Despite the difficulties in cooperation for R&D due to the COVID-19 pandemic, studies in the AI field have been very lively. The number of papers on AI technologies has been growing annually and, as a result, it is expected that about 60,000 papers will have been registered to the scientific paper repository archive by the end of 2021. The number of AI-related papers increased from 6,466 in 2015 to 43,677 in 2020 (meaning roughly seven times).

3. Trends in AI technology

A. AI market

The size of the AI market is expected to reach USD 190 billion in 2025. It is forecast that the greatest growth will be witnessed in the Asia-Pacific region and that China will emerge as one of the leaders in the field of AI technologies. According to the responses, the biggest difficulty in market entry is a lack of trained personnel, and 93% of field engineers felt that they were not prepared to embrace new technologies. Enterprises chose a lack of technical experts (56%), fear of technical ignorance (42%), and difficulty in pinpointing the timing of technology adoption (26%) as major difficulties.

B. Application of AI technologies

AI technologies are actually creating economic value. An exemplary case is Netflix's content-recommendation service using AI, which is creating USD 1 billion in revenue every year. At 54%, the majority of management personnel thinks that introducing AI improves productivity. For consumers, the most frequently used type of AI technology is voice assistants. The use of digital assistants around the globe is expected to double by 2024. It was found that the most promising application of AI assistants is for customer management (chatbots, behavior prediction, and personalization) in the retail industry.

C. Jobs and AI

In this case, 38% of respondents feel that AI will take away their jobs within the next three years, and even experts forecast that 16% of jobs will disappear in the US alone due to AI. On the other hand, 63% of CEOs of US enterprises expect that AI will have a positive impact on jobs. In reality, 43% of manufacturers are hiring new data scientists and data-quality analysts, and 35% answered that they are planning to hire additional personnel in such fields within the next five years.

D. Noteworthy AI technologies

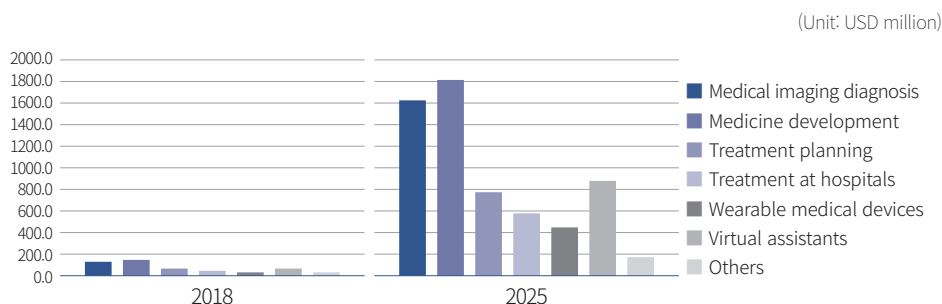
It is fair to say that the two biggest achievements in the AI field this year are GPT-3 and AlphaFold 2. GPT-3 is a deep-neural-network model developed for language learning, and by revolutionarily upgrading the level of the machine-learning model that reads, comprehends, and writes text, it contributed greatly to implementing a more human-oriented human-machine interface (HMI). Meanwhile, AlphaFold 2 is recognized for providing an innovative breakthrough in calculating the three-dimensional protein structure of amino acids. It is expected that the process of understanding diseases and producing cures will be significantly accelerated.

4. Future trends

A. Healthcare

To improve the quality of automated services, such as classification or diagnosis of diseases and determination of when to go ahead with outpatient treatment or medical checkups, application of AI technologies is urgent. The development of technologies like Google Deep Mind's AlphaFold 2 (mentioned above) is expected to shorten the period required for developing new medicines, and in the field of diagnostic radiology, AI technologies can help quickly and accurately identify diseases through X-rays or MRI images.

[Figure 1-1-1-1] Market value of AI technologies in the medical-service market



Source: Elinext.com, AI In Healthcare 2020: The Most Riveting Use Cases of Today and the Nearest Future, 2020

B. Voice and language processing

One of the biggest changes that the pandemic brought with it in 2020 was the non-contact trend. To respond to the prolonged pandemic, companies and schools had to adopt non-contact methods, such as e-commerce and remote classes. In addition, as voice and language-processing technologies become more sophisticated with deep learning, the market for non-contact services using more human-friendly HMI has been growing. Between 2018 and 2020, the number of users of voice assistants in the US increased by 103%.

Non-contact voice and language-processing services are used in various ways in the healthcare field, such as for FAQ chatbots, virtual assistants, chatbot therapists, and customer agents for remote treatment. The market for voice-recognition technology is expected to reach about USD 27 billion in 2025. In the future, voice-assistant technologies will be able to provide user-customized services in more proactive manners and will have greater impacts on customized services for children and the elderly.

C. Cloud

Due to the COVID-19 pandemic, many companies are changing their business models to attain “Anywhere Operations.” It is cloud services that technically back up this change, and implementation of AI technologies also depends on cloud services. Voice assistants, including Apple’s Siri, Google Home, and Amazon’s Alexa, cannot perform voice-recognition tasks with their own operations alone. AI and cloud services are inseparable and go together like a needle and thread. The cloud industry has been launching cloud-based AI platforms (AIaaS) that allow inexpensive and fast use of the whole process from data collection and implementation of a machine-learning model to learning and services. Technavio, a market-research agency, forecast that the AIaaS market will grow to USD 15 billion by 2024.

Section 2 Cloud

1. Overview

Cloud computing is a type of service in which a company does not build or own any information system by itself but uses computing resources when needed and pays for this use.

[Table 1-1-2-1] Characteristics of cloud computing

Characteristics	Description
On-demand self service	Users are provided with computing resources, such as server time and network storage, when needed on their own and without requiring interactions with service providers, which is called provisioning. ¹
Wide-range network access	Regardless of devices, users can have access through a network in the standard access process.
Resource pooling	Using the multi-tenant ² model, the information resources from the provider are pooled ³ to provide services to many consumers and, upon consumer requests, various physical and virtual resources are dynamically allocated and reallocated.
Elasticity	From the perspective of consumers, the available information resources are limitless, and the information resources are provisioned automatically in a quick and elastic way and can be expanded or reduced.
Measurement service	A cloud system can control and optimize the use of resources automatically using measurement functionality and can monitor, control, and report resource usage, guaranteeing transparency for both providers and consumers of the service.

Source: NIST, 2009

The most basic cloud computing available for enterprises is IaaS (Infrastructure-as-a-Service). IaaS provides network and storage resources on demand for consumers and uses pay-as-you-use billing. In contrast, PaaS (Platform-as-a-Service) allows use of a complete platform (hardware, software, and infrastructure) capable of developing, executing, and managing applications through cloud computing instead of building and maintaining a platform on the premises.⁴

¹ Allocating, deploying, and distributing system resources upon user requirements in advance and, by doing so, having a system immediately available when needed

² A single software instance operates on a single server and services multiple tenants

³ Environment where physical and virtual resources are dynamically allocated

⁴ Way of installing software directly on a server for use

Companies use IaaS or PaaS for cloud storage to test or develop programs, analyze big data, and store files that are accessible through a web-based interface for storage or browsing or as a backup for disaster recovery. Furthermore, companies not only can use public cloud services for execution of applications and operations but can also connect them with their own cloud services on the holding on-premise system in a single process.

2. Brief status

A. Policy trends

After the enactment of the 「Cloud Computing Act」 in September 2015, the Korean government promoted relevant policies to foster the cloud computing industry and, by doing so, built an ecosystem for the industry's global competitiveness, such as establishing the cloud-security certification system and launching cloud-support programs for SMEs, according to the 1st Phase Basic Plan between 2016 and 2018. According to the 2nd Phase Basic Plan, between 2019 and 2021, the central and local governments were allowed to use private clouds, and efforts were made to extend practices of supporting development of cloud services in the private sector, such as manufacturing and medical services. As a result, the number of public institutions that use private clouds significantly increased from zero in 2015 to 187 in 2019.

B. Status of the Korean market

The domestic market for public cloud services in Korea has extended to various areas since the necessity of cloud computing for enterprises was recognized in 2019. In particular, the demand for security services has greatly increased to KRW 1.3 trillion, signifying a 25.2% increase from the previous year. In 2020, the demand for cloud computing and SaaS including cloud-based work solutions, such as remote work and video conferencing, and automation increased to KRW 1.95 trillion, marking a 25% increase compared to 2019, as these are key aspects of non-contact technologies, which became widespread due to the COVID-19

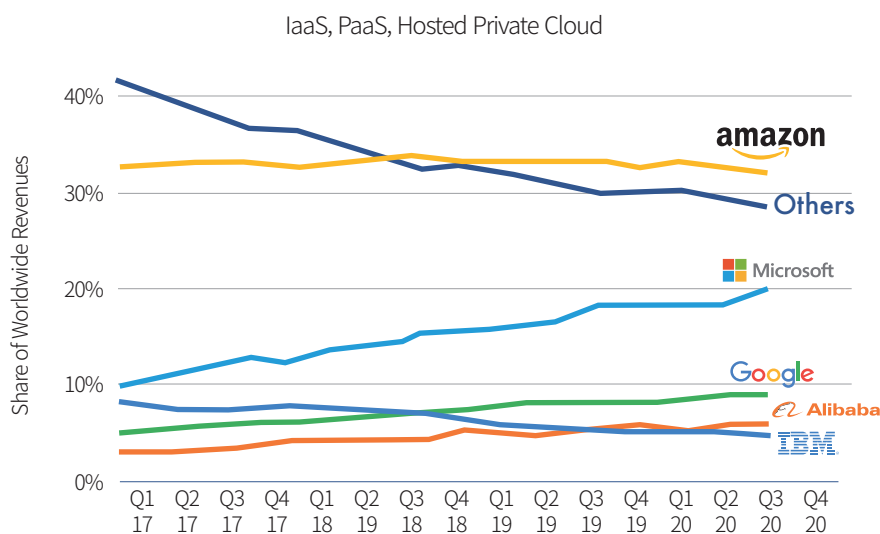
pandemic (IDC).⁵

C. Status of the global market

The global market for cloud computing has also been showing continuous growth trends. It is estimated that the public cloud market is worth USD 304.9 billion in 2021, an 18.2% increase from the previous year, and will be worth USD 362.2 billion in 2022, predicting an increase of 18.7% (Gartner Group). It is also forecast that, as the cloud computing market continues to grow, its portion of the IT market will grow from 9.1% in 2020 to 14.2% in 2024.

Looking into the share of the global public cloud market, Amazon ranks first, at 33%, followed by Microsoft (18%). China's Alibaba and Tencent rank 4th and 7th, respectively, and have experienced significant rises. The growth of the hybrid cloud market accelerated Microsoft's growth, and it was found that Amazon's AWS holds 77 available zones across 24 regions.

[Figure 1-1-2-1] Cloud market share



Source: Synergy Research Group, Cloud Market Ends 2020 on a High while Microsoft Continues to Gain Ground on Amazon, 2021

As the share of trial application of MS Azure increases, the gap between AWS

⁵ <https://zdnet.co.kr/view/?no=20210106104027>

and Azure is narrowing, and looking into the charges paid by enterprises to public cloud providers, 58% of enterprises are paying USD 1.2 million or more per year to AWS, 48% are paying USD 1.2 million or more per year to Azure, and 32% are paying USD 1.2 million or more per year to Google.

3. Future prospects

Cloud computing is changing from an optional to essential service. Amid the changed business environments due to the COVID-19 pandemic, the capability of an enterprise to adapt itself quickly to the digital economy is recognized as a determinant of the enterprise's success or failure, and it is forecast that agility, flexibility, and service elasticity using cloud computing will have an impact on this. Considering the motives of changes to the cloud, such as IDC, it is expected that future cloud services will come with the growing importance of AI or machine-learning-based services and the extended multi-cloud phenomenon.

To date, companies have used IaaS-based services with the objective of increasing cost efficiency and improving stability in IT maintenance, but there are now growing demands for AI, big-data analysis, etc., to differentiate and improve the efficiency of services and businesses. Furthermore, the trend of multi-clouds, where a single company uses two or more cloud computing services, is being accelerated.

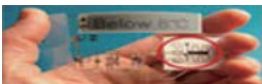
Section 3 Internet of Things

The Internet of things (IoT) is an infrastructure and ICT-converged technology that enables exchanges of information between objects, spaces, and humans through interconnection on the Internet and without direct human intervention. By doing so, it can provide more intelligent services.

1. Results and achievements

Beyond the concept of interconnection and communication between things, IoT extends its coverage to application services capable of utilizing information linked on the Internet and performing interactions. In particular, as it is integrated with AI technologies, intelligent IoT, or Artificial intelligence of things (AIoT), is being introduced into our daily lives, starting with smarter home appliances.

[Table 1-1-3-1] IoT-integrated products and services

Classification	2018	2019	2020	2021	2022	2023
Service	Emergency-rescue-system service	Data-centered smart city		Task-centered public IoT service		Autonomous-sensing service
						
Product	Intelligent IoT device	Micro-size disposable IoT device		Complex environmental sensor	Multiple-imaging sensor	Digital-functional twins
						
	Open-standards IoT-device software	Micro-size radar-safety-management system	Edge GW	Light-data analyzer	Autonomous GW	Object-cooperation intelligence
						

Source: IITP, Technology Roadmap 2030, 2018

2. Brief status

The COVID-19 pandemic in 2020 contracted consumption across all sectors. In particular, as IoT was considered lower priority in terms of urgency and required a large-scale infrastructure investment due to its business characteristics, the overall investment showed a decreasing trend, especially regarding the sales of IoT-applied electronic products, such as autonomous cars, which decreased by 3%. On the other hand, IoT in the field of medical services recorded two-digit growth in 2021.

A. Policy status

1) Global status

The German government launched “Industry 4.0” ahead of other nations and is working on resolving medical, climate, environmental, security, and social problems using AI and IoT under the “Advanced Technology Strategy 2025.” The EU, under the “2030 Digital Vision,” is pursuing digital transformation of businesses and digitalization of public services using IoT and 5G technologies and is accelerating the development of solutions as society and related enterprises are preparing a digital-innovation framework. The US has promoted smart city programs and developed national IoT strategies to trace exercise habits, sleep behaviors, and overall health indicators using IoT devices, such as smart temperature-control devices, and is generating data to respond to the pandemic. Meanwhile, Japan is presenting AI strategies and regulation reforms to implement Society 5.0 in order to expand the achievements and promote digital transformation. China emphasized integration of IoT and AI technologies into the manufacturing industry and advancement of the industry in the government’s work report and advanced-technology development plan and announced a 10-trillion-yuan investment plan by 2025 into 5G, big data, and advanced ICT technologies to respond to the COVID-19 pandemic.

2) Status in Korea

The Korean government defined the Fourth Industrial Revolution as a super-connected intelligence revolution and started the world’s first commercial 5G mobile-communication-network service, which is the infrastructure required for super-connected intelligence, in 2019. The country’s existing isolated IoT policy

evolved into an ICT-integrated social and economic problem-solving policy through integration with 5G technologies, and its effectiveness has been proven in the time of the COVID-19 pandemic. The isolated IoT policy was established and executed in the R&D phase, but in the application phase, service creation through integration of other technologies and innovative business and service policies are required. Gartner predicted that, by 2022, more than 80% of enterprises' IoT businesses will include AI technologies. In line with that, Korea is also promoting projects and preparing policies to develop AIoT technologies and foster related industries.

B. Technology and industry status

The service fields where newly emerging AIoT technologies are being applied include autonomous cars, drones, robots, and so on. As integration with AIoT technologies extends and businesses in different industries are interconnected, more diverse values are created in a more effective way. Smart homes, smart grids, smart cars, smart transportation, and smart environments are being combined to evolve into a large-scale service: smart cities. Furthermore, the addition of IoT to manufacturing and distribution not only improves productivity but also enables effective inventory management, resulting in relatively high profits.

3. Future prospects

The full-scale 5G service can contribute to implementation of IoT services by resolving cost issues in connecting a number of sensors. It accelerates the introduction of IoT technologies into industries and lowers the prices of sensors, enabling real-time intelligent personalized services. The growth of IoT technologies is in full swing. In particular, in response to the COVID-19 pandemic, applications to the field of medical services were accelerated. Based on AIoT technologies where IoT technologies and AI technologies are combined, further industrial growth and development are expected in fields related to the Fourth Industrial Revolution.

Section 4 Blockchain

Blockchain-based virtual assets have drawn global attention, and blockchain technology is used even in identification. Many nations and enterprises consider blockchain the next-generation key infrastructure and are promoting a variety of related policies and projects. In Korea, as well, diverse policy supports are being provided for fostering blockchain technology and related industries, and based on those supports, the blockchain technologies are entering the regular expansion phase.

