INVEST KOREA

INVESTMENT
OPPORTUNITIES
IN KOREA

Information and Communications Technology(ICT)

Contents

* Figures on the report show the likely adjustment of average yearly currency rates from Korean Won (KRW) to the US dollar (USD). A rate adjustment is adopted particularly reflecting the recent average market variations to eliminate the valuation effects arising from movements in exchange rates in case when the data expressed shows an annual growth rate on the paper.
* Rate adjusted figures are rounded off, but the sum is correct down or up to the decimal when the rounded values are not equal to the adjustment.

1 Industry Trends

Definition and Classification

■ (Communication equipment industry) A device industry is an industry related to the collection, processing, storage, search, reception and utilization of telecommunications services, and is classified into wired communication devices and wireless communication devices in detail.

- Wired communication devices are classified into wired telephone, exchanger and network equipment. Wireless communication devices include wireless communication terminal, wireless communication system and transceiver.
- At present, the communication equipment industry requires a next generation mobile communication system, mobile convergence device and parts with high speed and high quality along with related technologies for 5G mobile communication service.

■ (Telecommunication service industry) It is classified into wired communication service and wireless communication service, and classified into main communication, separate communication and supplementary communication according to whether it possesses facilities and provides the kinds of communication services under the Telecommunication Business Law.

- With the commercialization of 4G mobile communication services, the service range has expanded from voice to data, and various services such as smart home, AI and autonomous driving are expected to be realized according to 5G advancement.
- As the communication service has evolved, many industries such as related network equipment, terminals and contents have grown together, and even in the 5G era, it is expected to create added value in equipment and parts in the early stages, and in the mid- and long-term, added value in active convergence services.

1.1 Status of the Industry

Global Market Trends

○ The total worth of the global ICT market is estimated at USD 3.747 trillion in 2018, and is expected to grow to USD 3.79 trillion in 2019 by 1.1% compared to last year.

- The data center system market is expected to shrink at the highest rate compared to 2018 due to the decrease of server market price.
- Enterprise software is expected to drive ICT growth through “cloudization” of the non-cloud product group
- The device and telecommunication service markets are also expected to shrink compared to 2018 due to slowing demand in developed markets and prolonged replacement period, but are expected to grow as the 5G era blooms by 2020.

Global ICT Market Status and Prospects

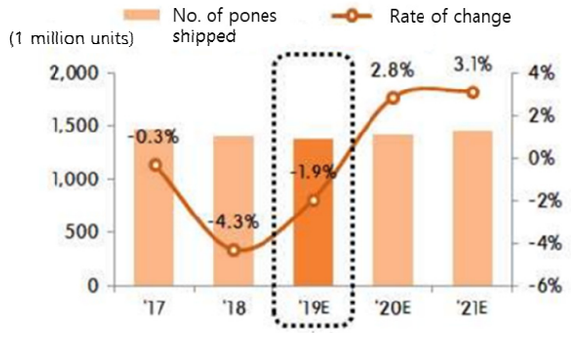
(Unit: USD billion, %)

Classification	2018	2019	2020	Growth rate (compared to the previous year)	
				2019	2020
Device	667	655	677	-1.9	3.5
Data center system	210	204	207	-2.8	1.7
Software (For business)	399	427	462	7.1	8.2
IT service	982	1,016	1,065	3.5	4.8
Communications service	1,489	1,487	1,513	-0.1	1.7
Total	3,747	3,790	3,925	1.1	3.6

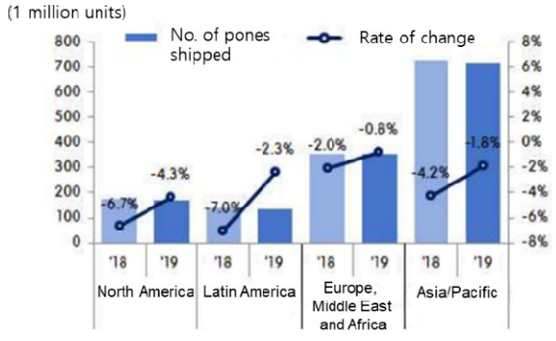
Source: Gartner (April 2019)

- The smartphone market will continue to shrink for three consecutive years, but the pace of decline will slow down with the launch of new products.
  - Smartphone shipments in 2019 are expected to drop by 1.9% to 1.38 billion due to stagnant demand for smartphones in leading markets such as China, the U.S. and Western Europe, prolonged replacement period and intensified global trade conflict.
    * Global Smartphone Shipment Growth Rate (%, IDC): (2017) -0.3 → (2018) -4.3 → (2019) -1.9 → (2020) 2.8 → (2021) 3.1
  - Demand for new products, including foldable displays and 5G communication-enabled smartphones, is expected to increase by 2.8% after 2020.
    * Share of 5G smartphones in the smartphone market (%, IDC): (2019) 0.4 → (2023) 22.8

Global Smartphone Market Status



World Smartphone Shipment Forecast

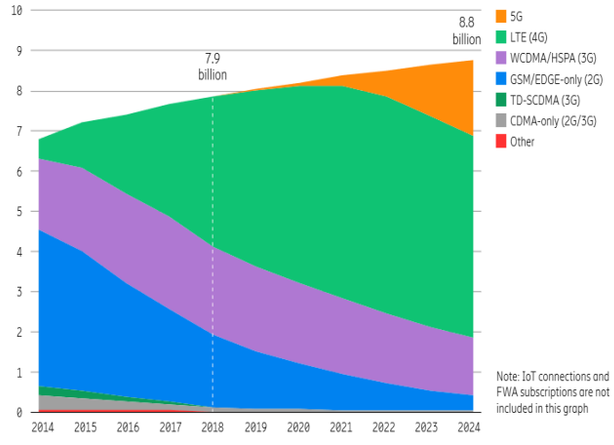


Smartphone Shipments by Region

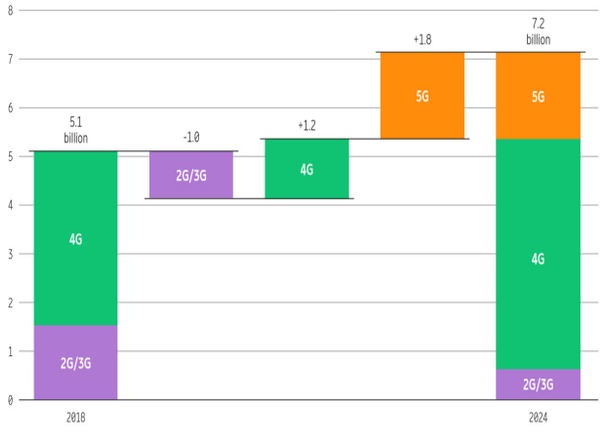
Source: IDC (June 2019), IITP (July 2019).

- The global mobile communication market has grown steadily, with 4G (LTE) driving this growth up until 2019. Starting in 2020, 5G is projected to drive market growth.
  - The number of 4G (LTE) subscriptions will continue to increase, reaching 5.3 billion by 2020, and 5G will be fully utilized in 2020, reaching 1.9 billion subscriptions by 2024.
  - The number of smartphone subscriptions is expected to increase from 5.1 billion in 2018 (percentage of 3G and 4G: 99%) to 7.2 billion in 2024.

World Mobile Communication Status



Mobile Subscription by Technology



Smartphone Subscription by Technology

Source: Ericsson (June, 2019)

Korean Market Status

- The Korean telecommunications industry slowed down due to the increase in overseas production of mobile phones.
  - In 2018, communications equipment production decreased by 1.6% year over year to USD 37.51 billion.
  - Production and export growth in Korea slowed down due to the expansion of production in overseas bases such as Vietnam and India.
    * Percentage of overseas smartphone production: (%, IITP): (2013) 83.6 → (2015) 88.1 → (2017) 91.3 → (1Q 2018) 91.0
  - Overseas expansion of parts makers has also increased for competitive advantages such as cost saving, as production of mobile phone parts expanded at overseas production bases.
  - The production of communication devices is expected to shrink in 2019 due to the maturity of the smartphone market, the price burden on high-end smartphone and the lack of differentiation. So, the smartphone market centered on flagship products is expected to shrink.