1. Results and achievements

As diverse data-based application technologies are developed in the Fourth Industrial Revolution era, blockchain technology has emerged as a key technology capable of giving data reliability. In the earlier stage, blockchain technology was used for virtual assets, and between 2018 and 2019, it has turned into distributed data-management technology. Since the accredited-certificate system was abolished, following the enforcement of the revised 「Digital Signature Act」 in December 2020, decentralized identity (DID) services have been gaining attention.

A. Policy status

1) Global status

China has blockchain policy in place in its main regions, such as Beijing and Hainan. Meanwhile, Germany listed the pilot projects including digital identity management and the digital economy in September 2019 and announced a draft bill for blockchain-based stock issuance in October 2020, defining that blockchain-based electronic stocks have the same value as existing stocks. In January 2021, the EU and European Central Bank organized a digital-euro working group to discuss policy, legal, and technical issues for the introduction of digital euros.

2) Status in Korea

The Korean government announced the “blockchain-technology development strategy” in June 2018 and put efforts into establishing the early blockchain market by improving the efficiency of public services and expanding investments into the private sector. In June 2020, through the “blockchain-technology expansion strategy,” it prepared a base for industrial development, such as expanding the successful blockchain practices that seem tangible to citizens, expanding next-generation blockchain technology, and invigorating DID services. In addition, it disclosed its investment plan worth a of total KRW 113.3 billion over the course of five years from 2021 to 2025 into development of key generic blockchain technologies (agreement-among-participants technology, identity-management technology, etc.) (June 2020). In April 2021, the “new industry strategic-support task force” was organized with five working groups for blockchain, cloud, intelligent robots, digital healthcare, and the metaverse and was placed under the leadership of the Ministry of Economy and Finance in order to prepare policies needed by the market. In May 2021, departments in charge of virtual assets and blockchain were separated. To settle down overheated speculation and improve the transparency in financial transactions regarding virtual assets and foster blockchain technology, the “virtual-asset transaction-management plan” was published.

B. Industry status

1) Pilot projects

The Ministry of Science and ICT and the Korea Internet & Security Agency (KISA) together promoted 28 public-led blockchain pilot projects from 2018 to 2020 to help central governmental offices, local governments, and public institutions improve their public work efficiency. Additionally, while conducting six private-led projects from 2019 to 2020, they collected free ideas from the private sector and provided support for the development of blockchain services applicable to citizens’ daily lives.

In 2021, the Ministry of Science and ICT increased its business scale (KRW 34.3 billion in 2020 to KRW 53.1 billion in 2021; a 55% year-on-year increase) together with KISA, the National IT Industry Promotion Agency (NIPA), and the Institute for Information & Communication Technology Planning & Evaluation (IITP) to develop the blockchain industry. KISA, as an institution that takes full

responsibility of pilot projects and spreading projects, promotes these projects in three sub-categories: leading pilot projects, DID-focused projects, and special-zone-connected projects. By discovering new and innovative services that can be extended to spreading projects, it helps build and vitalize them. Meanwhile, the NIPA fosters specialized companies and provides blockchain companies wishing to extend their business into the New Southern regions with support for technology verification with local companies and consulting services. The IITP promotes blockchain-technology development projects and provides support for nine projects across the four areas of highly functional agreement technology, smart-contract security technology, identity-management technology, and data-sovereignty guarantee technology.

2) DID-activation projects

Based on the enactment of the revised 「Digital Signature Act」 in December 2020, the accredited-certificate system was abolished, its name was changed to a joint certificate, and a variety of private certificates were launched. As a result, DID using blockchain technology is rising as the next-generation authentication system. DID is a technology friendly to the subject of information with which one receives a verifiable credential (VC) from an issuing agency, storing it in a smartphone's secure storage and selecting information to provide when proof of identity is required. Other nations have been gathering interest in DID and conducting related studies. The World Wide Web Consortium (W3C) designated standards for credential verification in February 2019 and for DID in November of the same year. The Decentralized Identity Foundation (DIF) defined standards for Universal Resolver² in November 2020.

In Korea, under the leadership of KISA, the “DID Technology and Standardization Forum” was established in September 2020 to vitalize DID technology and its ecosystem. There are policy, technology, and service working groups in the forum, and they are conducting diverse studies. In 2020, for vitalization of the DID ecosystem, two policy proposals were made, one for internal and external environment analysis and the other for a concentrated DID-fostering plan, and two standards were designated, one for definition of DID terms and the other for interworking technology requirements. In 2021, policy proposals for DID issuance and use were made, standards for a mobile driver's license were prepared, technical research on how to make different DID platforms interwork in a technical manner is underway, and studies on services,

such as defining a DID electronic wallet, are ongoing.

2. Future prospects

Blockchain is a technology for guaranteeing the reliability of data by managing data in a distributed way. In Korea, there are various policies in place to develop blockchain technology and foster related industries.

Firstly, to discover representative practices that are tangible to citizens, selection of concentrated promotion areas, which extend from the spreading projects, and application of a regulatory-sandbox are under consideration. Secondly, to foster blockchain companies with global competitiveness, consulting services that assist blockchain-service development and verification in the New Southern nations are under planning. Thirdly, an advisory group will be operated to discover regulations that hinder activation of the industry, and development of key base technologies will be conducted to overcome the technology gap with leading nations.

In the digital and non-contact era brought on by the COVID-19 pandemic, the need for non-contact proof of identity is growing. The Korean government is also paying attention to the DID technology as a foothold to strengthen the rights of the subject of identity and move towards a safer and more reliable society. The innovative pilot projects are focusing on the key DID businesses, and the “DID Technology and Standardization Forum” is making DID technology-based policy proposals and designating related standards. The central government offices are operating a DID-based mobile public-official identification system and developing a mobile driver’s license system. All are efforts to invigorate DID services.

Section 5 Metaverse

A metaverse is a form of huge virtual ecosystem made of a number of digital three-dimensional spaces. It is where digital-based three-dimensional space applications that are separated from each other and have different formats and objectives are connected economically among users. In other words, it is a visualized next-generation computing portal and, at the same time, the Internet that provides economic and technical exchange systems required to connect a ton of digital spaces with different world views.

1. Results and achievements

Until 2020, the Korean government had invigorated industries and aligned regulations according to technical classifications, such as VR and AR, and invested budgets in R&D and content development. In particular, to make the best use of 5G's high speed and low delay features, efforts were made to find ways to apply the technology to various fields, such as education, transportation, and medical services. In 2021, to turn interests in VR and AR into a growth engine, the government and industry are continuing to put in efforts and are extending them to a wider concept of the metaverse.

The Ministry of Science and ICT interpreted a metaverse as an extended virtual world that embraces VR and AR and defined it as a “virtual space where humans can live another life that can be used for entertainment, education, etc.” Additionally, it listened to opinions regarding the R&D budget for 2022 from the industry. Furthermore, the Metaverse Alliance to support invigoration of the private-led metaverse ecosystem was established under the leadership of the Ministry of Science and ICT on May 18, 2021. The Metaverse Alliance comprises about 30 experts from related industries and associations, such as extended reality (XR) companies, mobile network operators, and broadcasting and media, and aims at exploring necessary supports and plans to build the metaverse ecosystem in Korea.

Along with the establishment of the Metaverse Alliance, a metaverse hub was opened to support it. This hub, which is built jointly by the Ministry of Science

and ICT and the NIPA at the ICT & Culture Convergence Center, will be used as infrastructure to foster metaverse-specialized companies and developers.

Activities to collect ideas on how to spread the metaverse in Korea were carried out as well. The Ministry of Science and ICT held a VR and Metaverse Contest to discover solutions for remote meetings and education. In line with that, the 2021 Korea Metaverse Award (XR technology) was prepared to encourage promising Korean companies and entrepreneurs to contribute to the development of the metaverse-industry ecosystem based on XR technology and discover excellent content and solutions.

In October 2020, the Ministry of Science and ICT was designated by Statistics Korea to conduct a factual survey on the VR and AR industries as the Nationally Approved Statistics No. 127019. It arranged a survey population from among VR- and AR-related companies in Korea and arranged a classification system in preparation for the statistical survey before going on to conduct the factual survey among 591 companies.

Looking into the technologies applied by each company, 285 companies use VR only, 199 use both VR and AR, and 62 use AR only. According to the results of this survey, only 10.5% of the companies are focusing on AR at the moment, whereas 48.1% and 33.7% of the companies are using VR and both VR and AR, respectively. Therefore, it can be said that, at present, companies are putting more weight on VR.

It was found that the total sales amount for all respondent companies for the past three years was KRW 629.46 billion in 2018, KRW 751.82 billion in 2019, and KRW 803.23 billion (tentative) in 2020. The category of games accounted for the biggest portion of this sales amount, but its portion decreased from 50% in 2018 to 46% in 2020. On the other hand, the sales amount for industrial content, such as education, real estate, national defense, and medical services, increased from KRW 98.68 billion in 2018 to KRW 158.40 billion in 2020, demonstrating that the introduction of VR and AR is expanding across industries. However, whereas the sales of VR recorded KRW 468.17 billion in 2020, the sales of AR were KRW 288.52 billion, showing that VR is leading sales for the market. As the number of relevant companies increases, the number of IP rights held, including for VR- or AR-related patents, is also rising. Excluding utility models, the number of accumulated VR- or AR-related patents was 642 until 2018, but this number is on a steep trend of growth, with 296 more added in 2019 and 372 added in 2020. In addition to this excellent achievement by VR and AR companies in Korea,

improvement of hardware infrastructure is also expected. An independent VR headset equipped with a high-quality content platform was launched at a lower cost in the first half of 2021, and it gained great popularity, leading to 10,000 units sold within three days of its launch. It is predicted to have a significant impact on spreading hardware infrastructure and contributing to the expansion of the VR market.

2. Future prospects

A metaverse is a world that works based on the combination of a number of ecosystem elements connected through a network and interoperable in a technically and economically compatible system, solidifying the importance of guiding the private sector to build this compatible system. Since the Metaverse Alliance, which is composed mainly of private players, was organized as part of the feasible plans to prepare a solution for metaverse-related issues, it is necessary to observe its activities.

Therefore, the idea of resolving urgent issues first, rather than waiting for a solution for a long-term project, is expected to form a consensus. As non-contact education and work increase due to the COVID-19 pandemic, distribution of VR and AR infrastructure and content, which used to be far removed from the public, is going to increase. In place of the video classes provided so far, non-contact education can be held in a space like a classroom or lecture room, and firsthand experiences in a virtual space, such as experiments, field trips, and virtual training, using an online vocational-training platform, such as STEP, can be given with training points. All such cases are expected to increase.

Lastly, along with IT companies, other general companies that are working on digital transformation will look for ways to deal with the metaverse. Some may have introduced VR and AR into their operations already. However, to maintain the company values and, at the same time, find new business models in a metaverse's digital world, companies need to take action faster, which will add to accelerating the rise of the metaverse.

Chapter 2

Service



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Section 1 Internet Finance and Fintech

The term “fintech” is a compound of “financial” and “technology,” referring to new financial services enabled by the integration of finance and IT.

1. Results and achievements

A. Internet banking

1) Recent trends

In December 2019, the open banking service was launched in full scale. The open banking service is a financial service that enables a user to check balances of and pay or remit money from bank accounts at different banks with a single application.

2) Future prospects

Internet-based financial-transaction services can remove time and space restrictions and reduce costs for transactions, which are its main benefits. In addition, the COVID-19 pandemic puts even greater weight on such services.

B. Money transfers and payments

1) Recent trends

In November 2020, the revised bill of the 「Enforcement Decree of the Electronic Financial Transactions Act」 passed the cabinet meeting. Its purpose, because the 「Electronic Financial Transactions Act」 was legislated in 2006 and no longer properly reflected the recent environmental changes, was to realign the relevant law. The key change is that, before the revision, electronic financial institutions had been allowed to open accounts linked to a financial company, but after the revision, comprehensive-payment service providers can now directly hold user accounts and participate in the financial-payment network.

2) Future prospects

It is forecast that the impact of big tech companies, such as Naver and Kakao, which are leading money transfers and payment services, will be extended further. The financial authority is restructuring the payment-services systems overall, such as by introducing new businesses like payment-initiation service providers (PISP), account-information service providers (AISP), and comprehensive-payment service providers, and is allowing deferred payments for small purchases for fintech companies.

C. P2P and crowdfunding

1) Recent trends

In August 2020, the 「Act on Online Investment-Linked Financial Business and the Protection of Users」 (P2P Financial Act), which was the first P2P financial-business-related act in the world, was enforced. According to the act, entry regulations for P2P companies and regulations and requirements for principal investment were eased, which is expected to accelerate the growth of the Korean P2P market.

2) Future prospects

The investment amount collected through crowdfunding platforms showed a more than twofold increase in just a year, going from KRW 130 billion in 2018 to 310 billion in 2019, and the industry expects it to rise to over KRW 1 trillion in 2020. In addition to this growing trend already witnessed, the enactment of the P2P Financial Act and the registration of companies subject to the P2P Financial Act, which are Lendit, 8 Percent, and Peoplefund, in June 2021 will further expand the size of domestic crowdfunding in Korea.

D. Asset management

1) Recent trends

In May 2019, the Financial Services Commission approved the revised bill of the 「Regulations on Financial Investment Business」 where robo-advisor companies are allowed to be commissioned with funds or entrusted with asset operation. Additionally, as individuals are allowed to participate in the robo-advisor testbed, the application range of robo-advisors was extended. As a result, in

2020, the fintech robo-advisor market increased more than five times within a year, and the operation amount of the three major companies exceeded KRW 1 trillion.

2) Future prospects

Thanks to the eased regulations on the financial-investment business, the application range of robo-advisors was widened and the capability of digital management was expanded. As a result, there is a growing number of personalized asset-management services using robo-advisors. Asset management using robo-advisors is becoming faster and more sophisticated with the development of AI technologies and, together with the introduction of MyData, is quickly growing in popularity.

E. Internet-only banks

1) Recent trends

In June 2021, Toss Bank, the third internet-only bank in Korea, was approved to conduct bank business.

As of the end of April 2020, the number of customers of Kakao Bank was 14.32 million, while that of K Bank was 5.37 million. The savings and loan balances of these two internet-only banks have been steadily increasing, year by year. From 2017 to the end of 2020, the savings balance increased from KRW 6.1 trillion to KRW 27.3 trillion, and the loan balance increased from KRW 5.5 trillion to KRW 23.3 trillion, both showing a more than fourfold increase.

2) Future prospects

Recently, the Financial Services Commission announced a plan to expand loans from internet-only banks for those with mid and low credit scores. This was done based on the operation results of internet-only banks, where the credit supply for those with mid and low credit scores was smaller than expected. In the future, loans from internet-only banks for those with mid and low credit scores are expected to increase.

F. Insurtech

1) Recent trends

In June 2021, Kakao General Insurance (tentative name) obtained preliminary approval to conduct insurance business. This is the first case where a new company and not an existing insurance company has received preliminary approval as an insurance company specializing in telemarketing, which is expected to contribute to innovation of the insurance industry. Furthermore, as insurtech grows rapidly, startups, financial companies, mobile carriers, and big tech companies are actively joining the business.

2) Future prospects

Thanks to the technology development, insurtech will continue to grow and have a positive impact on activation of the insurance market. As the revised bills on the 「Three Data Acts」 were approved by the National Assembly, data combination and disclosure among institutions are to be allowed. Accordingly, new insurance-product development, examination for underwriting, and premium-rate improvement are expected to become easier. Introduction of the MyData program will promote the provision of customized services and make competition among institutions fiercer.

2. Future prospects

Non-contact services promoted by the COVID-19 pandemic situation caused a fundamental change to the existing financial business models and value chains, and fintech has become the norm in using financial services. As fintech has secured its position as key to the financial authority's policy, the Korean government is also preparing a variety of systems to invigorate the fintech industry. According to the 「Special Act on Support for Financial Innovation」 enforced in April 2019, the “Financial Regulatory Sandbox” was introduced, and through this, a total of 145 innovative financial services were designated as of June 2021. In 2020, the revised three data-related acts were enforced, laying a foundation for MyData. In 2021, the Financial Services Commission is working on legislating the 「Fintech-Fostering Support Act (tentative name)」 to prepare a legal basis for the fostering of fintech.

Section 2 Remote Medical Care

Remote medical care refers to services with which a patient can get medical treatment from a doctor through a network-connected device without any in-person visit to a clinic or hospital. Thanks to the integration of medical services and ICT, remote medical care has been rising as a new growing industry, and the COVID-19 situation has led to accelerating the development of remote medical care and related social flows.

1. Results and achievements

In Korea, the remote medical-care system among medical personnel was first introduced in March 2002, and the pilot remote medical-care project was conducted in July 2006. After that, the revised bill on the 「Medical Service Act」 that allows remote medical treatment and prescriptions from doctors was submitted twice in April 2010 and April 2014 but could not be placed on the table and was eventually discarded. However, due to the COVID-19 pandemic, the 「Plan on Temporary Permission for Telephone Consultation and Prescription」 was approved, and as of June 22, 2021, a total of 2.26 million telephone prescriptions have been made.

2. Brief status

A. Policy status

1) Global status

A) Nations providing remote medical care

Of the 37 OECD member nations, 32 are providing remote medical care. Among these 32 nations, some have remote medical-care-related laws, some do not have related laws but allow remote medical care, and some allow remote medical care under certain restrictions.

B) Status of remote medical care in major nations

In the UK, since even before the COVID-19 pandemic, it has been possible to make reservations and get remote consultations from doctors or nurses using the NHS application.

In the US, before the COVID-19 pandemic, doctors licensed by certain states could provide remote medical-care services for residents of that state only. After the pandemic, however, some states now allow doctors licensed by another state to offer remote medical-care services. China established the concept of remote medical care in 2014, opening “online hospitals” and allowing both remote medical care and prescriptions to be done online.

C) How the US launched remote medical care

The federal government of the US revised the 「Telecommunications Reform Act」 of 1996 and had the Federal Communications Commission make it mandatory that medical service providers in rural areas be guaranteed the equivalent level of access to remote communications facilities to medical service providers in urban areas. Additionally, in 1997, by revising the 「Balanced Budget Act」 of 1997, it had the Secretary of Health and Human Services make it mandatory that insurance payments be made through Medicare for remote medical-care services conducted in rural areas lacking medical experts.

D) How Japan launched remote medical care

Japan started allowing remote medical care between doctors and patients to improve accessibility to medical services for residents of distant islands or distant mountain areas in 1997. By establishing an official notification about medical treatment using communication equipment (remote medical treatment), it allowed remote medical care between doctors and patients in terms of supplementing face-to-face treatment. In 2018, remote medical care was included in the health-insurance system and remote medical-care expenses were newly added.

2) Korea

In Korea, the number of instances of medical treatment per person is 16.6, which is the greatest among OECD member nations, and it is expected that the demand for remote medical treatment will grow quickly.

The current 「Medical Service Act」 does not allow remote medical care between

doctors and patients, but after the crisis alert for COVID-19 was escalated to the highest level, Level 4, on February 23, 2020, the 「Plan on Temporary Permission for Telephone Consultation and Prescription」 was enforced on February 24, 2020. On December 15, 2020, according to the revised 「Infectious Disease Control and Prevention Act」, non-contact medical treatment was temporarily institutionalized and remains in place.

B. Technology status

Remote medical care entails a doctor's efforts to assess a patient's condition and conduct proper medical treatments from a remote place using information and communications technology, and this care can be categorized into two groups, depending on who receives the care: one group is for care between “doctors and medical personnel,” and the other is for care between “doctors and patients.”

C. Industry status

The eased regulations, such as the temporary permission of non-contact medical treatment and telephone prescriptions, have opened up the opportunities for remote medical-care businesses. However, medical-service platforms are still facing strong opposition from the medical circles and social groups due to diverse problems, such as patient safety.

3. Future prospects

According to the current law, a doctor can only perform medical treatments in person, so to enable non-contact medical treatments, the 「Medical Service Act」 needs to first be revised. It may be possible to start with target groups who can reduce transportation costs and travel time through non-contact medical treatments, such as residents of islands and mountainous areas with very low accessibility to medical services, individuals with disabilities, and citizens residing in foreign countries. Temporary permission of non-contact medical treatment amid the COVID-19 pandemic revealed the substantial demand among the public for remote medical treatments, so now is the right time to have discussions on how to institutionalize it.

Section 3 Online Education and e-Learning

Online education and e-learning refer to learning conducted not in person but using electro-communication, such as information and communications technologies and radio and broadcasting technologies. Thanks to the recent growth of big data and AI technologies, they are evolving into the edtech industry, with offerings such as customized education through learner analysis and learning support using AI.

1. Results and achievements

In 2020, as a result of the COVID-19 pandemic, the online education and e-learning industry showed its biggest growth since the beginning of its launch in Korea. This was due to social-distancing measures for elementary, middle, and high schools, with students mostly attending classes online. As a result, the demand for establishing online education environments and for educational content skyrocketed. With this increased demand, in 2020, the e-learning supply market grew to KRW 4.63 trillion, while the demand market reached KRW 4.568 trillion.

2. Brief status

A. Supplier status

According to the 2020 e-learning industry factual survey disclosed by the NIPA, the total sales figure for the Korean e-learning market was KRW 4.63 trillion, a 17.2%p increase from the previous year and showing the highest growth rate since the first e-learning industry factual survey (in 2004). Out of the total sales, the sales for service businesses were largest, accounting for 73.2%, and this was followed by content (18.1%) and solutions (8.7%).

In 2020, the total number of e-learning businesses was 1,905, which was 94 (5.2%)

more than the previous year, continuing the steady growth trend from 2017. The number of personnel working in the e-learning industry increased by 11.1% to 31,747. The biggest increase was in the number of content developers, as high as 23.0%, followed by course instructors at 22.6%, consultants at 19.3%, and system developers at 18.9%. The per-capita output, which is the total sales for the industry divided by the number of workers, was KRW 145.84 million in 2020, a bit higher than the figure of KRW 140 million in 2019.

B. Consumer status

The size of the Korean e-learning demand market in 2020, estimated based on the expenses survey results among e-learning consumers in Korea, was KRW 4.568 trillion in total, increasing by 18.3% compared to the previous year. Looking into the different consumer classes, individuals account for KRW 2.365 trillion, while businesses account for KRW 1.6581 trillion. The sales for individuals showed a 30.5%p year-on-year increase, and sales for formal educational institutions showed a 21.2%p year-on-year increase, both of which are high. The usage of e-learning has also demonstrated continuous annual growth, going from 59.0% in 2018 to 59.2% in 2019 and 62.5% in 2020.

C. Key policies

In 2020, Korea struggled to provide uninterrupted learning support amid the difficulties due to the COVID-19 pandemic, which was also the first priority of related policies. Elementary, middle, and high schools launched online classes and provided both in-person and remote learning, while universities were allowed to provide all their classes online. All of these efforts were carried out in order to continue providing safe and sustainable learning environments, and political measures like urgent financial support were undertaken to make these changes possible.

3. Future prospects

As the educational environments shifted online almost semi-forcibly due to the COVID-19 pandemic, the e-learning industry seized another opportunity

for growth. However, this opportunity was given by the change to external environments, meaning the situation may return to the previous state once the COVID-19 pandemic is lifted. Nevertheless, the experience of all citizens who realized the benefits of non-contact education environments throughout the entire education cycle will not simply disappear. Therefore, it is expected that the regulations will be eased, remote classes will be systematized, and more policies will be developed to bring changes and innovations to the field of digital education. Furthermore, such changes will bring great opportunities for businesses in the online education, e-learning, and edtech industries. Meanwhile, in terms of technology, integration between big data and AI will be the most important topics of conversation.

Section 4 **O2O Service**

Online to Offline (O2O) services connect the real economy and demands through the internet. These services expanded quickly amid the COVID-19 situation in 2020. From the supply perspective, the business model called “subscription economy” was expanded. Accordingly, the number of O2O service providers increased, intensifying competition in the market. Due to the pandemic, the digital transformation permeated our daily lives, and the participation of even the strongest players in traditional industries is further accelerating the extension of O2O services and changing the characteristics.

1. Results and achievements

A. Rapid growth of the industry due to the COVID-19 pandemic

For Korea, the history of O2O services, where online platforms connect offline-based real things or services with consumers, goes back to 10 years ago. Around 2014, O2O services were called the “promising future” industry, and in 2020, it became part of the culture for Korean society – no longer a distinct service due to the COVID-19 pandemic.

The offline economy experienced a recession, but the O2O market expanded. The number of service companies in the market increased 22.2% from 555 in 2019 to 678. The amount of transactions reached KRW 126 trillion, up roughly 30% from the figure of KRW 97 trillion in 2019.

Even within the O2O industries, there was jubilation and there were tears due to the COVID-19 pandemic. O2O services that connect people with other individuals or spaces experienced a recession. Sales for Uber, a car-hailing service, decreased by about 14% to USD 11.1 billion in 2020 compared to the previous year (USD 13 billion). Sales for Airbnb, a room-sharing platform, went down by about 29% in 2020, and WeWork, an office-sharing service provider, recorded a loss of USD 3.2 billion. On the other hand, the transaction amount for O2O transport services increased to KRW 35 trillion from KRW 28 trillion in 2019. In particular, the amount of food-delivery transactions rose by about 44%

from KRW 14.36 trillion in 2019 to 20.1 trillion in 2020.

B. Emergence of a new industry growth engine called the subscription economy

In its earlier stage, a platform makes sales by inviting advertisements based on the number of users. The reason for not putting the burden of platform-operation costs on users and instead making advertisers pay these costs is to attract more new users and prevent existing users from leaving. Putting charges for using the platform on users while they are not yet fixed to the platform can lead to losing competitiveness for the platform. On the contrary, if a business is confident that its users are fixed enough, it can consider adding charges, in addition to advertisements, offering an additional source for sales from the business-strategy perspective.

Passing through the enlightenment period, the industry entered the settlement and expansion period, and the O2O market faced a change in the sales structure. The portion of charges in O2O sales in 2020 rose to 52.7% by 21.5%p compared to 2019 (31.2%). On the other hand, the portion of advertisements decreased from 25.6% to 7.3% (meaning 18.3%p). This can be interpreted as the result of food-delivery companies' changing their business models. Adding charges gives better visibility in terms of sales and is easier for the companies to control than advertisements.

In addition to charges per individual transaction, the “subscription economy” that provides services on a regular basis is expanding quickly. Compared to the charge-per-single-transaction system, subscriptions can give more stable sales and stronger fixation of users to the platform. The subscription economy not only accelerates the paradigm shift of consumption from “ownership” to “use and experience” but also contributes to extending the range of products and services provided through online platforms. Thanks to this integration with the subscription economy, the O2O market is turning into a space for a variety of innovative services to emerge.

2. Future prospects

Thanks to the combination of the expanded digital economy, improved literacy on digital media across society, and innovative business ideas, services come

in more diverse forms, have become more sophisticated, and are extending externally.

Expansion of the “subscription economy” made competition in the O2O market more intense, as legacy companies, which formerly produced real things or provided services in person, have entered the game of O2O services and joined the competition in the digital economy. Among them, the strategy of mobile carriers stands out as they try to get in on the subscription economy through aggressive collaborations and alliances with real-economy partners. In addition, existing e-commerce companies started dealing with products that seem exclusive to existing O2O service companies on a rental basis.

O2O services that connect offline and online will become an essential part of our daily lives. Accordingly, the effectiveness of the name “O2O service” is expected to become extinct as the digital economy becomes the norm. In other words, the separation between digital platforms and O2O services may lose its meaning.

Section 5 Social Media and Content

The major issues in the field of social media and content in 2021 were “settlement of video-based social-media culture,” “communication in the metaverse and through a digital human,” “expansion of voice-based group social media,” and “success of K-content in the global market.” In the field of social media, global companies like YouTube, Instagram, and Facebook stood out most. In the field of content, a variety of formats, such as video-based and voice-based content, drew attention among users, and following “K-Pop,” the status of “K-Dramas” was raised, as well. Metaverses and digital humans, for which the basis is a virtual world, received attention from the market or policy-makers and became a topic of much discussion.

1. Results and achievements

A. Settlement of video-content-based social-media culture

In 2021, as the COVID-19 pandemic lingered on, platform services with active video-content-based communications remained in their standing. According to the “2021 Internet Use Survey” report issued by NASMEDIA, the service with the largest number of video viewers was YouTube, followed by Netflix, Naver, Instagram, and Facebook, in that order.

Excluding Netflix, all of these platform services providing video content are social-media platforms where users communicate with each other using video content as a medium.

In the case of YouTube, it has successfully positioned itself as the representative video-platform service with which people can acquire a variety of information and enjoy entertainment while carrying on with non-contact daily living under the COVID-19 pandemic circumstances. Meanwhile, NAVER provides services like news, communities, blogs, and shopping, recently placing its focus on video-content-based social-media features, as video stands out as the main medium to deliver information for such services.

Instagram and Facebook are also providing various examples of video content. Instagram and Facebook are providing short-form video-content services like

Reels and Watch, respectively, to invigorate formation of user communities and communication among users.

B. Communication in a metaverse and through a digital human

A metaverse, as a virtual space for playing out the same social activities as in the real world, and digital humans, like virtual influencers who do activities like real influencers in a social-media space, are the big keywords for 2021.

The metaverse has become a major component that will give the ICT industry a boost. As PwC (Pricewaterhouse Coopers), a multinational consulting firm, referred in its report to the size of the AR and VR markets, which are technologies closely related to the metaverse, it has marked a continuous growing trend since 2019. As a reflection of this trend, there were many cases witnessed where the government set the conditions for the metaverse to lead the market.

The year 2021 was one in which digital humans distinguished themselves in the business and marketing fields. Shinhan Life Insurance, a Korean insurance company, selected Rozy, a digital human, as a model for its TV commercial in July 2021, and the result produced a great success. Social media has been replacing the space for web and mobile communication, and diverse forms of image and video content were spread through social media. In 2021, the possibility was detected for changing the form of social media and content as a space for communication.

C. Spreading voice-based group social media

Clubhouse, a voice-based social-media platform launched in March 2020 and is the representative service that benefited from the COVID-19 pandemic situation. Its number of users was about 600,000 until December 2020, and it started to skyrocket in mid-February 2021. One of the characteristics of Clubhouse is that general service users can be invited to join a space where celebrities are speaking and can listen to their voices.

As it grew very rapidly, the Clubhouse service revealed many issues regarding its adverse effects. Due to its exclusivity in only allowing invited users to enjoy the service, issues were raised regarding discrimination and reported hatred, and due to the poor data-processing environment, its weak security was highlighted.

D. Success of K-Content in the global market

In 2021, a memorable event in the field of Korean content occurred when the series “Squid Game,” created by a Korean director and performed in by Korean actors, became a great success for Netflix, eclipsing the records for existing popular content on the platform. On October 29, 2021, Bloomberg, a US economics magazine, reported that Netflix estimated the value obtained from the hit series to reach more than USD 900 million. Leading to a new cultural phenomenon, the “Squid Game” series gave Netflix a chance to rebound with its OTT service.

2. Future prospects

In 2021, there were phenomena noticed in the field of social media and content that settled in due to the COVID-19 pandemic situation. Mostly, those phenomena can be summarized as “diverse communication formats, such as video and voice,” “social-media formats based on virtual spaces and characters,” and “success and strengthened position of K-Content.” In the future, even once the COVID-19 pandemic recedes across the globe, aspects of these trends are expected to continue.

Section 6 **Administrative Services**

Administrative services refer to services that deal with civil petitions through electronic channels, according to the 「Electronic Government Act」, and public services for the socially disadvantaged, along with services that are provided through the e-Government portal.

1. Results and achievements

The history of Korean e-Government goes back to when the big server was introduced for statistics management for the National Bureau of Statistics under the Economic Planning Board and has gone through rapid growth for 50 years to the current intelligent e-Government. To this point, the focus of e-Government has been on making public services available online, but since 2019, it has been evolving to offer preemptive customized services that are provided even before requested by identifying people's needs using big-data analysis and AI and positioning itself as a comprehensive portal where people can handle everything at once. The usage of administrative services based on intelligent e-Government is continuously growing.

2. Brief status

A. Government 24

Government 24 is the representative comprehensive portal for the Korean government's online administrative services. Totalling about 90,000 services, including handling of civil petitions, such as copies of resident registration and land registers, and services provided by other agencies (about 85,000 governmental services and 5,000 civil-petition services), and up to a thousand services can be requested, inquired on, and issued at once. Furthermore, it provides one-stop support services for pregnancy, childbirth, and all-day care, meaning those in need of such services can check on related information and

make a request for a service. Services by stage in the lifecycle, where people can select and use services based on their age, along with customized package services for different interests, such as safety in daily life, travel, and life after retirement, are also provided.

Government 24 has established itself as the representative online administrative service, and after its integration with Civil Petition 24, the number of civil petitions processed has been increasing significantly.

B. Korean Digital New Deal

The Korean government announced the “Korean New Deal” in July 2020. The Digital New Deal to strengthen the digital foundation for the economy, industry, and society is the key component of the Korean New Deal. A total of KRW 58.2 trillion will be invested into this Digital New Deal, and the intelligent e-Government plan is one of the four major projects. The objective is to provide non-contact customized governmental services using new technologies, such as blockchain and AI, and digital foundation, such as 5G and the cloud, and the essential plans include expansion of data-based intelligent services, introduction of digital certification, reinforcement of public services for the socially disadvantaged, and improvement of public participation and cooperation.