- Korea's communication device industry is centered on wireless communication terminals such as smartphones, but Korean companies are putting in efforts to foster communication equipment as a new competitive field in the 5G era.
  - Stable network infrastructure is needed to handle the increasing traffic due to entry into the hyper-connected era, and Korea also creates market demand by securing global technological competitiveness in related fields.
  - The Korean network equipment industry is expected to grow fast as small, medium and middle-standing companies expand their overseas operations, with Samsung Electronics taking the lead.
    * Samsung Electronics' global communication equipment market share (%): (2015) 4.3 (6th) → (2016) 4.0 (5th) → (2017) 4.1 (5th) → (2018) 5.0 (5th)
    * Q4 2018 5G Equipment Market Share (%, IHS): (1st) Ericsson 24, (2nd) Samsung 21, (3rd) Nokia 20, (4th) Huawei 17
  - Currently, Samsung Electronics accounts for over 50% of the production and export of mobile communication equipment, but more middle-standing companies have annual sales of KRW 100 billion (USD 91 million) including Dasan Network, Solid and Ace Technology.

Production Trends of Korea's Communication Equipment Industry

(Unit: USD billion, %)

Classification	2015	2016	2017	2018		Growth rate (compared to the previous year)	
					Percentage	2017	2018
All communication equipment	51.10	44.96	38.11	37.52	100.0	-15.2	-1.6
Wired communication device	2.33	2.21	2.18	2.15	5.7	-1.7	-1.1
Landline telephone	0.12	0.13	0.16	0.12	0.3	18.4	-22.6
Exchanger	0.08	0.06	0.08	0.08	0.2	23.7	0.2
Network equipment	0.15	0.17	0.17	0.16	0.4	-0.1	-4.0
Wired communication equipment parts	0.59	0.62	0.63	0.64	1.7	1.2	2.0
Wireless communication equipment	48.77	42.75	35.94	35.36	94.3	-15.9	-1.6
Wireless communication terminal	44.19	37.95	31.11	30.55	81.4	-18.0	-1.8
Mobile phone terminal	42.74	36.45	29.71	29.15	77.7	-18.5	-1.9
(Smartphone)	28.79	23.58	18.19	17.97	47.9	-22.9	-1.2
(Mobile phone parts)	13.94	12.86	11.52	11.18	29.8	-10.4	-3.0
Wireless communication system	2.18	1.66	1.67	1.68	4.5	0.7	0.4
Wireless communication equipment parts	1.33	1.69	1.77	1.73	4.6	4.6	-1.8

Source: Ministry of Science and ICT, ICT Major Trend Survey

- The telecom service industry has expanded rapidly as LTE service was commercialized, and telecom service sales are expected to increase again from 2019 when 5G is commercialized.
  - The Korean mobile communication service market is USD 21.97 billion in 2018, and accounted for 64.9% of total telecom service revenue.
  - Recent explosive growth in data traffic and device connections, convergence of broadcasting and telecommunications and increased use of cloud are expanding the demand for new communication technologies, and the Korean telecom service market is expected to expand in the future.

Sales Trends of Korea's Telecom Service Industry

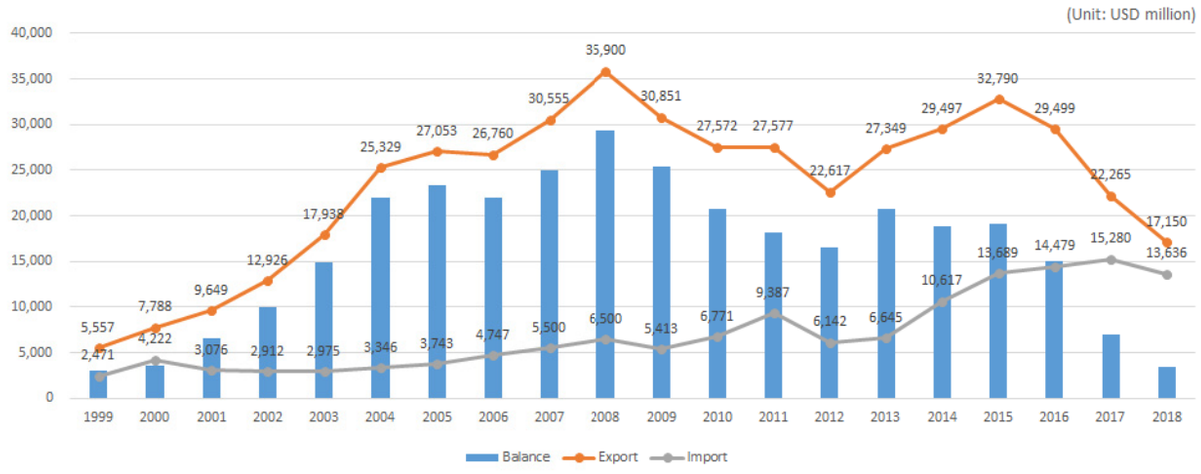
(Unit: USD billion, %)

Classification	2015	2016	2017	2018		Growth rate (compared to the previous year)	
					Ratio	2017	2018
Communication service	34.06	34.55	34.56	33.87	100.0	0.0	-2.0
Wired communication service	9.69	9.65	9.62	9.42	-0.4	-2.1	-2.1
Wireless communication service	22.40	22.88	22.95	22.44	0.3	-2.2	-2.2
Mobile communication service	21.85	22.37	22.48	21.97	0.5	-2.3	-2.3
Telesales and mediation services	1.97	2.01	1.98	2.01	-1.2	1.4	1.4

Source: Ministry of Science and ICT, ICT Major Trend Survey

- Exports and imports of Korea's telecommunication equipment industry are also heavily influenced by mobile phones (finished products and parts) of wireless telecommunication equipment.
  - Mobile phones are one of the top 10 export items in Korea, constituting a major industry, and wireless communication devices account for about 2.8% of Korea's total exports and 2.2% of imports in 2018.
  - Total exports of telecommunication equipment have dropped by 30% in the past two years due to the expansion of emerging market penetration, expansion of replacement cycle and the expansion of local production by Korean companies.
  - In the past, overall mobile phone exports remained flat even as the production of finished handset products declined, owing to increased exports of parts. However, exports are declining as part makers move overseas with set makers.

Import and Export Trends of Korea's Telecommunication Equipmetnt Industry



Source: Ministry of Science and ICT, ICT Major Trend Survey

Export Status by Item of Korea's Communication Equipment Industry

(Unit: USD million, %)

Classification	2015	2016	2017	2018		Growth rate (compared to last year)	
					Percentage	2017	2018
All communication equipment	32,790	29,499	22,265	17,150	100.0	-24.5	-23.0
Wired communication device	668	733	815	959	5.6	11.1	17.6
Landline telephone	59	65	72	57	0.3	11.0	-20.7
Exchanger	4	2	5	5	0.0	98.1	0.2
Network equipment	42	22	30	24	0.1	38.3	-20.1
Wired communication equipment parts	297	343	427	568	3.3	24.6	33.0
Wireless communication equipment	32,122	28,765	21,450	16,191	94.4	-25.4	-24.5
Wireless communication terminal	30,258	26,904	19,217	14,819	86.4	-28.6	-22.9
Mobile phone terminal	30,032	26,726	19,036	14,596	85.1	-28.8	-23.3
(Smartphone)	10,378	8,157	6,972	6,121	35.7	-14.5	-12.2
(Mobile phone parts)	19,653	18,569	12,064	8,475	49.4	-35.0	-29.7
Wireless communication system	1,248	1,323	1,808	994	5.8	36.7	-45.0
Wireless communication equipment parts	95	87	148	121	0.7	70.0	-18.2

Source: Ministry of Science and ICT, ICT Export Statistics.