In addition, “Gwanghwamun 1st Street (May 2017),” where the public can participate in the whole process of policy-making, such as budget establishment, policy evaluation, and organizational diagnosis, and the “MyData” service, in which the subject of information provides his or her own administrative information for himself, herself, or a third party (administrative, public, or private institutions), as designated by himself or herself, are run on a trial basis. With MyData, one can qualify himself or herself simply by providing the mandatory data, instead of submitting required documents (certificates), when applying for various reductions and exemptions, additional points for an apartment application, and subsidies or emergency support funds.

C. Administrative services amid the COVID-19 pandemic

The solid foundation for Korea’s intelligent digital government played a critical role in dealing with the crisis brought on by the COVID-19 pandemic. Apps are used to disclose public data for people to stay informed with the inventory of

publicly distributed masks and to check symptoms for the self-quarantined and remotely verify their position. Additionally, people applied for and quickly received emergency disaster-relief funds online.

The Korea Disease Control and Prevention Agency opened and is running the COVID-19 vaccination-reservation system. Furthermore, if requesting the vaccination-notification service on the Virtual Assistant Service for the Public website, one can receive prior notification for the first or second doses of vaccination one day before the appointment, a guide on precautions following vaccination, and tips on how to deal with abnormal reactions persisting three days after the vaccination, all provided through private apps or text messages.

3. Future prospects

As the information technologies develop and the non-contact economy becomes the norm due to the COVID-19 pandemic, the necessity for digital transformation of administrative services is growing fast. Following the pilot service of mobile identification, “paperless government services” are currently being planned. In 120 work areas where the public can easily recognize the effects of these services, such as management of duplicate welfare- benefit reception, real-estate transactions, and online voting, “blockchain technology” will be applied on a trial basis and will later be expanded. Furthermore, 1.25 million academic journals and books held by the National Assembly Library and National Library of Korea will be digitalized every year. The Korean government aims to digitalize more than 80% of all administrative services by 2025.

Section 7 Smart City

The basis of Korea's smart city policy and projects can be found in the new smart city strategy published in 2018 and the revised 「Smart City Act」. The project with the highest priority is building national trial cities, and, in addition, the smart challenge program to support local governments' related projects will be conducted. Furthermore, projects for technology development through R&D activities, innovation of regulations, and capability development through fostering of personnel are underway.

1. Results and achievements

A. Progress

Under the catchphrase “u-City, a Korean-style smart city,” the Korean government started building smart cities in 2003 both in existing cities like Busan and Seoul and in newly developed cities like Incheon Songdo and Hwaseong Dongtan. In the beginning, u-City made many successes using smart transportation cards and CCTV. However, since it could not distinguish itself from the previously conducted city-informatization projects, it started losing trust from the public and the general market around 2008. It was around 2017 when the concept of a smart city regained trust from the government and the market. The Korean government was presenting the Fourth Industrial Revolution as a new national development strategy at the time, so it needed new infrastructure and a service foundation, which can be provided by a smart city.

B. Smart city policy framework in Korea

The current smart city policies and projects are based on the new strategy and revised act after 2017. The new smart city strategy of Korea, published in 2018, was the outcome of efforts not to make the same mistakes of u-City in the past. Cities are categorized into three types as new cities, mature cities, and declining cities, and different approaches were applied according to each city type.

The highest priority in the Korean smart city policy is put on the national trial cities. In 2018, District 5-1 of Sejong and Eco-Delta City in Busan were designated as trial cities, and a chief planner was appointed for each city in order to make a model smart city that Korea and the world at large can follow. The second priority is on the smart challenge program. It invites public participation in the three areas of smart city, smart town, and smart solution and selects projects for support. The third priority is on R&D activities for a smart city, and the representative project is the innovative growth engine R&D project to build a smart city data hub. The fourth priority is development of the capabilities for a smart city, and the representative projects are the regulatory-sandbox project for innovation of regulations and the smart city personnel-fostering project.

C. Support from local governments: Smart challenge program

To this point, there have been diverse support projects led by the central government for building a smart city, such as building a specialized complex with a theme and support for urban regeneration, but none of them are integrated into the smart challenge program which began in 2019. The smart challenge program, as mentioned previously, is composed of the smart city challenge of supporting city-level projects, smart town challenge of supporting complex-level projects, and smart solution challenge of supporting the development of good solutions and their expansion.

D. Innovation of regulations

In the smart city field, innovation of regulations is of great significance. No matter how good the technology and services are, they cannot be put in place if there are too many regulations. To resolve that issue, five places, including the national trial cities in Sejong and Busan, the ongoing smart city challenge areas in Incheon and Bucheon, and the innovative-growth-engine R&D area in Siheung, were designated as regulation-innovation-applied cities.

E. Smart city platform

Another element of a smart city with significance is a platform. A platform not only provides a common function or a common foundation required by various

services but also connects these services together. The issue in a smart city is how to secure interoperability among platforms. A single platform that connects the entire city can integrate and share all the services and data effectively, but it is just not possible to build a complicated system like a city on a single platform. Therefore, instead, the key objective of many nations promoting the building of a smart city is to make different platforms interoperable in a seamless manner.

2. Future prospects

After the COVID-19 outbreak, the building of smart cities is being accelerated across the globe. Most fundamentally, to build a non-contact society, the role of smart cities is essential. Furthermore, there is growing demand for citizens to be able to satisfy their own needs rather than depending on the urban system, creating a more distributed and augmented society.

Life

Chapter 1 **Strengthening of Digital Capabilities**

Chapter 2 **Inclusive Digital Culture**

Chapter 3 **Inclusive Use Environment**



2

Chapter 1

Strengthening of Digital Capabilities



Section 1 **Fostering Software Talents**

Section 2 **IT Education for the Socially
Disadvantaged**

Section 1 **Fostering Software Talents**

As the non-contact lifestyle becomes the norm in line with the Fourth Industrial Revolution and the COVID-19 pandemic, digital transformation is spreading across the economy and industry. Accordingly, the demand for software talents is skyrocketing among not only ICT companies but all companies, in general. By resolving job-talent mismatches and fostering innovative talents through the National AI and Software-Training Spreading Plan (2020), Big 3+ AI Talent-Fostering Plan (2021), and Private-Public Cooperation-Based Software-Talent-Fostering Measures (2021), the Korean government has been preparing for the coming era of the Fourth Industrial Revolution and digital transformation.

1. Brief status and prospects

A. Software-talent-fostering policies of other nations

The US recognized the importance of STEM (Science, Technology, Engineering, and Mathematics) education and established and announced its five-year federal STEM-education strategy and plan in December 2018. The Biden administration proposed “Innovate in America” to secure global R&D-based AI leadership and foster software-related talents, investing about USD 300 billion into innovative fields, such as 5G, AI, and electric vehicles. In line with that, the US has been focusing on fostering personnel by running digital-technical-training programs, etc. Meanwhile, China established the Next-generation AI Plan in 2017, the AI-Innovation Action Plan for Universities, and Global AI Talent-Fostering Plan for Universities in 2018 to nurture high-level AI talents and is pursuing a policy of having Chinese AI talents working abroad return to China. Turning to Europe, a long-term roadmap was presented with an investment worth KRW 180 trillion by 2030, designating the fostering of 20 million ICT and SW professionals as the top-priority policy task.

B. Prospects for demand and supply of software talents in Korea

In Korea, as the shortage of software talents for digital transformation is being noticed, there are active movements for companies aiming to attract developers. The Ministry of Science and ICT, together with the Korea Research Institute for Vocational Education & Training, analyzes the demand and supply status of Korean ICT and software professionals by level of education and type of occupation every year and provides the results. Despite the efforts of the Korean government, the shortage of talents due to the skyrocketing demand is getting worse. According to the 2020 ICT and software professional factual analysis and prospects, the shortage of software professionals will be 6,450 for those with undergraduate degrees and 23,530 for those with graduate degrees. In particular, it is expected that the shortage of talents will be more serious for software consultants, data specialists, and software and SI developers.

The Korean government supports formal education courses, such as Software Meister High Schools, Software-Oriented Universities, and AI postgraduate courses, and established the Innovation Academy (non-formal education course) by benchmarking Ecole 42 of France to educate architect-level software talents, aiming at accelerating innovative growth.

[Table 2-1-1-1] Prospects of Demand for New Digital-technology Personnel (2020-2024)

(Unit: Thousand persons)

Classification	AI	Big data	Cloud	5G	IoT	Sum
Total	41.3	56.8	17.0	42.4	19.7	177.2
Top-level	18.0	16.3	1.9	19.9	10.0	66.1
Mid-level	20.6	28.8	13.2	22.5	7.5	92.6
Entry-level	2.7	11.7	1.9	0.1	2.2	18.6

Source: Korea Research Institute for Vocational Education and Training, Prospects of Demand for New Digital-technology Personnel (2020-2024)

C. Software-talent-fostering policy of Korea

1) Software-Oriented University

To foster software-specialized and related talents and reform the software-education system in universities based on demands from the industrial field, the Ministry of Science and ICT has been designating and supporting Software-Oriented Universities since 2015. As of 2021, 41 universities are designated as

Software-Oriented Universities and are receiving support. From 2021, to extend the achievements of Software-Oriented Universities to the greater society and encourage participation of capable small- and medium-sized universities, the ministry newly established a “specialized track” and is planning to improve software-education-innovation capabilities by reflecting the demand for new technologies to the existing general track.

2) Innovation Academy

With the objective of supplementing a uniform education system and nurturing architect-level software talents, challenging education courses are being developed, and for the introduction of innovative education programs to support business incubation, the Innovation Academy (42 SEOUL) was established in December 2019. The Innovation Academy is a two-year non-degree course, and it aims to strengthen mentoring, including guidance on learning direction, technical consultation, code review, and tech seminars, for non-major students and to extend existing channels between the field and students, such as through cooperative projects with companies and internship programs.

3) AI postgraduate course

Given the global shortage of AI talents and fierce competition to attract them, the Korean government launched the AI postgraduate school-support program in 2019 to foster essential AI R&D personnel in Korea. In addition to the first five universities (KAIST, Korea University, Sungkyunkwan University, GIST, and POSTECH) designated in 2019, three more (Yonsei University, UNIST, and Hanyang University) in 2020 and two more (SNU, Chung-Ang University) in 2021 were designated, giving a total of 10 AI postgraduate schools in operation.

4) ICT Innovation Square

ICT Innovation Square was established in 2018 to nurture ready-to-work professionals for the software fields, such as AI and blockchain, which are the core technologies for the Fourth Industrial Revolution, and to support business opening. It aims at improving the understanding of software technologies among undergraduate and postgraduate students, general citizens, software developers, and industrial employees, strengthening their application capabilities and further nurturing 6,000 or more ready-to-work professional developers for SMEs and startups by providing education programs for new technologies.

2. Future Prospects

According to the private-public cooperation-based software-talent-fostering policy announced in June 2021, in the short term, by expanding the short-term training led by the private sector, 21,000 talented individuals that are immediately needed will be fostered by the first half of next year in order to solve the existing shortage of talents for SMEs and startups. In the mid- and long-term perspective, more Software-Oriented Universities will be designated, and a cooperation model between enterprises and universities will be built, with the objective of nurturing 68,000 additional personnel members within four years to further resolve the shortage of software talents.

Section 2 **IT Education for the Socially Disadvantaged**

In 2020, the non-contact culture became the norm during the COVID-19 pandemic, and the importance of social inclusion was emphasized more than ever. Therefore, the Ministry of Science and ICT and the National Information Society Agency (NIA) established a digital learning center to launch the digital-capability-reinforcing education program for the first time.

1. Results and achievements

A. Support system

In 2020, the Ministry of Science and ICT confirmed the “Digital-Inclusion Promotion Plan” with the objective of “implementing an inclusive digital world for everyone” (June 22, 2020). Moreover, the budget of KRW 50.3 billion for the “digital-capability-reinforcing education program” was added to the “comprehensive Korean New Deal plan” to deal with the social gap caused by the COVID-19 pandemic (July 3, 2020). Through the digital-capability-reinforcing education program, digital learning centers are to be built in all villages across the nation to guide people on how to use smartphones.

Digital learning centers act as spaces of education provided through life SOC (Social Overhead Capital) facilities, such as lifelong education centers, community service centers, and libraries. In 2020, 17 upper-level local governments and 215 basic local governments (95% participation rate) participated in the program and established a total of 1,065 centers.

In 2020, these digital learning centers employed 4,712 talented local citizens in each region of the nation as instructors and supporters, educating a total of 428,000 students.

B. Learners at digital learning centers

Looking into the distribution of learners, teenagers account for 21%, while those in their 50s account for 42%, showing a solid distribution of participation across different age brackets. About 64,000 (roughly 15% of all learners), including 47,000 who are preparing for employment and business establishment, 14,000 women who are experiencing career disruption, and 3,000 small-business owners, participated in the program for digital-based economic activities.

[Table 2-1-2-1] Status of learners by age bracket in 2020

Ages	10s	20s	30s	40s	50s	60s	70s and over
Percentage	21%	9%	9%	19%	15%	14%	13%

C. IT education for the socially disadvantaged

The socially disadvantaged include individuals with disabilities, elderly citizens, members of multicultural families, and farmers and fishers. The NIA conducted IT education for the disabled in line with 17 upper-level local governments across the nation at community rehabilitation centers or by paying a visit to each household. From 1999 to 2020, education on how to use the internet or smartphones was provided for almost 1.18 million citizens.

The Korean government has provided 666,218 elderly citizens with education programs to assist their daily lives, such as how to use financial apps, mobile welfare services, and AI speakers and how to book a train ticket using kiosk, since 2000. Furthermore, from 2011, it educated married immigrants with ICT knowledge as visiting instructors for multicultural families (about 30 instructors from eight different nations). From 2021, IT education for members of multicultural families will be merged with the digital-capability-reinforcing education program at digital learning centers.

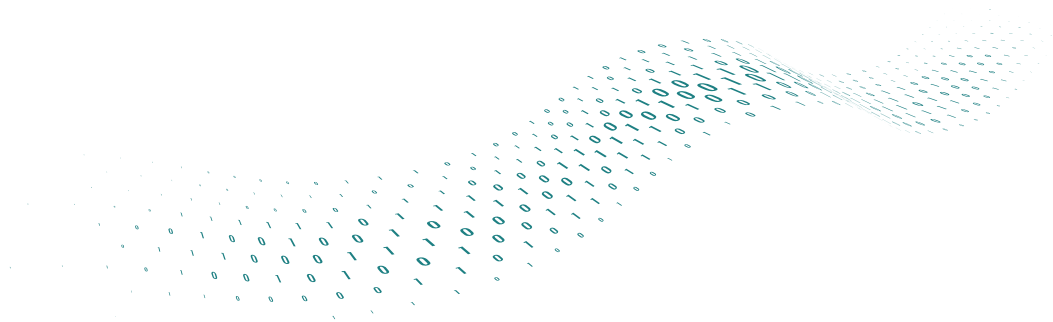
2. Future prospects

The year 2020 was the first year that programs at digital learning centers were opened to the entire public. Education programs range from digital basics (how

to use smart devices), digital lives (mobile finance, shopping, etc.) to advanced digital knowledge (various certificates, smart office, etc.).

In the future, it is necessary to advance the programs and connect the digital learning centers to the existing systems of each basic local government. In that case, it is recommended that all the regulations and governance regarding operation of the programs should be taken by local governments. Furthermore, in addition to the existing educational content, new technologies, including AI, VR, IoT, big data, and drones, need to be covered. To that end, utilizing the personnel and facilities of universities is an available option to take. Considering the current non-contact trend, it is also necessary to consider provision of O2O (Online to Offline connected) education programs.

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Chapter 2

Inclusive Digital Culture



Section 1 **Prevention of Smartphone and
Internet Overdependence**

Section 2 **Internet Ethics**

Section 3 **Response to Distribution of
Harmful Information**

Section 4 **Inclusive Digital Technologies
and Services**

Section 1 **Prevention of Smartphone and Internet Overdependence**

One of the main changes in 2020 is the growing overdependence on smartphones as the non-contact culture permeates into our daily lives. This phenomenon is called “smartphone overdependence” and refers to “the state of having an intense salience bias towards smartphones due to overuse of smartphones and, as a result, experiencing reduced control over their use and problematic results.”

1. Results and achievements

A. State of smartphone overdependence

The Ministry of Science and ICT and the NIA have conducted a factual survey on problematic use of smartphones every year to prepare for the establishment of policies against smartphone overdependence and evaluate previous policy decisions. According to the results in 2020, the percentage of the overdependence risk group (high-risk group + potential-risk group) among smartphone users is 23.3%.

B. Policies against overdependence

To deal with the overdependence issue, the NIA has operated 18 internet-addiction-prevention centers, including programs by local governments for local residents (15 cities and provinces) and joint programs with local governments (three education offices). In 2020, 75 programs were conducted, including visiting internet-addiction-prevention magic shows ICT-career education for teenagers, and program advancement and expansion. Specialized response materials are provided through the IAPC website (www.iapc.or.kr), and the telephone counseling service is also available through the IAPC’s nationwide representative telephone number (1599-0075).

C. Education for overdependence prevention

In 2020, preventive education programs were provided for a total of 739,635 individuals, which is an increase from 2019 (728,121). This increase was thanks to customized prevention programs for all age brackets, including mandatory prevention-education programs for daycare centers, nurseries, elementary, middle, high schools, and public institutions, ICT-career education programs, and (trial) education programs for elderly citizens.

Instead of collective training programs, small-sized participatory programs for prevention education, such as ICT-career education programs for teenagers and educational performances for preschoolers, were conducted to improve the effects of education. For prevention education, three types of online content were developed: one for preschoolers (8 minutes and 45 seconds long), one for adults (15 minutes and 5 seconds long), and one for parents and teachers (12 minutes and 29 seconds long).

[Table 2-2-1-1] Results of smartphone-overdependence prevention education in 2020

(Unit: Persons)

Classification	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan	Sejong	North Gyeonggi	Southern Gyeonggi
People	46,349	54,104	27,403	33,212	47,805	26,546	44,475	21,583	47,170	118,502
Classification	Gangwon	Chungcheongbuk-do	Chungcheongnam-do	Jeollabuk-do	Jeollanam-do	Gyeongsangbuk-do	Gyeongsangnam-do	Jeju	Sum	
People	33,437	33,725	28,952	38,123	35,238	46,935	32,886	23,190	739,635	

Source: Internal Data from National Information Society Agency, 2021

D. Professional counseling for overdependence

In 2020, visiting counseling programs were provided for the socially disadvantaged (single-parent families, child-grandparent families, low-income households, multicultural families, double-income families, individuals with disabilities, and unemployed adults) and members of the internet- and smartphone-overdependence risk group from general families through visits to each household. Visits were paid to a total of 1,697 households, and 3,011 counseling sessions were conducted. The rate of symptom alleviation was 82.7%, and 95.1% of recipients stated that they are satisfied.

2. Future prospects

As multiple kinds of mutant viruses broke out in 2021, the non-contact culture is getting even more pervasive. Communications through virtual spaces like the metaverse and digital shopping are now a general trend of the era. As found in the results of the 2020 factual survey, the overdependence phenomenon is getting more serious. However, as social-distancing policies continue and the public adapts to this new cultural trend, there may emerge a new boundary that shifts the perspective toward overdependence. It also seems necessary to strengthen the response system against smartphone overdependence.

Section 2 Internet Ethics

As the COVID-19 pandemic lingers on, the duration of using the Internet has lengthened, and intelligent information services have extended their reach into our daily lives. As a result, newly emerging adverse effects of digital functionalities, such as deep fakes, digital sexual assaults, and spreading of inaccurate information, are emerging. These adverse effects are diversified, advanced, and highly organized (creating proceeds through crime), and anyone from a celebrity to a general citizen can become a victim under the current circumstances.

1. Results and achievements

According to the Intelligent Information Society User Survey after the initial COVID-19 outbreak, conducted in January 2020, the respondents reported that their time spent using online services had increased, such as for watching videos on platforms like YouTube and Naver TV (68.2%), searching for information on the internet (65.0%), playing games (54.5%), and using social media (49.8%). This corresponds to the list of spaces where online violence frequently occurs, as announced in the 2020 Online-Violence Factual Survey.

According to the result of the 2020 Online-Violence Factual Survey conducted by the Korea Communications Commission (KCC) and the NIA, the rate of having an experience as an assailant or victim was 32.7%, a reduction of 0.8%p compared to 2019, but the rate of having an experience as a victim increased to 29.7%, showing a continuous year-on-year trend of growth.

Therefore, to respond to the newly emerging adverse effects of digital functionalities and prevent further damages, the KCC and the NIA are holding education programs on internet ethics and the prevention of online violence according to different lifecycle stages.

A. Customized internet-ethics education programs by stage of lifecycle

As the non-contact social culture was established, the formats of education programs on internet ethics and prevention of online violence were diversified

into a variety of non-contact-but-connected ethics-education programs, interactive remote programs, real-time streaming performances, and programs using digital teaching aids. Digital teaching aids were developed in which one can experience the position of either an assailant or a victim through online-violence cases, and education programs using the aids were expanded to middle-school students. As a result, with the opinion that the education programs related to preventing online violence were more impactful than face-to-face programs, the satisfaction rate was significantly improved, along with the education effects.

As the education environment changes, the content of education reflects interests of different target categories, such as preschoolers, teenagers, parents, military members, employees, and elderly citizens, in order to ensure better use.

B. Attractive Internet Sector campaign

To create a wholesome internet-use culture, the KCC and the NIA carried out online and offline promotional and campaign activities for the public. The messages promoting public interest were delivered through television and radio broadcasts, and public facilities, such as messages on subway screen doors, outdoor billboards, and elevators, social media, such as YouTube and Instagram, and the Attractive Internet Sector website, were used to publicize the campaign and bring it into public daily life.

2. Future prospects

To improve awareness for digital ethics among one-person content creators regarding sensational or violent content, defamation, malicious replies, etc., which occur as a result of the growing one-person-media market, the KCC and the NIA are planning to publish and spread guidebooks for different sectors, such as MCN companies, legal circles, and the media industry. In addition, to respond to the environmental changes in the intelligent information society, they have plans to expand ethical-education programs to prevent second convictions for online offenders whose indictments are suspended and operate participatory education programs for elementary and middle-school students about ethics in intelligence to help them properly absorb information.

Section 3 Response to Distribution of Harmful Information

Responses against distribution of harmful content online are being made in various forms, but the most common one is through the deliberation system of the Korea Communications Standards Commission (KCSC). The KCSC conducts deliberations on “information that is recognized to require deliberation, such as unlawful information and harmful information for teenagers” (harmful information) according to Article 44-7 of the 「Information and Communications Network Act」 among pieces of online information, and can request a correction (deletion of information, block of access to a website, suspension or termination of account use, etc.) to the information and communications service provider.

1. Results and achievements¹

A. Status and overview of deliberations on harmful information by the KCSC in 2020

The KCSC deliberated on 226,846 cases of information in 2020, deciding to request corrections for 211,949 cases (93.4%), and labeled 72 cases as harmful media content for teenagers.

Among the correction-requested cases, “block of access” to information distributed through overseas servers took the largest portion, with as many as 161,569 cases (76.2%), followed by “deletion” with 34,512 cases (16.3%) and “termination of use” with 15,685 cases (7.4%).

Looking into the numbers by violation type, the number of “gambling information” cases was the largest at 52,671 (24.9%), followed by “sex trafficking and obscene information” cases at 49,052 (23.1%), “unlawful information about food or medicine” cases at 37,558 (17.7%), and “other information that violates the laws” cases (illegal financial activities, document forgery, violation of the

¹ Korea Communications Standards Commission, Fourth Korea Communications Standards Commission Whitepaper, 2021, Korea Communications Standards Commission, 2020 Deliberation Casebook, 2021

National Security Act, etc.) at 36,787 (17.4%).

B. Reinforced response against distribution of digital sex-crime information

While considering the social requirement that a quicker response against digital sex-crime information is necessary, the KCSC established the Digital Sex-Crime Deliberation Sub-Committee in September 2019 and gave it full charge of digital sex-crime information deliberation. Additionally, it reinforced responses against distribution of digital sex-crime information by introducing the electronic deliberation system, implementing a 24/7 response system and operating the post-monitoring program by specialized monitors.

C. Proactive response against information related to the COVID-19 pandemic that causes social unrest²

In 2020, the KCSC took aggressive responses against, in particular, information related to the COVID-19 pandemic that causes social unrest. “To deal with inaccurate information that puts the public in danger in terms of their lives, health, and safety and causes social unrest, we held the communications deliberation sub-committee more frequently – three times a week – assigned more personnel for deliberation support, and cooperated with the governmental disease-control institutions,” the KCSC said.

D. Strengthening the cooperative self-review system, such as international cooperation in investigations with overseas global businesses

The cooperative self-review system is a system that guides businesses through cooperative methods to take self-regulating measures against explicitly illegal information before a communications deliberation is held. Thanks to the system, 11,886 illegal information cases in 2018, 14,083 cases in 2019, and 29,027 cases in 2020 were self-regulated.

² Korea Communications Standards Commission, (Press release) “KCSC to Take a Proactive Response against Information Related to the COVID-19 Pandemic that Causes Social Unrest” (January 10, 2021)

2. Future prospects

With louder requests for regulations against false information or hate speech, “harmful information” deliberation within the KCSC, where deliberative regulations, such as “causing social unrest” and “discrimination and abasement,” are applied, is expected to expand steadily. Furthermore, the proper policy direction for responding to distribution of unlawful information would entail changing the political leaning of the organization and the legal status of the KCSC to an independent private institution and strengthening the self-regulation support and cooperation system to put self-regulation principles firmly in place.

Section 4 **Inclusive Digital Technologies and Services**

Thanks to the recent fast growth of AI technology, it has become easier to develop inclusive digital technologies and services, and development of intelligent systems to provide human-friendly services has been ongoing continuously. The key technology of an AI system is the language-intelligence technology that enables a user to be served with the desired knowledge while having a conversation and to obtain various pieces of information and through communications without any language restrictions. Using this technology, users can search a large volume of information sources in different languages using Korean keywords and can acquire the desired information while communicating with users in different languages.

1. Results and achievements

As most of the industries have recently been equipped with intelligence, AI technologies capable of providing differentiated added values are applied to inclusive digital technologies and services, and an environment where those technologies and services are available to everyone is being built. To successfully build that environment, it is necessary to develop and use advanced technologies based on related policies and laws and to apply them to industries in a standardized manner, in order to maximize their effectiveness.

A. Policy status

1) Policy status

Regarding digital inclusion, a revised bill for the 「Act on the Prohibition of Discrimination against Disabled Persons」 passed the Assembly Plenary Session in June 2021. The revised bill includes mandatory provision of convenience for both disabled and non-disabled persons when installing and operating automated information terminals, such as kiosks, to guarantee equal accessibility and usability.

The 「Digital Inclusion Act」 proposed in the National Assembly aims at resolving concerns over the digital divide, which is getting bigger as the non-contact society arrives due to the Fourth Industrial Revolution powered by data, networks, and AI, also known as “D-N-A.” Although there is the 「Framework Act on Intelligent Informatization」 in place in preparation for the Fourth Industrial Revolution era, many agree that, as the transition to the non-contact society is being accelerated due to the uncontrollable COVID-19 situation, the codes of the 「Framework Act on Intelligent Informatization」 cannot solve all the problems stemming from the digital divide, making it necessary to prepare a separate bill for digital inclusion. Additionally, the basic objective of the digital inclusion policies led by the Korean government is to, beyond simply narrowing the information gap by enhancing information accessibility for the socially disadvantaged, build an inclusive digital environment where every citizen can participate in and benefit from the digital society.

2) Examples of foreign policies

The UK, even before the COVID-19 outbreak, has been promoting a variety of digital-inclusion policies to solve the issue of digital inequality for individuals with disabilities, and these policies include the digital-inclusion strategy for 2014, the digital strategy for 2017, the social-service digital-inclusion guide of the NHS (NHS Digital 2019), an application guide of the digital strategy for social services, and the application of non-contact social services in “COVID-19: Our Action Plan for Adult Social Care” in 2020.

B. Technology and industry status

Empowered by the development of AI technologies, language-intelligence technologies suitable for accessibility and inclusive technical environments are in wide use in different industries. In the era of the AI-centered knowledge revolution, a variety of natural language-processing-based application technologies are allowing users to find and use necessary knowledge in a convenient manner. Voice-interface technologies, automatic-translation technologies, and natural-language query-and-response technologies are the main examples, and they are being developed and integrated into a comprehensive service.

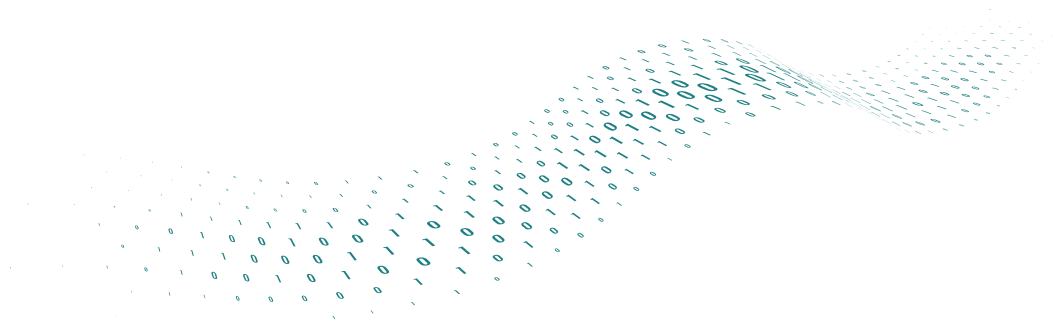
C. Standardization status

Standardization related to inclusive technologies and services is ongoing in various ways by both de facto standardization groups, such as MPAA, IEEE, and W3C, and de jure standardization organizations, such as ITU-T and ISO. To date, inclusive digital technologies and services have been focusing on individuals with disabilities, but recently, in addition to this group, foreigners and elderly citizens are being taken into consideration as beneficiaries. Additionally, the ITU Intersector Rapporteur Group on Audiovisual Media Accessibility (IRG AVA) was organized to establish accessibility standards among multiple groups, allowing participating groups to hold discussions during the regular standardization meeting period and to conduct joint studies on standardization among the groups.

2. Future prospects

AI technologies are expected to reform the structures of the economy and employment by providing high productivity and efficiency and enabling automated operation. Inclusive digital technologies and services are receiving more attention these days given that improvement of welfare is being promoted by means of ICT, which has gone through drastic technical development based on AI. This is also because the focus of accessibility is extending from those with disabilities to a wider range including the elderly and the illiterate.

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Chapter 3

Inclusive Use Environment



Section 1 **Web Interoperability**

Section 2 **Internet Openness**

Section 1 Web Interoperability

In the past, the use of the internet in Korea was mostly done through Internet Explorer, a web browser by Microsoft, and it caused inconvenience due to the installation of ActiveX. However, thanks to the development of the web-standard technology (HTMP5), the emergence of various browsers and terminals, termination of technical support for Internet Explorer, and plugin-improvement policies and web-standard expansion support by the Korean government, the use environment of the internet in Korea is getting friendlier for the public.

1. Results and achievements

A. Improvement of plugins (ActiveX, execution files) for 500 private websites

A plugin is a program that needs to be installed to enable additional functions, such as security and payment, not provided by web browsers or operating systems in the past, and its examples are ActiveX and execution (.exe) files.

Removal of plugins from websites is for “implementation of a convenient online use environment for citizens,” as promised by the Korean government. The Ministry of Science and ICT, the Financial Services Commission, and KISA designated the improvement of ActiveX for 500 private websites (with usage by 83% of the public) as a national project, and the Ministry of the Interior and Safety promoted removal of unnecessary plugins in the public sector as another national project. Both have promoted various policies since 2018.

A guideline presenting how to remove plugins and representative cases was distributed in 2018. The guideline contains ways of removing plugins by implementing their functions based on web standards and of providing an option for asking users whether to install security plugins, such as antivirus software and personal firewalls, that cannot be handled using web standards alone. In addition, the government took necessary actions to remove the need for plugins, such as by improving laws, systems, or procedures that require functions only implementable by plugins.

By 2020, as a result of joint efforts by the government and the private sector to

remove plugins, the number of plugins to install for 500 private websites has decreased by 89.7% since 2017 (2,266→234), and the number of plugins to install for public websites has dropped by 99.9% (3,889→5).

In the private sector, these improvements were mostly done for the 500 most-visited websites (10 fields, 50 websites per field). As a result, the number of websites with no installation of plugins increased from 151 in 2017 to 403 in 2020. To analyze the level of convenience that real users experience thanks to the government's efforts to remove plugins, a survey was launched to gauge how much improvement of the internet-use environment users experienced. According to the results, the portion of those who answered "it is more convenient than it was in the past" was higher than the portion who answered "it is still inconvenient," showing that, to some extent, users experienced improvement.