Import Status by Item of Korea's Communication Equipment Industry

(Unit: USD million, %)

Classification	2015	2016	2017	2018		Growth rate (compared to last year)	
					Percentage	2017	2018
All communication equipment	13,689	14,479	15,280	13,636	100.0	5.5	-10.8
Wired communication device	1,687	1,686	1,731	1,783	13.1	2.7	3.0
Landline telephone	120	103	104	102	0.7	0.9	-2.0
Exchanger	17	19	17	20	0.1	-13.4	22.3
Network equipment	106	79	73	52	0.4	-7.4	-28.2
Wired communication equipment parts	672	672	660	668	4.9	-1.8	1.3
Wireless communication equipment	12,002	12,792	13,549	11,853	86.9	5.9	-12.5
Wireless communication terminal	10,379	11,081	11,999	10,105	74.1	8.3	-15.8
Mobile phone terminal	10,303	10,967	11,886	10,041	73.6	8.4	-15.5
(Smartphone)	3,068	2,885	4,794	4,319	31.7	66.2	-9.9
(Mobile phone parts)	7,235	8,082	7,092	5,721	42.0	-12.2	-19.3
Wireless communication system	850	788	903	1,015	7.4	14.5	12.4
Wireless communication equipment parts	394	390	247	264	1.9	-36.6	6.7

Source: Ministry of Science and ICT, ICT Export Statistics

1.2 Industrial Competitiveness

Status of Korea's ICT industry and communication device industry

- Since 2011, the ICT industry has accounted for more than 9% of gross domestic product (GDP). ICT-related GDP is approximately USD 169.5 billion (10.3% of the total) in 2018 and contributed greatly to Korea's economic growth.

ICT GDP and Growth Rate

(Unit: USD billion, %)

Classification		2013	2014	2015	2016	2017	2018
Total Industry	GDP scale (real)	1,420	1,466	1,507	1,551	1,600	1,643
	Growth rate (real)	3.2	3.2	2.8	2.9	3.2	2.7
ICT Industry	GDP scale (real)	132	137	139	151	156	169
	Percentage (real)	9.3	9.4	9.2	9.7	9.7	10.3
	Growth rate (real)	5.7	4.0	1.6	8.1	3.5	8.3

Source: Bank of Korea, National Account

Note: 1) ICT includes manufacturing (semiconductor, display, parts, wire, cable, broadcasting communication equipment, information equipment, precision equipment), broadcasting, communication, SW development supply, computer related services and information services.
2) Real GDP (Identifying Economic Growth) represents the value of the production of goods and services calculated based on the base year prices (constant prices).
3) ICT industry share is the percentage of ICT industry in all industries.

- In Korea, the percentage of the ICT industry in facility investment was about 20%, and overall industrial facility investment decreased slightly in 2018, while ICT-related facility investment increased to 4.1%.

ICT Facility Investment and Growth Rate

(Unit: USD billion, %)

Classification		2013	2014	2015	2016	2017	2018
Total Industry	Facility investment scale (Real)	201	211	219	226	254	253
	Growth rate (real)	-0.4	4.8	3.8	3.2	12.4	-0.6
ICT Industry	Facility investment scale (Real)	26	27	28	28	30	52
	Percentage (real)	21.3	21.1	21.0	20.1	19.5	20.4
	Growth rate (real)	1.4	3.8	3.3	-1.2	9.1	4.1

Source: Bank of Korea, National Account

Note: Equipment investment in the ICT sector aggregates the investment in ICT equipment and devices (computers, communication devices, etc.) in the national economy.

- The telecommunication equipment and telecommunications service industries will respond quickly to changes in new technologies and market demands, and lead the Korean ICT industry through continuous investment in innovation.
  - The telecommunication equipment and service industries are the leading industries, which drove the national economy by creating 9.7% of employment and 15.8% of added value in the ICT industry.

- The telecommunication equipment industry accounts for 9.3% of the ICT industry's total output and 7.5% of the ICT industry's exports, and the telecommunications service industry accounts for 8.0% of the ICT industry's output.

Status of Korea's Telecommunication Equipment Industry

Classification	Number of busines ses	Total Number of workers	Value added (USD 100 million)	Production (USD 100 million)	Trade (USD million)		
					Export	Import	Balance
ICT industry	35,549 (100.0)	1,034,334 (100.0)	1,937 (100.0)	4,311 (100.0)	233,075 (100.0)	107,119 (100.0)	113,222 (100.0)
Telecommunication and broadcasting companies	960 (2.7)	58,669 (5.7)	128 (6.6)	402 (9.3)	17,576 (7.5)	13,914 (13.0)	3,662 (3.2)
Wired communication equipment business	214 (0.6)	7,714 (0.7)	7 (0.4)	-	959 (0.4)	1,783 (1.7)	-824 (-)
Broadcasting and wireless communication equipment business	746 (2.1)	50,955 (4.9)	120 (6.2)	-	16,617 (7.1)	12,131 (11.3)	4,486 (4.0)
Telecom service	439 (1.2)	41,560 (4.0)	177 (9.2)	346 (8.0)	-	-	-
Wired communication service business	150 (0.4)	26,453 (2.6)	-	96 (2.2)	-	-	-
Wireless communication service business	122 (0.3)	12,513 (1.2)	-	230 (5.3)	-	-	-
Communication resale business	167 (0.5)	2,594 (0.3)	-	20 (0.5)	-	-	-

Source: Ministry of Science and ICT, ICT Survey
Note: 1) As of 2017 (or 2018, for trade statistics)
2) The statistics for the equipment industry are based on businesses with 10 or more employees (excluding trade statistics), and the statistics for the service industry is based on head offices.
3) ( ) is the percentage in the ICT industry.

Change in the rank of global wireless communication equipment production and sales

- Korea is the 5th largest producer of wireless telecommunications devices and parts, although overseas production of finished mobile phones and parts has also increased.
- The proportion of Korea's wireless communication equipment production in global production declined from 5% in 2016, to 4.6% in 2017 and to 4.3% in 2018, but Korea is always among the top 5 producers.

Change in Ranking of Global Wireless Communication Equipment Producers

(Unit: USD 100 million, %)

Ranking	2016			2017			2018		
	Country	Production	Ratio	Country	Production	Ratio	Country	Production	Ratio
1st	China	1,720	46.0	China	1,780	46.3	China	1,843	46.4
2nd	U.S.	752	20.1	U.S.	772	20.1	U.S.	794	20.0
3rd	Vietnam	266	7.1	Vietnam	255	6.6	Vietnam	268	6.8
4th	South Korea	186	5.0	South Korea	178	4.6	India	175	4.4
5th	Japan	121	3.2	India	140	3.6	South Korea	170	4.3
6th place	India	109	2.9	Japan	115	3.0	Japan	109	2.8
7th	France	98	2.6	France	102	2.7	France	105	2.6
8th	UK	60	1.6	UK	59	1.5	Brazil	61	1.5
9th	Brazil	52	1.4	Brazil	59	1.5	UK	60	1.5
10th	Taiwan	46	1.2	Taiwan	45	1.2	Taiwan	42	1.0
	Worldwide	3,740	-	Worldwide	3,841	-	Worldwide	3,970	-

Source: Reed Electronics Research, Year Book of World Electronics Data, each year

- In the global smartphone market, Korea has maintained the number 1 position since it ranked number 1 in the world in 2011.
  - Although the market share fell slightly, the influence of Korean manufacturers such as Samsung Electronics on the smartphone market is immense.
  - Korean manufacturers continue to rank first in smartphone sales by bolstering their mid/low-end smartphone lineups, while leading innovation by launching premium smartphones with new technologies such as 5G and foldable screens.

Trends of Top 5 Companies in the Global Smartphone Market

(Unit: %)

Ranking	2015		2016		2017		2018		Q1 2019	
1	Samsung Electronics	22.8	Samsung Electronics	20.5	Samsung Electronics	20.9	Samsung Electronics	19.0	Samsung Electronics	19.2
2	Apple	16.2	Apple	14.4	Apple	14.0	Apple	13.4	Huawei	15.7
3	Huawei	7.4	Huawei	8.9	Huawei	9.8	Huawei	13.0	Apple	11.9
4	Lenovo	5.2	Oppo	5.7	Oppo	7.3	Oppo	7.6	Oppo	7.9
5	Xiaomi	4.9	Vivo	4.8	Vivo	6.5	Vivo	6.6	Vivo	7.3

Source: Gartner
Note: based on sales

Mobile communication/network technology level and technology gap

- Korea provides the world's best mobile communication services, as exemplified by the demonstration of 5G service at the PyeongChang Olympics and the commercialization of the world's first 5G service. However, Korea depends mostly on foreign countries for communication module/part technology.
  - According to the Korea Institute of Information and Telecommunication Planning and Evaluation, Korea's level of network technology is relatively low, but the level of mobile communication and network technology has improved 4 points from the previous year.
    * Changes in Korean Technology Level by Sector: [Mobile Communications] (2017) 92.3 → (2018) 96.8 (4.5 ↑), [Network] (2017) 81.1 → (2018) 85.9 (4.8 ↑)

Technology Level by Sector in 2018

Classification	South Korea	U.S.	Japan	China	Europe
Mobile communication	96.8	100	93.9	97.5	96.4
Communication service	97.7	100	94.2	95.8	97.0
Wireless communication module	94.9	100	93.9	98.9	98.7
Communication module/parts	97.8	100	93.6	97.9	93.5
Network	85.9	100	90.5	89.4	96.4
Communication service	90.7	100	89.8	91.8	92.6
Wired communication system	87.8	100	93.4	93.4	93.4
Communication module/parts	79.2	100	88.3	82.8	85.5

Source: ICT Evaluation Report, ICT Technical Level Survey Report (July 2019)
Note: out of 100 points

- Korea leads 5G international standardization, for example, by proposing Korea's commercial 5G technology as an International Telecommunication Union (ITU) standard.
  - Korea proposed three 5G-related standards at the ITU Mobile Telecommunication Standardization Conference and spread the world's first commercial 5G technology, which was introduced in the final proposal, to 193 ITU member states around the world (July 2019).
  - Korea seeks to become the world's top 5G country by having its 5G technology designated as an ITU standard.
    * The final decision will be adopted after verification and evaluation of 5G candidate technology and drafting of standards (by November 2020).

International Index in ICT

- The World Economic Forum (WEF, Davos Forum) evaluated Korea as a major innovation hub and highly assessed the country as a global leader in the ICT sector, based on its high level of ICT technology and penetration rate.
  - The technology acceptance ranking of Korea has soared to No. 1 in 2018 due to the increase in the number of mobile subscribers per 100 people and the percentage of Internet users.

Trends of Technological Readiness Ranking

Classification	2012	2013	2014	2015	2016	2017	2018
Korea	18th	22nd	25th	27th	28th	29th	1st

Source: The World Economic Forum, The Global Competitiveness Report, each year
Note: 1) Evaluates current high-speed internet status and readiness to adopt new technologies
2) Technology acceptance sector replaced by ICT adoption in 2018

- According to the global competitiveness assessment published by the Swiss International Institute for Management Development (IMD), Korea maintains a competitive advantage with high ranks in IT-related indicators.
  - The technology infrastructure ranking rose to the third place compared to last year with a high ranking in detailed evaluation criteria such as broadband subscriber per population of one thousand (5th) and investment in the telecommunications sector (9th).

Trends of Technology Infrastructure Rankings in Evaluation of Global Competitiveness

Classification	2012	2013	2014	2015	2016	2017	2018
Korea	14th	11th	8th	13th	15th	17th	14th

Source: IMD, The IMD World Competitiveness Year Book, each year
Note: Evaluates the overall technology infrastructure, including the number of subscribers, fees and investments in telecommunications services.

1.3 Promising Fields in Korea

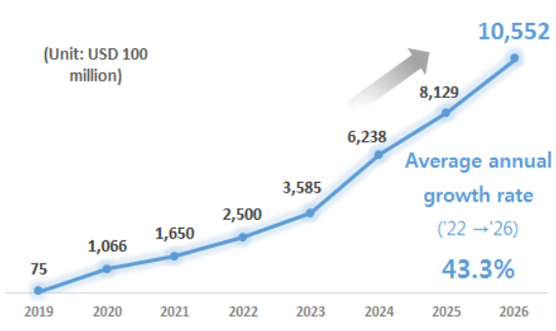
5G

- In the 5G sector, Korea aims to not only improve transmission speed but also to connect multiple devices and connect with ultra-low delay, so that it will be applied to various industrial fields and advanced devices beyond the 4G era that was only limited to smartphones.

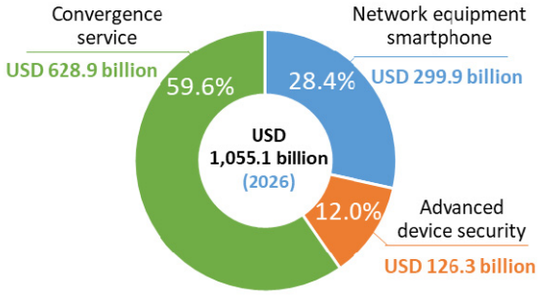
- With the transition to 5G, the convergence of mobile communication will be realized with other industries, and new market opportunities will be created with 5G-based advanced models in various B2B areas such as autonomous vehicles, smart factories, drones and healthcare.

- 5G is expected to stimulate mutual growth of the front and rear industries and create a large amount of value added for the future market as it converges to all industries.
  - Market creation is expected to be worth a total KRW 1,161 trillion (USD 998 billion) in 2026 among key industries including network equipment and terminals, advanced device security and convergence services.

Global 5G Market Outlook



Annual Global Market Outlook



Global Market Outlook by Sector

Source: 5G + Strategy, Ministry of Science and ICT (June 2019)

- With the commercialization of 5G mobile communication services, handset manufacturers, parts companies, mobile carriers and content companies are making efforts to respond to the new 5G market.
  - Early commercialization of 5G provides an opportunity to preoccupy the global market by leaping into the terminal and equipment industry and creating new markets for converged services and devices, as the related industry struggles due to global competition.

Smartphone

- To secure a new growth engine in the stagnant smartphone market, handset manufacturers have been actively including 5G-enabled phones in their new smartphone lineups.
  - In line with the commercialization schedule of global 5G, most smartphone makers will cooperate with Korean and overseas mobile operators to strategically occupy the initial 5G market.

5G Smartphone Launching Strategies of Major Smartphone Manufacturers

Company name	Strategy
Samsung Electronics	- Galaxy S10, the world's first smartphone to support 5G, launched on April 3, 2019 - Two-track strategy using premium lines (Galaxy S10, Galaxy Note 10 (August 2019), Galaxy Fold (September 2019)) and low-end 5G models (Galaxy A90 (September 2019)) with 5G capability
LG Electronics	- Launched 5G smartphones 'G8 ThinQ' (March 2019) and 'V50 ThinQ' (May 2019) - 'V50S ThinQ' (tentative name), the successor to the V50 ThinQ, released at IFA2019 (September 2019)
Apple	- The lawsuit against Qualcomm expected to hinder 5G modem chip supply and the 5G model not applied to iPhone 11 - 5G models to be released as early as 2020 or later in the year
Huawei	- Mate 20X 5G released (July 2019) and foldable smartphone 'Mate X' launched on October 2019 to promote 5G - Future direction uncertain due to U.S. sanctions

Source: Company PR materials, press releases

- Many smartphone manufacturers are preparing new smartphones to cope with the 5G market, and the competition focused on 5G smartphones will intensify from 2H 2019.
  - Korean companies are expected to preempt the market early due to the absence of major competitors such as Apple and Huawei.