B. Education and campaign on web standards in Korea

The Ministry of Science and ICT and KISA are putting diverse efforts into improving plugins for private websites, spreading web standards, and fostering related developers in Korea. First of all, to enable web developers in Korea to learn and use web-standard technologies effectively, they continuously post domestic and international web-standard content and trends on the website of the Next-Generation Web-Technology Support Center and provide practical and professional education programs (to about 1,500 people/year). Additionally, for website operators and web developers, they hold a conference to share and discuss new web-standard trends and prospects every year.

2. Future prospects

In Korea, there has previously been difficulty with installing plugins when using web services because of widespread non-standard technologies, but thanks to the changed internet-use environment and government policies to improve plugins, it is expected that much of this difficulty will be resolved.

For the private sector, through promotion of policies from various angles, such as preparing and distributing guidelines, visits to the sites, and support for conversion to web standards, there have been continuous efforts to spread the

status of plugin use, necessity and method of improvement, and encouraged voluntary improvement. Support will continue to be given to companies requiring technical support in the future.

Section 2 Internet Openness

Internet openness refers to an environment where one can use the internet anywhere, anytime. Internet openness is based on the principle of net neutrality that any legitimate internet traffic should be processed equally, regardless of content, format, and provider.

1. Brief status

A. Changes to net neutrality in Korea and in the world

Conflicts among providers regarding net neutrality have become noticeable since the early 2000s because of expense sharing for excessive traffic. In other words, the issue of the net using charges.

In the case of the US, after the inauguration of President Trump, the Federal Communications Commission (FCC), the US national broadcasting and communication regulation agency, abolished net neutrality. However, President Biden pledged to reinforce net neutrality, meaning the dispute is expected to continue in the future. The EU has clarified that, based on the principle of net neutrality, all EU member nations should be able to access the open internet and all internet traffic shall be treated equally.

In Korea, the Korea Communications Commission established and institutionalized the basic principle about internet neutrality, protection of user rights, and deviant situations in 2011. Since the Ministry of Science and ICT announced the “Guidelines for Net Neutrality and Internet Traffic Management” in April 2018, the Korean government has been maintaining the principle of net neutrality in its policies, even in this new internet environment.

As network technologies like 5G advance, the Ministry of Science and ICT revised part of the guidelines in December 2020. The revised guidelines, which took effect in January 2021, introduced the concept of special services, like in the EU and the US, in addition to the existing exceptional-service-provision requirements for net neutrality to clarify these requirements. The guidelines define special services as services that are provided for certain users for a

particular purpose while guaranteeing a certain level of quality (speed, delay, etc.) through a network that is physically or logically separated from internet-access services.

B. Changes to the media environment and internet openness

In June 2021, during the first trial for the network-fee lawsuit between SK Broadband, a high-speed-internet service provider, and Netflix, an online video-streaming service provider, SK Broadband won the case. This lawsuit started when SK Broadband requested that Netflix pay network fees for the excessive traffic that it caused, and Netflix refused to pay, citing net neutrality as a reason in 2019. While this application for a ruling that SK Broadband submitted to the Korea Communications Commission was underway, Netflix filed a suit to the court to state that it is not liable for network fees and to ask for confirmation of the non-existence of an obligation. Due to this ruling, there is a high possibility for Netflix to become liable to pay reasonable network fees based on a separate contract to network service providers, along with other Korean OTT service providers that provide internet-based online streaming services. The way of using media has recently changed to a social-network type in a form of “connected individualism.” Furthermore, the “zero TV” phenomenon where people watch broadcasts on a wired or wireless IP-based device is spreading quickly.

Given the media environment that is evolving into the IoT and a hyper-connected society where all devices are closely connected in the era of the Fourth Industrial Revolution, thanks to AI and big data, it is the right time to discuss how to share the costs for skyrocketing traffic in a fair and reasonable manner.

2. Future prospects

The Korean government announced the “Digital New Deal” policy in July 2020 and is now exploring new growth opportunities by supplementing the 5G infrastructure and discovering a variety of non-contact services. Since access to digital services and online interactions, such as remote work from home, remote classes, and use of online video, has been growing due to the COVID-19 pandemic, the discussions on internet openness and net neutrality are expected to continue. In the future,

with technical advancement of the network and the emergence of new services, such as VR/AR content, smart factories, autonomous-driving cars, smart cities, and digital healthcare, the net-neutrality policy is expected to go through co-evolution.

Infrastructure



Chapter 1 **Internet Infrastructure**

Chapter 2 **Related Laws and Systems**

Chapter 3 **International Cooperation**



3

Chapter 1

Internet Infrastructure



Section 1 **Internet**

Section 2 **Internet-address Resources**

Section 3 **Standardization and
Authentication Technology**

Section 1 Internet

1. Backbone network

A backbone network is a network that ties together multiple small networks and is connected with a collection of other networks at an extremely high bandwidth through large-scale pipelines.

A. Results and achievements

1) Major issues in 2021

Under the social-distancing policy, remote work from home and remote classes/meetings increased. Accordingly, traffic for mobile carriers (KT, SKB, LGU+) significantly rose by an average of 33%. During the same period, traffic for global OTT services (YouTube, Netflix, etc.) also skyrocketed.

2) Status and application of businesses/technologies in Korea and in the world

As a flexible response to this skyrocketing traffic, upsizing of equipment (64TB or higher) and widening of the bandwidth (100G) are being done not only for the domestic sections (Main relay/IDC/CP) in Korea but also for overseas sections (POP/ISP). In addition, simplification of the network structure and improvement of the traffic-delivery structure, such as integration of divided networks by service and removal of unnecessary line-concentration hierarchy, are continuously underway.

3) Effects and related achievements and results of businesses/technologies

Despite excessive traffic due to the COVID-19 pandemic, through the upsizing and bandwidth widening of backbone networks, it was possible to take a flexible response and provide stable internet service. Moreover, by changing the way of routing overseas traffic from concentrating it around Seoul first and then delivering it nationwide to delivering it directly from Busan, where the overseas traffic comes into Korea, to nationwide destinations, the latency was reduced by more than 77%.

B. Future prospects

To deal with the traffic increase due to large-sized content, etc., upsizing of equipment and lines (64-100TB or higher) and widening of the bandwidth (400G) will continue. Additionally, to reduce costs and time for delivering the traffic, the network structure will be changed to one where platforms are built close to customers so that traffic can be quickly delivered.

2. Subscriber networks

A. Results and achievements

1) Major issues in 2021

· KT

KT commercialized ‘its’ 10-Giga internet service in 2018 and has since continuously made investments into the infrastructure to expand the service section. At the same time, it replaced the existing 1-Giga subscriber network with the 10-Giga bandwidth one, minimizing inconvenience in subscribers’ internet environments due to traffic overloads.

· SKB

SKB established a network where the 10G PON Trunk technology is applied for apartments to advance the superhigh-speed/IPTV infrastructure. It is also planning to apply the PON Stick, which won the “Best FMC Network Solution” award from BBWF in 2020, to the commercial network as a pilot project.

· LGU+

As it is forecast that traffic variability will continue in 2021, LGU+ added a criterion of extending the trunk capacity for instantaneous traffic peaks and reinforced the existing extending criteria, taking preemptive responses to traffic increases.

2) Status and application of businesses/technologies in Korea and in the world

As of April 2021, the total number of internet service subscribers in Korea was 22.56 million. The portion of low-speed xDSL and HFC forms has been decreasing, and the FTTH form that can support 10-Giga internet service has seen continuous growth.

3) Effects and related achievements and results of businesses/technologies

Investment into the 10-Giga infrastructure was continuously made and concentrated to new large-sized apartment complexes for promotion of 10-Giga internet services. Using the FTTH and optical LAN forms, the coverage of 10-Giga-level internet has been expanding.

B. Future prospects

In the case of wired internet, it is predicted that the demand for 1-Giga or higher services will grow following the expansion of Wi-Fi 6 and that customer needs for high reliability and speed will rise as more video services emerge. In terms of network data, the amount of super-large, high-quality, and personalized data is expected to jump. Additionally, to enable subscribers to use a diversity of services without problems in the future, services that exceed 10G will become essential. To that end, the base of the services must be the FTTH form.

3. Research networks (KREONET)

The Korea Research-Environment Open Network (KREONET) started from the research-computer network, one of the five national backbone computer networks, in 1988 and has been performing a role of providing networking technologies and resources for national research on basic science, fusion research, and global-level joint research.

A. Results and achievements

1) Major issues in 2021

In 2021, to enable joint research derived from big science to be conducted anywhere in Korea, KREONET is extending the superhigh-speed, high-performance, and small-latency research network to every inch of the science and technology field. At the moment, based on the stable 200G-level research-network services between Seoul and Daejeon, it is planning to provide a TB-level research-network-transmission service in 2022 and is working on expanding connections and cooperation with large-scale national experiments and measurement equipment. Moreover, in the case of the international

network, through direct connections and cooperation with overseas research networks (APAN, GEANT, Internet2, etc.), alongside the 100G ‘networks’ in Seattle, Chicago, and Hong Kong and international PoP, it is supporting global cooperative research between Korean institutions and advanced research institutions.

2) Status and application of businesses/technologies in Korea and in the world
KREONET provides research-network services for about 200 research institutes, universities, governmental agencies, and societies/associations, along with about 100 advanced science and technology-research institutions in Korea. In particular, it is enhancing the research- network services for institutions conducting challenging and multidisciplinary studies and, considering the networking technologies and speed required in certain science and technologies fields, such as astronomical cosmology, high-energy physics, genomes, and supercomputing, it is providing optimized services for using research-network resources and receiving technical support.

Section 2 Internet-address Resources

Internet-protocol (IP) addresses and autonomous-system (AS) numbers are kinds of “internet-address” systems, meaning an information system composed of numbers, characters, and signs, or their combination, and enabling identification of and access to a specific information system according to a certain communications protocol by the international standards or national standards on the Internet.

1. Overview

There are two kinds of IP addresses: one is the Internet Protocol version 4 (IPv4), commonly used on the internet, and the other is Internet Protocol version 6 (IPv6), also known as the next-generation internet address.

AS numbers are used as the identification system devised to identify an independent network (autonomous system) implemented according to the international standards on the internet, and a unique number is given to a network operated under the same routing policy, where routing is an operation of selecting a transmission channel to receive and send communication data based on the IP address on the internet.

IP addresses and AS numbers are delegated and managed by hierarchy. The Internet Corporation for Assigned Names and Numbers (ICANN) allocates IP addresses and AS numbers to the appropriate Regional Internet Registry (RIR), which are the Asia-Pacific Network Information Center (APNIC), American Registry for Internet Numbers (ARIN), Réseaux IP Européens Network Coordination Center (RIPE NCC), Latin American and Caribbean Internet Addresses Registry (LACNIC), and Africa Network Information Center (AfriNIC), and these registries allocate IP addresses and AS numbers to the National Internet Registry (NIR) or internet service providers (ISP) in each region. In the case of Korea, KISA, the national internet-address administration agency of Korea, receives IP addresses and AS numbers allocated by the APNIC and allocates them to ISPs or independent users in Korea.

2. Brief status

A. Internet-address-retention status

As of the end of July 2020, the number of IPv4 addresses allocated across the world is about 3.68 billion, the number of IPv6 addresses allocated is about 310,000 (/32) (=290,000×296), and the number of AS numbers allocated is about 97,000.

Korea has been putting efforts into securing IP addresses and AS numbers for provision of stable internet services since the early 1990s. As of the end of July 2020, the number of IPv4 addresses retained by Korea is about 112.47 million making it the 6th largest in the world, and the number of IPv6 addresses is 5,260 (/32), the 15th largest in the world. The number of AS numbers for Korea is 1,036, ranking 20th in the world.

[Table 3-1-2-1] Status of internet-address retention for major nations (as of the end of July 2020)

Retention of IPv4 addresses by nation			Retention of IPv6 addresses by nation			Retention of AS numbers by nation		
Rank	Nation	IPv4 addresses	Rank	Nation	IPv6 addresses (/32)	Rank	Nation	AS numbers
1	US	1,610,240,256	1	US	55,325	1	US	27,976
2	China	340,634,624	2	China	50,196	2	Brazil	8,061
3	Japan	190,019,840	3	Germany	22,868	3	Russia	6,281
4	Germany	124,255,104	4	UK	20,457	4	Germany	2,884
5	UK	114,647,576	5	France	14,296	5	UK	2,841
6	South Korea	112,476,928	6	Russia	12,574	6	India	2,692
7	Brazil	86,880,512	7	Netherlands	10,558	7	Australia	2,658
8	France	82,630,160	8	Japan	10,051	8	Poland	2,595
9	Canada	69,494,528	9	Italy	9,547	9	Canada	2,208
10	Australia	63,216,384	10	Australia	9,331	10	Ukraine	2,198
11	Italy	55,013,952	11	Brazil	7,319	11	China	1,952
12	Netherlands	47,838,176	12	Spain	5,677	12	Indonesia	1,857
13	Russia	46,064,896	13	Poland	5,464	13	France	1,600
14	India	41,079,040	14	Argentina	5,263	14	Netherlands	1,511
15	Taiwan	35,705,600	15	South Korea	5,260	15	Rumania	1,252
16	Spain	31,758,400	16	South Africa	4,783	16	Italy	1,180
17	Sweden	29,656,936	17	EU	4,451	17	Spain	1,152
18	Mexico	29,022,208	18	Egypt	4,106	18	Japan	1,129
19	Belgium	28,312,960	19	Swiss	3,348	19	Argentina	1,115
20	South Africa	27,719,168	20	Turkey	2,793	20	South Korea	1,036

Source: Korea Internet & Security Agency, 2020

B. Allocation-policy status

As the use of the internet increases around the globe and, along with it, the use of IPv4 addresses, ICANN declared the exhaustion of IPv4 addresses on February 3, 2011, meaning the number of IPv4 addresses held by ICANN was “0” and it could no longer allocate IPv4 addresses to RIRs (APNIC, ARIN, RIPE NCC, LACNIC, and AfriNIC).

The APNIC, which is in charge of distributing IPv4 addresses in the Asia-Pacific region, including Korea, enforced the “final allocation policy” to allocate IP addresses restrictedly as of April 15, 2011. The “final allocation policy” differs from the existing “normal allocation policy” of allocating IPv4 addresses upon user requests, becoming a policy that allocates IPv4 addresses restrictedly, regardless of the requested amount. The APNIC’s last 103 range addresses (103.X.X.X, about 16.77 million) are allocated only once per institution for the purpose of new member institutions’ access to the internet or existing member institutions’ preparation for IPv6 transition. KISA has been reflecting this change to the APNIC’s IPv4 address allocation and related transfer policies into the domestic IP-address administration policy in Korea.

If an entity is operating equipment capable of implementing an independent network on the internet, the network is or will be connected to two or more different networks, and independent routing is possible, meaning the entity can get an AS number allocated from KISA.

Section 3 **Standardization and Authentication Technology**

1. Standardization trends in internet-infrastructure technologies

Thanks to the development and expansion of internet protocol, represented by TCP/IP, the internet has been continuously evolving into a backbone network that ties the whole world into one. The internet works as the networking and service infrastructure not only for industrial fields but across all areas of people's daily lives for their active economic and social activities. Upon requirements from newly emerging services, it has been making great strides.

A. Brief status

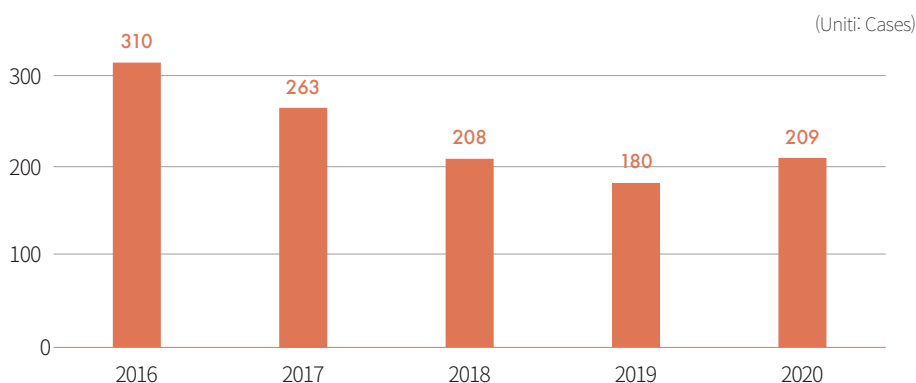
The Internet Engineering Task Force (IETF), an organization working on standardization of internet technologies, currently operates seven standardization areas along with multiple working groups (WG), organized under each area, to actively develop related standards and guidelines. It is common that a WG performs standardization activities on a particular issue for a certain period of time, but some WGs last and act longer. WGs are established and abolished frequently, and about 100 WGs are active at the same time. As of August 2021, 121 WGs are active.