Network Equipment

- Network equipment makers, of which sales growth was limited due to a reduced LTE investment by telecom operators, are expected to recover sales through 5G investment.
  - The market generally recovers with the increase of 5G-related technologies and equipment companies with recent business agreements.
  - High growth potential for Korean companies including SMEs is expected due to increased demand for small cells and repeaters.
- Samsung Electronics chose 5G as its future growth business and plans to invest heavily in related chipsets, terminals and equipment.
  - Samsung Electronics' Network Division plans to expand the market by collaborating with global telecommunications companies to apply a number of 5G technologies with the aim to increase global market share by 20% in 2020.
    * Samsung Electronics signed a 5G fixed wireless access service (FWA) communication equipment contract with Verizon, U.S. (January 2019).

5G Mobile Communication Service

- Major carriers in Korea expanded 5G coverage by launching the world's first 5G commercial service.
  - SK Telecom, KT launched priority services in the Seoul Capital Area and other metropolitan cities, and LG Uplus launched priority service in the Seoul Capital Area and Daejeon.
  - By the end of 2019, base stations will be built in 85 major cities across the country to secure 230,000 base stations and 93% coverage of the population.
    * Status of 5G mobile phone lines (no. of units): (April 2019) 271,686 → (May) 784,215 → (June) 1,336,85
- Korean carriers need to provide stable communication services and launch competitive plans for universal 5G services.
  - Considering market conditions such as terminal and coverage expansion, mid and low-rate plans need to be expanded as early as possible.
  - An Unlimited 5G data plan has been released at a lower price than LTE (KT, USD 80 → USD 73), resulting in a full-fledged rate competition between mobile carriers (SKT and LGU+ also provide unlimited data plans).

SWOT Analysis of Korea's 5G Industry

Strength	Weakness
- Global mobile communication infrastructure and terminal powerhouse - World-class ICT manufacturing competitiveness	- Small market and investment compared to competitors - Inferior competitiveness in the equipment/device industry - Lack of global success experience in service sector
Opportunity	**Threat**
- Opportunities for market dominance created by promoting the world's best 5G commercialization based on smartphone - Early stage of large market	- Uncertainty of initial profit model (killer service) - Escalating global competition from China - Threats and ramifications of cybersecurity and communication disasters aggravated in 5G hyper-connected environment

Source: Ministry of Science and ICT, 5G + Strategy, (June 2019)

2 Trends of Foreign Direct Investment

2.1 Foreign Direct Investment Status

- As of 2018, investment inflows in the electronics industry amounted to USD 1.35 billion, down by 10.3% year-over-year.
  - Investments in the completion of the global value chain increased through cooperation of large Korean companies and investment in front and rear related industries (materials and parts).
- In 2018, investment inflows in the information and telecommunication industry amounted to USD 3.12 billion, an increase of 135.6% over the previous year, accounting for 11.6% of the total investment.
  - By industry, investments in games, e-commerce and the main quaternary industries such as, cloud, AI and 5G, have increased.
    * Gaming (Blue Hole, USD 400 million), E-Commerce (Coupang, USD 110 million), Cloud (Amazon, USD 110 million), Data Management (LinePlus, USD 100 million), AI (Lunit, USD 6 million), 5G (China Mobile, USD 5 million)
  - Investments in the quaternary industries, such as 5G, IoT, AI and cloud will continue to increase in the future.
    * Telecommunications companies and terminal manufacturers around the world are collaborating with three Korean telecommunication companies to develop international standardization, application technology and 5G service.

Trends of Foreign Direct Investment in Communication Devices and Communication Services

(Unit: no. of investments, USD million)

Classification		2012	2013	2014	2015	2016	2017	2018
Electric/electronics	Number	140	101	115	123	109	118	99
	Amount	1,239	394	536	1,012	969	1,509	1,354
Communication and broadcasting equipment manufacturing industry	Number	14	17	12	9	11	13	5
	Amount	199	91	55	99	27	114	84
Telecommunications	Number	171	186	205	226	260	226	303
	Amount	1,056	775	1,693	986	2,024	1,326	3,124
Electric communication	Number	4	5	3	8	5	3	3
	Amount	33	16	18	22	73	3	7

Source: Ministry of Trade, Industry and Energy, Foreign Direct Investment Statistics

Note: 1) Electricity/electronics refers to manufacturing industries related to electronic components, computers, telecommunications and broadcasting equipment and video and audio equipment. Information and communication refers to publishing, broadcasting, communications and programming and includes services such as system integration, management and information service.

2) The number of investments per business type is recorded based on the number of reported investments.

2.2 Success Cases of Major Foreign-Invested Companies

Nokia Solutions and Networks Korea

- Nokia Solutions and Networks Korea (hereinafter referred to as NSN Korea) is a telecommunication equipment company established in 2006, with its headquarters in Finland.
  - NSN Korea is a mid-sized company with approximately 186 employees located in Seoul, providing wired and wireless network infrastructure solutions to all three Korean mobile operators.
- The company took a leading position in the global network equipment market by becoming the world's No. 1 company in the mobile broadband sector and successfully demonstrating the world's first LTE technology.
  - NSN Korea emerged as a leader in the wireless network equipment market by providing innovative products and services to telecom operators and continuing to invest in the future, including mobile broadband, related areas and next-generation network technology.
- NSN Korea strives to provide network infrastructure virtualization and solutions for 5G mobile communication.
  - It provides advanced 5G network solutions, including the launch of FWA Fast Mile 5G Gateway, and also promotes 5G advancement in cooperation with mobile operators in Korea.

Country	Parent company name	Korean company name	Address	Item	Number of employees
Finland	Nokia	Nokia Solution& Networks Korea	Seoul	Communication equipment, systems, etc.	186 (As of December 2018)

Ericsson-LG

- Ericsson-LG was established in 2010 as a joint venture between Ericsson, a Swedish telecommunications equipment company, and LG Electronics, a leading Korean IT company.
  - Ericsson owns 75% of the share and LG Electronics owns 25%, while the Ericsson-LG headquarters and its core R&D center are located in Seoul.
- Ericsson regards Korea as an attractive and optimal investor, because it is pursuing massive R&D projects and Korea is actively investing in R&D.
  - Ericsson noted that Korea has excellent manpower and infrastructure, and has an excellent track record in R&D. Domestic environment and marketability, such as Korea's high smartphone penetration rate, are also decisive factors for the investment decision.

- Ericsson focused its efforts on technology development by committing 500 engineers with outstanding technological expertise in the Seoul R&D Center while utilizing Korea's superb R&D infrastructure.
- As a result, the company applied for and registered more than 45,000 patents, and developed and supplied various products and solutions.
  * Seoul will play a key role in Ericsson's 5G testbed solution by developing 5G plug-in core parts and key technology of the 5G generation at the Seoul R&D Center.

- Ericsson leads innovation in Korea's telecommunications industry by utilizing Sweden's innovation and Korea's technology
  - LG has been a leading force in Korea's telecommunication industry. It produced the first commercial electronic telephone exchangers in Korea (1984), commercialized CDMA for the first time in the world (1995), achieved the world's first nationwide LTE deployment including VoLTE and LTE-A (2013), succeeded in 5G-only data telecommunication with SK Telecom (2019) and built 5G telecommunication equipment infrastructure for three Korean telecommunication companies (2019).
  - Ericsson-LG seeks to take the number one spot in the global telecommunication equipment market including Korea in the 5G era based on the ecosystem built through collaboration of partner companies in R&D, mobile telecommunications and solutions.

Country	Parent company name	Korean company name	Address	Item	Number of employees
Sweden	Ericsson, LG joint venture	Ericsson-LG	Seoul	Wired/wireless exchange equipment, transmission equipment, communication system, etc.	643 (As of December 2018)

China Mobile International Korea

- China Mobile International Korea is a wireless telecommunications company established in 2015.
  - The company entered Korea to establish a branch office in the form of an interconnection point for mobile switching center of LTE.
    * An interconnection point refers to the point of interconnection between carriers, which means a facility equipped directly in the target country with a local exchanger or central station and telecommunication equipment to facilitate roaming service and mutual communication.
    * The company commercialized heterogeneous LTE data roaming between countries through the Strategic Cooperation Framework Agreement (SCFA,) between China Mobile and KT-NTT DoCoMo, to establish roaming belts encompassing three countries (Korea, China and Japan) in Northeast Asia regardless of frequency method (February 2014).
    * The Strategic Cooperation Framework Agreement (SCFA) is a strategic cooperation community between Asia's largest telecommunication providers representing three Northeast Asian countries; KT, China Mobile and NTT DoCoMo. The SCFA was established in 2011 and is scheduled to operate until January 2022.

- A subsidiary company of China Mobile (100% owned by China Mobile), China Mobile International Korea has exclusively operated the parent company's international businesses such as international voice roaming, IP access service and cloud service.
  - The company established the Korean branch office to provide Korean telecommunication companies with B2B services such as network and platform business as well as B2C services for Chinese citizens in Korea and Koreans preparing to travel to China.
- China Mobile International Korea promotes Korea's mobile communication businesses by cooperating with KT in promising areas such as VoLET automatic roaming commercialization, next-generation Wi-Fi roaming and 5G service commercialization.
  - The company is working toward 5G roaming between China and Korea, including 5G roaming demonstration between China Mobile and KT.
    * China Mobile International signed an MOU with KT to promote IoT business cooperation at the SCFA General Assembly (November 2017).
    * China Mobile strengthened cooperation with KT-NTT for 5G technology development and commercialization service at the SCFA General Assembly (September 2018).
    * China Mobile succeeded in broadcasting eSports Live, a KT 5G subscriber-only service, through a pilot 5G network (May 2019).

Country	Parent company name	Korean company name	Address	Business contents	Number of employees
Hong Kong	China Mobile International	China Mobile International Korea	Seoul	Wireless communications.	12 (As of September 2019)

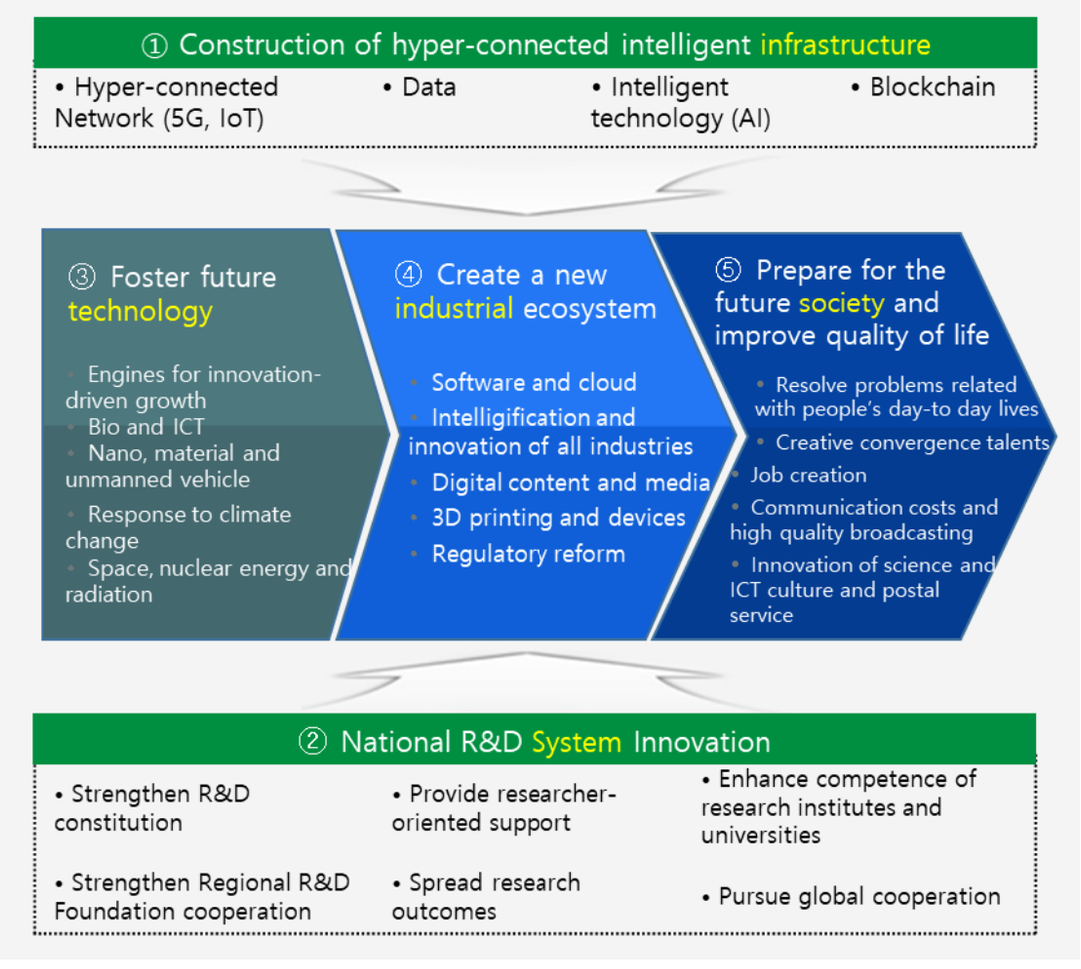
3 Policy and Locations

3.1 Key Policies and Incentives

I-KOREA 4.0

- (Strategic goal) I-KOREA 4.0 aims to establish strategies to realize a people-centered 4th Industrial Revolution based on innovative growth, safety and inclusiveness.
- (Strategic tasks) I-KOREA 4.0 consists of the following tasks: △ establish hyper-connected intelligent infrastructure △ innovate national R&D system and △ establish three tasks for enhancing the country's quality of life to lead innovative growth.

I-KOREA 4.0 Promotion Strategies and Tasks



Source: Ministry of Science and ICT, The Fourth Industrial Revolution Centered on Science and ICT (January 2018).

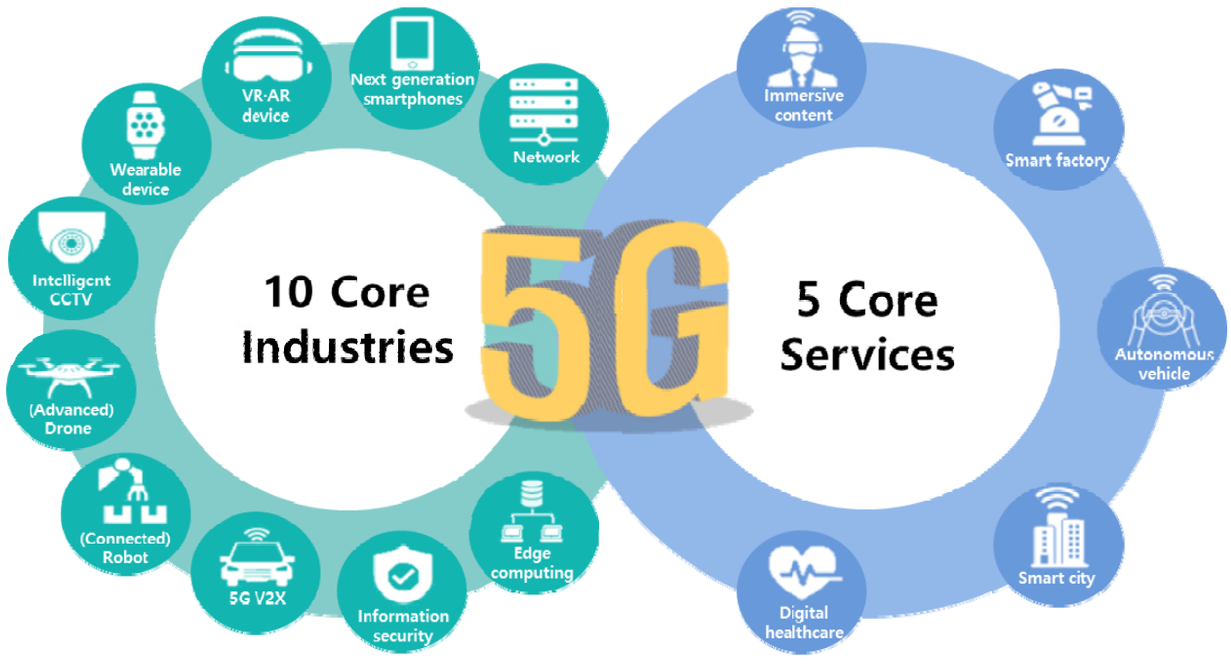
- (Establishing hyper-connected intelligent infrastructure) Develop convergence services to create innovative industries and services that can enhance the quality of life by promoting 5G intelligence and building a data utilization ecosystem beyond the world's first commercialization of 5G
- (Innovating the national R&D system) Eliminate partitions between departments and innovate national R&D systems including researcher-centered R&D as an integrator and a coordinator of national R&D projects
- (Enhancing the quality of life of the nation) Create a safe ICT and R&D environment such as preventing disasters in the network and securing cyber safety, solving people's day-to-day life problems, and support job creation by producing creative and convergent talents