Whereas the IETF aims at developing standards for shorter-term issues, the Internet Research Task Force (IRTF) works on longer-term requirements for improvement of internet infrastructure and application technologies and performs research on specific standard technologies and advanced-development activities. At the moment, 14 research groups (RG) are focusing on research activities regarding internet-protocol-standard technologies to improve the performance of internet infrastructure and support emerging application services by resolving any corresponding issues. Usually, when the result of the advanced standard-technology research by the IRTF becomes tangible, development of specific standards regarding the corresponding issue is transferred to the IETF.

The key output of the standardization activities by the IETF/IRTF comes in the

form of the internet standards called a request for comments (RFC). In 2020, a total of 209 RFCs were published, and the status of RFC publication for the past five years is detailed in the following figure. I-Ds (Internet-Drafts) are draft documents for a standard, and in 2020, over a thousand independent proposals were made and discussed.

[Figure 3-1-3-1] Status of RFC standard documentation by the IETF/IRTF



Source: IETF 2020 Annual Report

Recently, the first among key issues of interest to different standardization working groups is standardization of automated internet management.

The second issue is standardization of interconnection and utilization of IoT devices without human intervention in the internet environment. In particular, protocols and best practices of communications and security among IoT devices are under development.

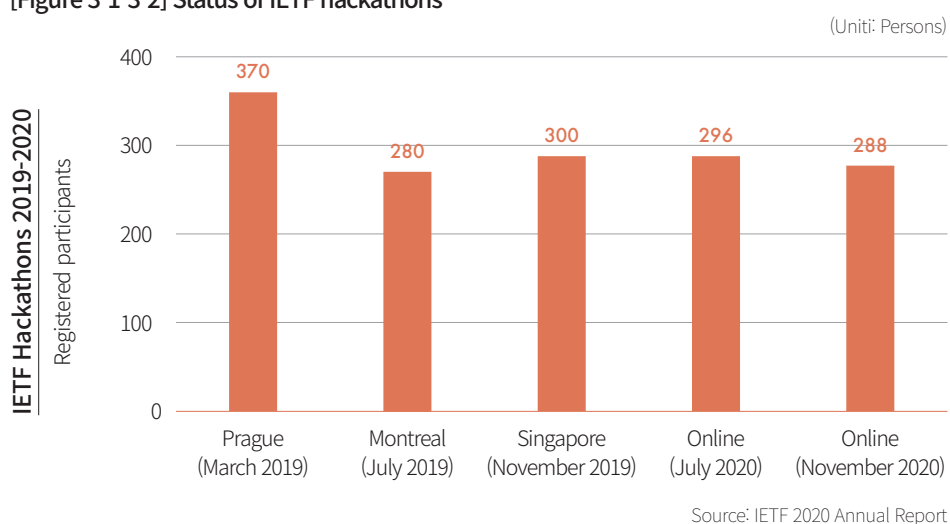
The third issue is standardization of new internet-transmission technologies. Transmission technologies are key to advancing performance in data transmitting/receiving for various internet applications, so standardization of safe transmission, improved transmission performance, multi-streaming, reduced waiting time, quick recovery from errors, real-time transmission, delay-tolerant network (DTN) mechanisms, and measurement of network characteristics are underway with priority.

The fourth issue is standardization of internet security and personal-information protection technologies that assure users of reliability in dealing with secure communications, reliable networks, and privacy protection.

Along with these standardization activities, the IETF holds regular hackathons as developer events to encourage mutual exchanges and verification activities,

such as development ideas, sample codes, and actual implementation results, all regarding internet-technology standards. Since the first event was held with about 50 participants in 2015, the numbers of developer participants in IETF hackathons have steadily increased. During the events, verification and interoperability tests for development solutions about the major IETF technology standards, such as naming, web access, software-defined networks, real-time transmission, webRTC, secure transmission, and network management, are actively conducted.

[Figure 3-1-3-2] Status of IETF hackathons



B. Future prospects

The IETF and IRTF are expected to continue standardization activities for advancement of the internet, functional enhancement of internet services, improvement of existing internet-standard technologies, and application of innovative information and communications technologies, leading the realization of the Fourth Industrial Revolution.

The Internet Society (ISOC) announced the “Action Plan 2021” that will focus on making the internet safer and stronger by improving its vulnerabilities.

Chapter 2

Related Laws and Systems



Section 1 **Information Protection and User
Protection**

Section 2 **Internet-regulation Improvement
and Promotion**

Section 3 **Framework Act on Intelligent
Informatization**

Section 1 Information Protection and User Protection

Korea has been improving and revising internet-related laws preemptively to lead the growth of the intelligent information society. As 5G-based new innovative services, such as AI, big data, and robots, are being boosted, the internet environment is going through drastic changes. Now is the time for corresponding growth of these new technology industries and reasonable responses to the legislative system for information protection and user protection.

1. Summary

In Korea, the definition of “information protection” is stated in the 「Framework Act on Intelligent Informatization」 and the 「Act on the Promotion of the Information-Security Industry」. Firstly, the 「Framework Act on Intelligent Informatization」 gives the definition of “having in place managerial and technical means (hereinafter referred to as an ‘information-protection system’) to prevent any damage, alteration, leakage, etc., of information which could occur while information is being collected, processed, stored, retrieved, transmitted, or received.” In addition to that, the 「Act on the Promotion of the Information-Security Industry」 defines it as “establishing managerial, technological, and physical means for activities in responding to accidents, disasters, crimes, etc., by utilizing security technology, such as cryptography, authentication, identification, and surveillance, or safely operating related equipment and facilities.” In the 「Regulation on Supervision of Electronic Financial Transactions」, according to the 「Electronic Financial Transactions Act」, the concept of “information protection” is the same. This regulation further defines an information-processing system, an information-protection system, hacking, and malicious computer code so as to clarify the target of information protection. Considering all these, “information protection” can be understood as “having in place managerial, technical, and physical means to prevent any damage, alteration, leakage, etc., of information, which could occur

in any process, such as collection, destruction, and recovery of information.”

In 2021, revisions to key laws regarding information protection and user protection were made, such as revision of the 「Act on the Promotion of the Information-Security Industry」 that obligates an information-security disclosure system, which was previously left to companies’ discretion, and revision of the 「Information and Communications Network Act」 that clarifies the qualification of a chief information-security officer (CISO). Moreover, for enforcement of the revised three data-related acts (「Personal-Information Protection Act」, 「Information and Communications Network Act」, and 「Credit-Information Use and Protection Act」 (hereinafter, 「Credit-Information Act」)), which were revised in February 2020, various disclosures and guidelines were prepared.

2. Results and achievements

A. Information protection

In August 2020, upon the revision of the so-called three data-related acts, which are the 「Personal-Information Protection Act」 「Information and Communications Network Act」, and 「Credit-Information Act」, the foundation was laid for using pseudonymous data for the purpose of scientific research, statistics, preservation of records for public interest, etc., without agreement of the subject of information.

Meanwhile, although it is getting increasingly important for companies to manage information security, the 「Act on the Promotion of the Information-Security Industry」 leaves disclosure of information protection to companies’ discretion as an arbitrary activity. The current 「Information and Communications Network Act」 prescribes that providers of information and communications services should appoint an executive-level CISO for security and safe information management to report to the Minister of Science and ICT and, if the company’s total amounts in assets and sales meet the criteria defined by the presidential decree, this appointment is not mandatory.

B. User protection

The recent story of a digital sex crime threatening dozens of women, including

minors, that involved making sex-extortion videos of them to trade over social media raised awareness that this is a serious social problem. As a countermeasure, the 「Telecommunications Business Act」 and 「Information and Communications Network Act」 were revised, and these revised laws went into effect on December 10, 2020.

The current laws have the KCSC deliberate on digital sex-crime materials, but the number of cases detailing “blocking of access” against overseas servers has been significantly growing, from 17,248 in 2018 to 25,896 in 2019, 35,526 in 2020, and 2,596 in January 2021 alone. As a response, on June 8, 2021, the 「Act on the Establishment and Operation of the Korea Communications Standards Commission」 was revised to add “international cooperation” to the list of duties in order to enable the KCSC to promote active collaboration and cooperation with overseas business entities, preparing a foundation for the KCSC to conduct aggressive activities to prevent illegal transaction of digital sex-crime materials, drugs, and guns, and distribution of illegal harmful information, such as harmful media materials.

Furthermore, the 「Telecommunications Business Act」 was revised in a way for value-added telecommunications service providers meeting the criteria defined by the presidential decree, such as the number of users and the amount of traffic, to take necessary measures, such as securing of a means to stabilize services and handling of user requirements.

In June 2021, through the revision of the 「Framework Act on Broadcasting Communications Development」, the Communication-Disaster Management and Deliberation commission was newly established, and the overall system regarding communication disasters, such as classification of communication facilities and joint use of wireless-communication facilities in case of a disaster, was improved. Most of all, the 「Framework Act on National Informatization」, which had been the most fundamental basis of the informatization policies of Korea, was completely revised to the 「Framework Act on Intelligent Informatization」, and the new act went into effect on June 10, 2021. To protect users of the intelligent information society, it prescribes access to intelligent information services and convenient use of them for individuals with disabilities and the elderly, prevention and resolution of overdependence on intelligent information services, and execution of social-impact evaluation of intelligent information technologies and services. Furthermore, it prescribes guarantee of security in using intelligent information services, such as information

protection, for safe use of intelligent information technologies and intelligent information services. In particular, it prescribes those policies on the ethics of the intelligent information society that state that ethical principles related to safe and reliable use of intelligent information technologies should be established, and regulations on the intelligent information society should be enacted.

3. Future prospects

Although the three data-related acts were revised and went into effect, provisions about reinforcing the rights of a subject of information corresponding to the new technology environment, such as rights to data portability of personal information, were not introduced, and the online/offline double-regulation issue was not yet resolved, causing confusion and burden in identifying who is subject to the law. Therefore, the Personal-Information Protection Commission made an advanced legislation notice that it is now pursuing. Once this bill passes and takes effect, the special regulations regarding providers of information and communications services will be unified into common regulations, so any confusion in applying the law and the double burdens will be resolved. Furthermore, regulations for overseas transfers corresponding to the international standards will be put in place, and the right of choice for a subject of information will be strengthened as the right to request transfer of personal information is introduced, which will supplement the inadequacy of the existing laws.

In addition, various bills about regulations on online platforms for fair competition among online-platform businesses and protection of their users are under discussion. Moreover, many members of the National Assembly and the Korea Fair Trade Commission are working on making a revised bill for the 「Act on Consumer Protection in Electronic Commerce, etc.」.

Section 2 Internet-regulation Improvement and Promotion

It has been three years since the ICT regulatory-sandbox program came into force, and it has obtained strong results with steady applications from companies and stable operation of a deliberation committee. Moreover, the overall program operation has been improved, such as introduction of the regulation that considers an extension of the validity period of the temporary permit and expansion of documentary deliberation. Deliberated and designated projects went into service, and relevant legal regulations were improved, completing the virtuous circle of the entire process.

1. Results and achievements

A. Results

According to the Ministry of Science and ICT, after the enforcement of the ICT regulatory-sandbox program (January 17, 2019), a total of 305 cases were submitted and 259 of these were processed by June 2021. In particular, 111 cases were approved for temporary permits and as special cases for demonstration, while 63 new technologies and services were launched in the market, contributing to improved convenience in public daily life (as of the end of June 2021).

B. Achievements

1) The 15th meeting of the deliberation committee

This was the first meeting of the deliberation committee held in 2021, a year of recovery and leaping ahead. During the event, two years' worth of achievements for the ICT regulatory-sandbox program were presented, and a total of four projects – one proactive public administration, two temporary permits, and one special case for demonstration – were approved (January 20, 2021).

2) The 16th meeting of the deliberation committee

This was the deliberation committee's meeting to announce the constitution of the second-round deliberation committee. It approved a total of eight projects: one proactive public administration and seven special cases for demonstration (April 7, 2021).

3) The 17th meeting of the deliberation committee

This was the first documentary deliberation held in 2021, where five projects identical or similar to the projects approved in the previous committee meetings went through the simplified deliberation process and were approved.

4) The 18th meeting of the deliberation committee

Three new services using new ICT technologies, which are an autonomous-driving robot-based map-production technology, facial-recognition technology, and VR and AR technology, were designated as special cases for demonstration (May 26, 2021).

5) The 19th meeting of the deliberation committee

This was the second documentary deliberation held in 2021, where one new project (local-channel commerce-broadcasting service) and four projects that are identical or similar to the projects previously approved by the committee were deliberated and resolved.

To this point, documentary deliberation had been processed by applying a fast track for projects identical or similar to previously approved projects, but this committee proved that it is applicable to new projects, as well.

2. Brief status

A. Constitution of the second-round deliberation committee

As the term came to a close for the civilian members of the first-round new technology and service deliberation committee, which was constituted on January 21, 2019, after the program took effect, the second-round civilian members were appointed (with their term going from April 1, 2021, to March 31, 2023).

The second-round new technology and service deliberation committee comprises 20 members, seven ex-officio members, including the chairperson (the Minister of Science and ICT), and 13 commissioned members who are civilian experts in their respective fields of academia, industrial circles, legal circles, and associations and organizations.

B. Revision of the Special Act on Promotion of Information and Communications Technology and Vitalization of Convergence Thereof

The 「Special Act on Promotion of Information and Communications Technology and Vitalization of Convergence Thereof」 (hereafter, “Information and Communication Convergence Act”) was revised (Act No.18202, June 8, 2021, Partial Amendment, Enforcement Date February 29, 2021) to realign the details about the ICT regulatory-sandbox temporary-permit system.

Before the validity period for a temporary permit expires, the head of a relevant institution should prepare the legislation to back the permit, and if this legislation is not prepared within the validity period, the period will be considered extended until the legislation’s preparation is complete. However, if the target of the prepared legislation is an act, the cases will be excluded from consideration for validity-period extension. Thanks to the revised “Information and Communication Convergence Act,” a basis was prepared for companies with a temporary permit to proceed in making innovative efforts without worrying about project termination.

C. Institutions operating and supporting the ICT regulatory-sandbox program

Following the enforcement of the 「Special Act on Promotion of Information and Communications Technology and Vitalization of Convergence Thereof」, the Ministry of Science and ICT has been operating the ICT regulatory-sandbox program since January 17, 2019.

Companies can contact the ICT Regulatory-Sandbox Consulting Center or the Sandbox Support Center freely to obtain information about procedures or methods to use the ICT regulatory-sandbox program, receive consulting services about documents to prepare, and submit their completed documents to the center in order to apply for the ICT regulatory-sandbox program and submit their application to the Ministry of Science and ICT.

D. Status of operating the ICT regulatory-sandbox program

In 2021, two years after the enforcement of the program, the initial two-year validity period for the temporary-permit and special-cases-for-demonstration projects designated in 2019 came to a point of expiration. In response, the Ministry of Science and ICT received requests for approval on extending the validity period from the temporary-permit and special-cases-for-demonstration companies and, after reviewing the requests, approved the extension of the validity period.

Moreover, there is an actively running procedure of approving changes to the designation conditions (additional conditions) or business plans if there is a request from a company in the process of launching a business or service, following the grant of a temporary permit or designation as a special case for demonstration and after a review by the relevant departments and a report to the deliberation committee.

Since the enforcement of the program in 2019, out of the 111 projects designated by the regulatory-sandbox program approved in the 19 meetings of the deliberation committee, 63 new technologies and services have been launched in the market, improving convenience in people's daily lives (as of the end of June 2021). Furthermore, related regulations for 23 projects were improved, meaning the special cases from the regulations are incorporated into the formal sector, creating a virtuous-circulation ecosystem for vitalization of new ICT industries and services.

Section 3 Framework Act on Intelligent Informatization

To prepare a basis for core technologies, such as AI and data, build industrial ecosystems, and contribute to strengthening the national competitiveness and improving the quality of people's lives by establishing a national promotion system to support the Fourth Industrial Revolution, the 「Framework Act on National Informatization」 was fully reformed to the 「Framework Act on Intelligent Informatization」, which went into effect on December 10, 2020.

1. Overview

For the purpose of giving consistence to individual activities by each national institution for informatization promotion and for formation of a basis for information and communications businesses, the 「Framework Act on Informatization Promotion」 was legislated on August 4, 1995. After that, as the paradigm for national informatization shifted rapidly from promotion of informatization to application of information, with the goal of contributing to the realization of an intelligent information society, the 「Framework Act on Informatization Promotion」 was fully reformed to the 「Framework Act on National Informatization」 on May 22, 2009.