5G + Strategy

- (Background) The Korean government established and implemented a nationwide 5G Plus (5G +) strategy to maximize the ripple effect on 5G front and rear industries and secure global leadership in new 5G-based industries.
  - In order to maximize the effect of early 5G commercialization, the government will push ahead with the national strategy to foster new 5G-based industries and revitalize the private-led market.
- (Goal) The government will foster strategic industries, including 10 5G-based core industries and 5 core services, to achieve 15% market share in the global market in 2026, create 600,000 jobs, export USD 73 billion and achieve KRW 180 trillion in production.
- (Promotion strategy) The government and the public sector will introduce and utilize 5G, and demonstration projects and pilot projects will be carried out to establish a public-private cooperation system so that the market will be revitalized at a fast rate.
  - Lead the initial market with 'public leading investment' such as the demonstration of 5G + core service, public service and smart city 5G introduction
  - Enhance government support for 'private investment expansion' including 5G tax and investment support, 5G test and demonstration infrastructure and content and technology commercialization
  - Revitalize 5G service through ‘institutional reforms' such as improvement of the 5G tariff system, establishment of a safe 5G user environment and regulation reform of 5G convergence services
  - Strengthen global competitiveness through 'building the industrial foundation' by securing global leading technology, strengthening the competitiveness of the information security industry, promoting startups and fostering talent

- Promote globalization of 5G services through 'overseas expansion support' such as support for mutual entry of large and small companies, 5G international standardization and international cooperation

Ten Core Industries and Five Core Services of 5G + Strategy



Source: Ministry of Science and ICT, 5G + Strategy (June 2019)

5G + Strategic Tasks

Core task	Details		Promotional timeline
1. Public-led investment	1.1. Demonstrate and spread 5G + core services	Demonstration of realistic content, smart factory, autonomous vehicle, smart city	2018-2021
		Demonstration of digital healthcare (Emergency medical system)	2018-2020
		5G + Innovation project	2021-2025
		5G + Innovation center	2021-
	1.2. Generate public demand	5G + Smart SOC project	2020-
		Application of 5G based digital twin	2020-
		5G-based secure nuclear dismantling	2020-2023
		5G-based public service robot pilot project	2020-2023
		Development of 5G drone technology demonstration	2019-
		5G based CCTV development and pilot service	2020-

Core task	Details		Promotional timeline
	1-3. Introduce 5G public services and smart cities	5G + Life project	2021-
		Introduced 5G-based real-time remote cooperative care	2020-
		Improvement of site-based welfare administration and care for the disabled	2020-
		5G-based intelligent smart city foundation	2019-
		Discovery of 5G smart city service demonstration	2019-
2. Expansion of private investment	2.1. Support 5G taxes and investments	5G network investment R&D tax support	2019-
		Linking with existing investment business	2019-
		Raising Investment fund	2019-
	2.2. Build 5G testing and demonstration infrastructure	5G testbed deployment (Terminal/network equipment/vehicle communication/drone/edge computing)	2019-
		5G autonomous vehicles, held drone competition	2019-
		Songpa Mobile Cluster	2020-2025
	2.3. Commercialize 5G content and technology	5G content flagship project	2019-
		5G content development and globalization base	2019-
		Expand network equipment R&D and win-win cooperation	2019-
		Development of general purpose 5G module diffusion	2019-
		Expansion of purchase conditional R&D	2019-
	2.4. Boost productivity in major industries	Support for 1,000 5G-factories	2020-2022
		5G-based super-connected smart shipyard	2020-2026
		Smart shipping port logistics shipyard construction	2020-2026
		5G-based sewing factory	2020-
		Realization of renewable energy optimization system	2020-2023
		Pilot supply of AR service in manufacturing field	2020-
3. System maintenance	3.1. Reform telecom service plans and systems	5G tariff plan improvements	2019-
		Communication institution maintenance	2019-
	3.2. Expand radiowave resources and	Expanding 5G frequency supply	2019-
		Improvement of regulation on the Use of Radio Resources	2019-

Core task	Details		Promotional timeline
	3.3. Build a safe 5G environment	Establish cyber security prevention system	2019-
		Strengthen network safety	2019-
	3.4 Innovate 5G convergence service regulations	Regulatory sandbox linked regulation improvements	2019-
		Demonstration related regulation Improvements	2019-
		Deregulation of location information industry	2019-
	3-5 Bridge digital gaps and protect users	Expanding Information accessibility of Intelligent Information society	2019-
		Reinforcement of education using intelligent information service for mobile vulnerable class	2019-
		Strengthen user protection in the 5G era	2019-
4. Creation of industrial foundation	4.1. Secure global leading technology	Next generation device core technology development	2019-
		Leading Technology Investments to preoccupy the future market	2020-
	4.2. Strengthen the competitiveness of the information security industry	Support for 5G security leading technology	2019-
		Foundation of 5G convergence service security industry	2019-
	4.3 Build foundation for 5G + K-Wave	Enhancement of support for realistic Korean Wave contents technology development	2019-
		Discovery and reinforcement of 5G + Korean Wave contents service	2019-
	4.4 Promote 5G start-up and foster talent	Creation of 5G-based new industry startup ecosystem	2019-
		5G convergence talent training system	2019-
5. Support for overseas expansion	5.1. Promote globalization of 5G services	Support for strengthening large and small companies and global partnerships	2020-
		Discovery of 5G products services and global expansion	2019-
	5.2 Lead global 5G standardization	3GPP international standardization response	2019-2020
		ITU international standardization response	2019-2020
	5.3 Support overseas expansion in connection with international cooperation	Entered major countries and secured a new market bridgehead	2019-
		Securing global leadership through ODA and international exchange	2019-

Source: Ministry of Science and ICT, 5G + Strategy (June 2019)

3.2 Major Locations

■ As for the locations of communications device businesses, smartphone businesses are clustered around the Seoul Capital Area and Daegu·Gyeongsangbuk-do, and network equipment businesses are clustered around the Seoul Capital Area.

Smartphone

- As for the main production locations related to smartphones, various parts companies are located around the production locations of large set companies such as Samsung Electronics and LG Electronics (Pyeongtaek in the Capital Region), Daegu and Gyeongsangbuk-do (Gumi).
  - The Seoul Capital Area has Samsung Electronics' semiconductor sites (Giheung, Hwaseong and Pyeongtaek), LG Electronics' mobile phone sites (Pyeongtaek) and display sites (Daegu). In Gyeongsangbuk-do, a number of affiliated companies are clustered around Samsung Electronics' mobile phone sites (Gumi) in Gyeongsangbuk-do and Daegu.
  - In order to reduce cost and efficiently secure their presence in the market, large set companies producing finished cell phones are steadily increasing their overseas production in such countries as China, Vietnam and India, and their part-producing partners are also increasing their local presence in those countries.
    * Samsung Electronics produces some smartphones in Gumi (4.5% of total production as of 2018), but most of the production lines have been moved overseas (44.9% in Vietnam, 20.2% in India and 20.2% in China as of 2018).
    * LG Electronics plans to relocate its Pyeongtaek smartphone production lines to Hai Phong, Vietnam (end of 2019).