To respond preemptively to social and economic changes following the Fourth Industrial Revolution, it is necessary to establish a national promotion system and rearrange the regulation system for technical innovation, and to continue developing the competitiveness of Korea in the field of information and communications, it is urgent to put an efficient execution system in place by joining together the capabilities of the government and the private sector. Additionally, in Korea, with its economic system that is rather small and open, the government needs to support the Fourth Industrial Revolution by developing strategic technologies, expanding public investment, rearranging the system, and establishing an ecosystem. Given that a revolution in productivity will occur through so-called “destructive innovation” in the Fourth Industrial

Revolution era, fundamental changes to social systems, such as jobs, education, and welfare, are expected, as well. Under these circumstances, the 「Framework Act on National Informatization」 was fully reformed as the 「Framework Act on Intelligent Informatization」, and the new act became fully effective on December 10, 2020.

2. Results and achievements

A. Definition of terms related to intelligent informatization

Key terms, such as “intelligent information technology” and “intelligent information service,” were newly defined, making the concepts related to intelligent informatization more clearly and specifically established (Article 2).

B. Establishment of the comprehensive intelligent information society-building plan, etc.

Whereas the 「Framework Act on National Informatization」 prescribed that a base plan and an execution plan for national informatization should be established, the 「Framework Act on Intelligent Informatization」 changed them into a comprehensive plan and an execution plan. It expanded the existing base plan to deal with the overall change of and response to society into a more comprehensive national strategy, and the establishment period of the plan was changed from five years to three years (Article 6).

Additionally, to support policy development related to the intelligent information society, it prescribed establishment of the National Information Society Agency, changing from the existing National Informatization Agency (Article 12).

C. Fostering of professionals, leave of absence of public educational officials, etc.

Policies required to foster professionals should be established and executed (Article 23), and for a public educational official, etc., to work in an intelligent information company, this official can take a leave of absence or hold

concurrent positions as a representative or employee of the intelligent information company (Article 24 and Article 25). As a result, a legal foundation was prepared to foster professionals in intelligent information technologies, such as AI, and resolve the shortage of excellent personnel in education.

D. Establishment of data-related policies

The act also prescribed data policies to achieve the objective of activation of data distribution and fostering of specialized companies, such as enforcing policies to promote production, collection, distribution, and application of data and building a cooperative system for efficient production, collection, and management and active distribution and application of data (Article 42 and Article 43).

E. Response to the changing job and labor environments

Stating the preparation of measures for jobs, education, welfare, etc., the act prescribes policies to prevent adverse effects following the application and spread of new technologies and response to social changes (Article 55).

F. Guarantee of stability and reliability related to intelligent information technologies, etc.

Protective measures to secure the stability of intelligent information technologies and intelligent information services were prepared (Article 60), and the design was prescribed for intelligent information technologies and intelligent information services appropriate for protection of privacy and personal information (Privacy by Design) (Article 61). A legal foundation to enact national ethical regulations for the intelligent information society was put in place (Article 62).

3. Future prospects

With the full reform of the 「Framework Act on National Informatization」 into the 「Framework Act on Intelligent Informatization」 and preparation of the required laws, there came a comprehensive proposal on the role of the Korean

government and the directions for cooperation with the private sector and for securing technologies and labor. As a result, the groundwork to produce a strong drive for the national-level Fourth Industrial Revolution was put in place. However, there are many opinions that the current 「Framework Act on Intelligent Informatization」 alone is insufficient in terms of legislative support to realize an inclusive digital society and that additional legislation to regulate the overall data ecosystem does not exist. As such, in the future, regarding details that could not be specified in the 「Framework Act on Intelligent Informatization」, specific plans for development of the intelligent information society need to be continuously supplemented through revision of the 「Framework Act on Intelligent Informatization」 or establishment or revision of individual laws.

Chapter 3

International Cooperation



Section 1 **Global Status of the Internet**

Section 2 **Internet Governance and Related
International Laws**

Section 1 Global Status of the Internet

The number of global internet users has been steadily growing to the point where it was found that about 4 billion people, or 51.4% of the total population, are using the internet. In addition, it was investigated that this growth is greater in developing countries than in developed countries and, given the internet use rate by generation, the generation leading this growth is “Generation Z,” of which about 70% are using the internet. Global institutions and global research institutes recognized Korea’s excellent internet-use environment and classified Korea as a developed country in terms of the internet, where most of the population uses the internet. However, looking into the international evaluation index that measures overall industrial situations related to the internet, such as digital industrial capabilities and the technical-innovation acceptance rate, Korea’s rank is still relatively low but is seeing continuous improvement.

1. Global status of internet use

A. Global trends in internet use

The number of households using the internet around the globe has been continuously growing since the use rate exceeded the 50% boundary in 2018. According to the statistics for November 2020 by the International Telecommunication Union (ITU), 57.4% of households around the globe have access to broadband internet, and 51.4% of the global population is using the internet, meaning roughly 3.97 billion people.

The growth of the internet use rate is led by developing countries, not developed countries, and these nations also hold greater potential for future growth.

In particular, the internet use rate for Generation Z, meaning those born in 1997 or later and falling between the ages of 15 and 24 years old, is significantly higher than the overall internet use rate.

B. Changed ways of using the internet

Along with the growing trend of internet use, the ways of accessing the internet

are changing from a wired basis to a wireless basis. Whereas the rate of wired-based telephone or internet subscriptions per 100 persons has decreased or only slightly increased, the wireless broadband subscription rate has been showing a steady growing trend. The rate for wireless-type service subscriptions exceeded 100% as of June 2020, making it reasonable to infer that the ways of using the internet around the world have already been altered to or are on a rapid transition to the wireless type. One noticeable aspect is that the mobile-phone subscription rate slightly decreased compared to the previous years (107.8%→105%), and that can be interpreted as a reflection of the growing number of mobile broadband lines for tablets, etc.

2. Status of internet use in major nations

According to the ITU's survey results among national internet-infrastructure management institutions in each country, it was found that in Korea, 96.2% of the population is using the internet as of 2019.

It was examined that the use rates in developed countries, such as the US, Germany, France, and the UK, are lower than in emerging countries, such as Korea, Saudi Arabia, and the United Arab Emirates, and 80% or more of the population in major nations, excluding China and South Africa, is using the internet.

3. Status of ICT-related international indexes

Korea is in the upper ranks for ICT-related international indexes and is, therefore, evaluated as a strong IT nation, with the achievements of its governmental policies for digitalization also being highly recognized. Looking into more details, Korea showed a world-class level in indexes related to the public sector represented by the electronic government, participation (use) of users, and infrastructure, but in the comprehensive index assessing the ICT industry, overall, it ranked relatively low in the upper or mid-upper positions.

4. Future prospects

Internet-related global statistics and indexes prove that social digitalization is being accelerated and powered by the internet. According to a report by the ITU, which has long been collecting and analyzing data by different nations, the internet distribution rate and use rate in all nations in the world, including Korea, have been increasing. Looking into specifics about ways of use, the growing trend of internet use through the existing wired broadband lines (coaxial cable, optical cable, etc.) has stalled, and the cellular or mobile broadband applicable to mobile devices (smartphones, tablets, etc.) has jumped noticeably. As coverage for wireless broadband services based on 4G LTE and 5G extends, the cord-cutting of wired internet services is expected to be accelerated, and in the future, depending on whether the broadband services using the satellite communications system, such as Starlink of Space X and Iridium of Motorola, for which the coverage is the entire planet, become popular or not, the domain of wired internet services is expected to be significantly reduced.

At the same time, regarding internet users and expansion of infrastructure, developing countries are showing a more drastic growth trend than developed countries, and the internet use rate for Generation Z, with its members between 15 and 24 years old, is relatively high. In the future, the internet market will continue to grow, empowered by developing countries that still have potential and room for growth, and Generation Z, as digital natives, will lead this growth.

Section 2 Internet Governance and Related International Laws

The Internet Governance Forum (IGF) in 2020, which was held online for the first time, was part of the overall review process on execution of the outcomes from the World Summit on the Information Society (WSIS). It was considered the middle phase of the 10-year term of the second round approved by the UN General Assembly in 2015. Under the overarching theme of “Internet for human resilience and solidarity,” the IGF 2020 provided a multilateral platform for participation and discussions about internet-policy-related issues. Moreover, it is evaluated that the event exhibited how the internet can expand digital cooperation and support human rights and sustainable development goals (SDGs).

1. Brief status

A. Global discussion on internet governance

The UN IGF produced one of the most meaningful outcomes of the WSIS that obligated the UN Secretary General to officially convene this forum on July 18, 2006. In the resolution (70/125) approved by the UN General Assembly on December 16, 2015, the “General Assembly high-level meeting on the overall review of the implementation of the outcomes of the WSIS” extended the existing rights of the IGF stated in Paragraphs 72-78 of the Tunisian Agenda for another 10 years. A total of 15 annual conferences of the IGF were held until 2021 by the governments of different nations.

B. The 15th UN IGF in 2020

1) Overview

In 2020, the COVID-19 pandemic caused destructive impacts and changes to human lives and the global economy. Under social-distancing measures and quarantine situations, to resolve isolation issues, provide a continuous flow of

information, and maintain solidarity, connection to the internet and digital technologies were essential. Furthermore, in the pandemic situation, the serious digital gap was disclosed, along with a lot of problems regarding internet governance, including the infodemic, personal data protection, and cyber security, were revealed. Given these situations, at the 15th IGF Forum, which was held online from November 2 to 17, 2020, leaders, government heads, leaders of private organizations, technical communities, experts from academia and research institutes, legislators, and young people from many nations around the world were gathered at the right time and participated in discussions about internet-governance-related policy issues.

[Table 3-3-2-1] Key statistics related to the outcomes of the 15th UN IGF in 2020

IGF website	Social media
400,000+ page views on the IGF Website	 23,431 Top countries: US, Poland, India, Brazil, Germany
20,929 connections to sessions	 7,767 Top countries: Brazil, US, India, Mexico, Germany
295 events including 235 Webinars and 60 Meetings	 20,000,000+ Reach
	 15,668 Views on UN TV

Source: UN IGF(Internet Governance Forum), 2021

At the IGF 2020, more than 6,000 participants from 173 nations were in attendance, recording the highest participation rate ever. Not only is it a successful result to have held the IGF conference but it is also encouraging to see increased participation from all four corners of the world, including those from developing countries.

2) Main agenda

The agenda of global discussions on internet governance is expanding from internet addresses to general internet matters, such as net neutrality, information protection, content, e-commerce, privacy, and human rights.

2. Future prospects

The IGF is a global multilateral cooperation platform to discuss public policies related to internet governance. The IGF 2020 was a chance to discuss the point of intersection between digitalization and the environment, and during the process, participants agreed on the necessity of a sustainable way to connect people to the digital world while reducing environmental impacts. Furthermore, a summit among the youth was held for the first time, and by engaging the youth in flash talks and the high-level leaders track, their inclusion was greatly improved.

The next three IGF annual meetings will be held in Poland in 2021, in Ethiopia in 2022, and in Japan in 2023.

Appendix

Authors of 2021 Korea Internet White Paper

Advisors and Editors of 2021 Korea Internet White Paper

Authors of 2021 Korea Internet White Paper

Message from the Publisher	Moon Yong-sik	National Information Society Agency	President
History of the Internet in South Korea	Editorial staff		
2021 Korea Internet White Paper Infographics	Editorial staff		
Part 1. Technology and Service			
Chapter 1. Internet Convergence Technology			
Section 1. Artificial Intelligence	Kim Yeong-hun	Hanyang University	Professor
Section 2. Cloud	Choi Yeong-jin	Eulji University	Professor
Section 3. Internet of Things	Kang Seon-mu	Kyung Hee University	Professor
Section 4. Blockchain	Park Eun-su	Korea Internet & Security Agency	Senior researcher
Section 5. Metaverse	Choi Pil-sik	Tech G	CEO
Chapter 2. Service			
Section 1. Internet Finance and Fintech	Jeong Yu-sin	Sogang University	Professor
Section 2. Remote Medical Care	Kang Seong-ji	WELT	CEO
Section 3. Online Education and e-Learning	Kim Seong-jin	Seoul Digital Foundation	Team leader
Section 4. O2O Service	Kim Dae-won	Kakao	Director
Section 5. Social Media and Content	Choi Hong-gyu	EBS Research Center	Research director
Section 6. Administrative Services	Bak So-a	Daum Soft	Director
Section 7. Smart City	Hwang Jong-seong	National Information Society Agency	Research director

Part 2. Life			
Chapter 1. Strengthening Digital Capabilities			
Section 1. Fostering of Software Talents	Lee Seung-min	Institute for Information & Communication Technology Planning & Evaluation	General manager
Section 2. IT Education for the Socially Disadvantaged	Go Yeong-sam	Busan Digital Agency	President
Chapter 2. Inclusive Digital Culture			
Section 1. Prevention of Smartphone and Internet Overdependence	Go Yeong-sam	Busan Digital Agency	President
Section 2. Internet Ethics	Lee Sang-a	National Information Society Agency	Senior researcher
Section 3. Response to Distribution of Harmful Information	Son Ji-won	OpenNet	Lawyer
Section 4. Inclusive Digital Technologies and Services	Choi Mi-ran	Electronics and Telecommunications Research Institute	Researcher
Chapter 3. Inclusive Use Environment			
Section 1. Web Interoperability	Choi Yeong-jun	Korea Internet & Security Agency	Team leader
Section 2. Internet Openness	Go Heung-seok	Kunsan National University	Professor
Part 3. Infrastructure			
Chapter 1. Internet Infrastructure			
Section 1. Internet	An Sun-sik	Korea Internet Service Promotion Association	Director
Section 2. Internet-address Resources	Lee Han-sang	Korea Internet & Security Agency	General manager
Section 3. Standardization and Authentication Technology	Kang Sin-gak	Electronics and Telecommunications Research Institute	Division head
Chapter 2. Related Laws and Systems			
Section 1. Information Protection and User Protection	Kim Hyeon-gyeong	Seoul National University of Science and Technology	Professor
Section 2. Internet-regulation Improvement and Promotion	Kang Seong-im	National IT Industry Promotion Agency	Manager
Section 3. Framework Act on Intelligent Informatization	Jeon Hae-chung	Lim, Chung & Suh	Lawyer
Chapter 3. International Cooperation			
Section 1. Global Status of the Internet	Han Seong-ryeol	Korea Internet & Security Agency	Senior researcher
Section 2. Internet Governance and Related International Laws	Cheon Mu-ho	Korea Internet & Security Agency	General manager

Advisors and Editors of 2021 Korea Internet White Paper

Advisory committee

Park Yu-ri	Korea Information Society Development Institute
An Sun-sik	Korea Internet Service Promotion Association
Lee Su-dong	INFOGRAPHIC WORKS
Choi Yeong-jin	Eulji University
Hwang Yong-seok	Konkuk University

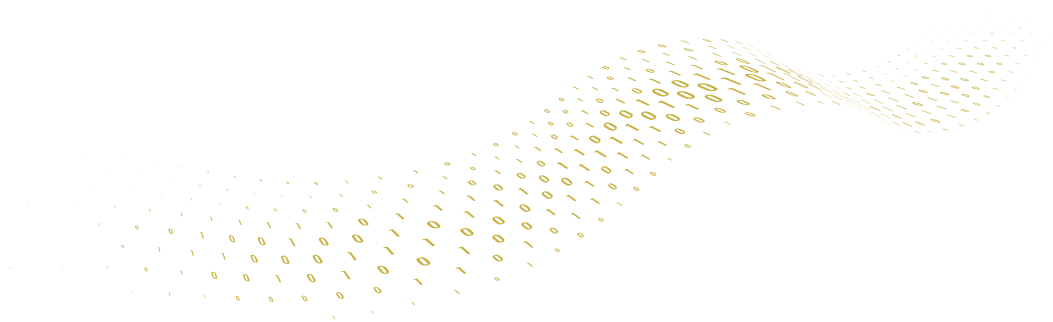
Editorial staff

- Digital Industry Policy Division, Ministry of Science and ICT

- National Information Society Agency

Geum Bong-su	Department head, Department of Digital Inclusion
Min Seong-jun	Team leader, Digital Inclusion Planning Team
Lee Yong-han	Research director, Digital Inclusion Planning Team
Han Yu-jeong	Senior staff, Digital Inclusion Planning Team
Go Hyeon-ji	Senior staff, Digital Inclusion Planning Team

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NIA NATIONAL INFORMATION
SOCIETY AGENCY

Daegu Headquarters

(41068) 53, Cheomdan-ro, Dong-gu, Daegu, Republic of Korea

☎ +82-53-230-1114

Seoul Office

(04520) 14, Cheonggyecheon-ro, Jung-gu, Seoul, Republic of Korea

☎ +82-02-6191-2114

Jeju NIA Global Center

(63568) 68-11, Seohojungang-ro, Seogwipo-si, Jeju-do, Republic of Korea

☎ +82-64-909-3114

🏠 www.nia.or.kr