Network equipment

- As for the production location of network equipment, they are concentrated in the Seoul Capital Area (Gyeonggi), and the concentration will be further intensified by the relocation of Samsung Electronics' network business.
  - As of 2017, most small and medium-sized companies including Ace Technology KMW and SOLiD GEAR are located in the Seoul Capital Area, and Samsung Electronics' Network Division is located in Gyeongsangbuk-do (Gumi).
  - At the end of 2018, Samsung Electronics Gumi Plant moved its network equipment production lines to Suwon, where the company has its 5G R&D organization, to build a smart factory.
  - The Seoul Capital Area (Gyeonggi) has emerged as a key area for the production of network equipment due to the relocation of major companies.

Seoul Capital Area, Daegu, Gyeongsangbuk-do Communications and Broadcasting Equipment Companies and Production Ratio

(Unit: no. of businesses, USD million)

Classification	Seoul Capital Area			Daegu Gyeongsangbuk-do	Total
	Seoul	Gyeonggi	Incheon		
Number of businesses (percentage)	113 (11.8%)	495 (51.6%)	91 (9.5%)	93 (9.7%)	792 (82.5%)
Production amount (percentage)	756 (1.9%)	12,170 (31.1%)	1,160 (3.0%)	22,051 (56.3%)	36,136 (92.3%)

Source: Ministry of Science and ICT, 2018 ICT Survey
Note: the percentages indicate the percentages of each region in the country (as of 2017).

- Communication service industry is accelerating the installation of 5G base stations following the construction of nationwide LTE mobile communication network infrastructure.

5G Service for mobile communication

- 3 mobile carriers and 5G service infrastructure are concentrated in the metropolitan regions such as Seoul, Gyeonggi and Incheon.
  - The number of 5G devices installed in the capital region was 88,746, accounting for about 60% of the total devices, and a considerable number of base stations were installed in metropolitan cities.
- By the end of 2019, 5G service coverage will be expanded by building balanced 5G infrastructure primarily in densely populated areas in 85 cities across the country.

Number of Reported 5G Devices by Region

(Unit: number of devices)

Classification	Seoul Capital Area			Busan	Daegu	Daejeon	Gwangju	Jeju	Other
	Seoul	Gyeonggi	Incheon						
Number of Devices (ratio)	46,436 (31.3%)	33,945 (22.9%)	8,365 (5.6%)	8,637 (5.8%)	7,988 (5.4%)	7,215 (4.9%)	5,755 (3.9%)	1,564 (1.1%)	28,559 (19.2%)

Source: Ministry of Science and ICT (As of June 21, 2019)

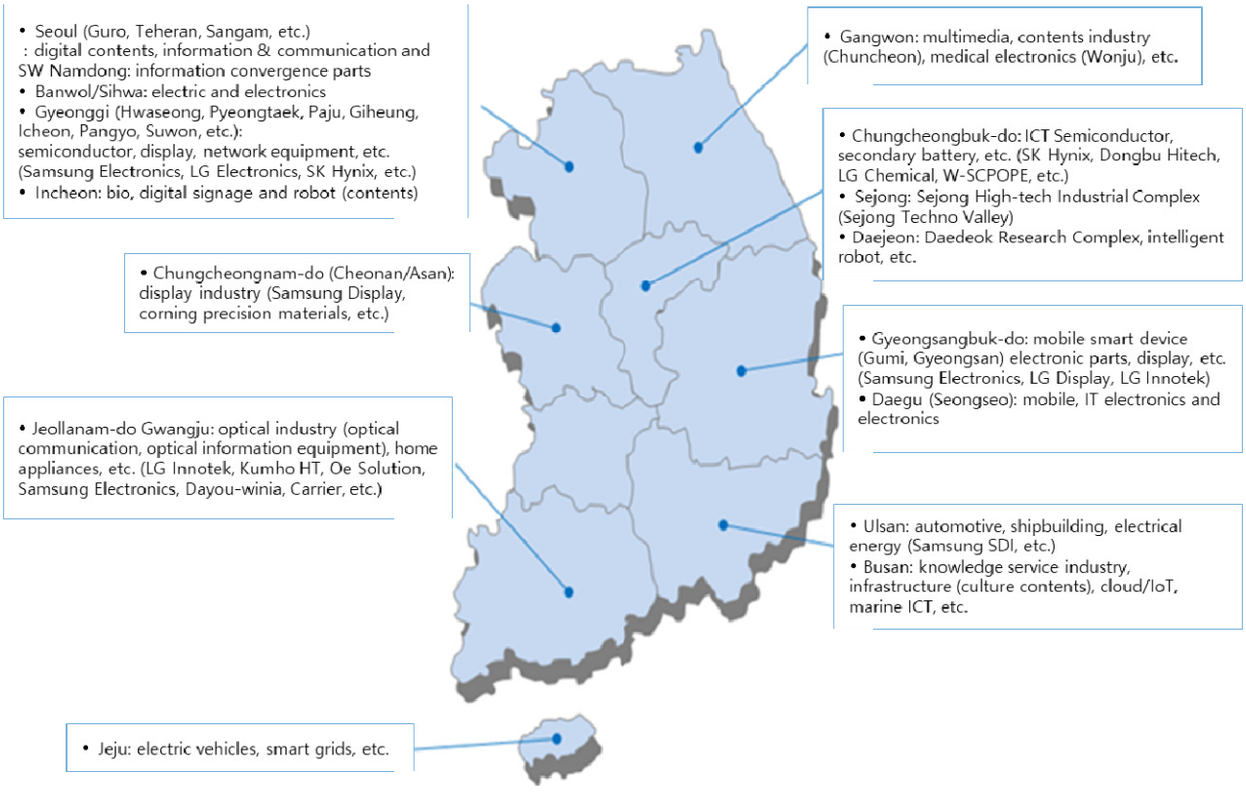
- The Korean government plans to create new added values for 5G regions and industries by creating 5G clusters throughout the country and providing specialized services in each region.
  - The government established 'Songpa Mobile Cluster' (2020-2025), which expanded its role to 5G equipment development and support for demonstration, and plans

to build a 5G content development base by advancing the Korea VR · AR Complex (Sangam), and expanding and reorganizing local VR and AR production hubs.

- SK Telecom established 5G clusters centered on four areas: △ services, △core business districts, △ B2B and △ seasons, and combined 5G mobile communication services with regional characteristics.

  * For B2B services, a total of 8 clusters will be created: 5G factory, smart hospital, smart logistics and distribution, smart city, media, public safety, smart office and national defense.

Current Status of ICT Clusters in Korea



4 Potential Partners

4.1 List of Related Companies

List of Major Companies Related to Communication Device Industry

Company name	Main item(s)	Website	Location
Samsung Electronics Co., Ltd.	Mobile communication terminal, computer, network system, semiconductor, display panel, home appliance, medical device, etc.	www.samsung.com/sec	Suwon, Gyeonggi-do
SAMSUNG DISPLAY CO., LTD.	Liquid crystal flat panel display (LCD, OLED), etc.	www.samsungdisplay.com	Yongin, Gyeonggi-do
LG Electronics Inc.	Mobile communication terminal, exchanger, communication equipment such as transmission, TV and, computer, etc.	www.lge.com	Yeongdeungpo-gu, Seoul
LG Display Co., Ltd.	Liquid crystal display, etc.	www.lgdisplay.com	Anyang-si, Gyeonggi-do
LG Chem	Lithium-ion secondary battery, flat plate, PVC, etc.	www.lgchem.co.kr	Yeongdeungpo-gu, Seoul
SAMSUNG ELECTRO-MECHANICS CO., LTD.	Image & audio, communication equipment, module, printed circuit board, multilayer ceramic capacitor, high frequency filter, crystal oscillator, chip inductor, digital satellite broadcast receiver, etc.	www.samsungsem.com	Suwon, Gyeonggi-do
LG Innotek Co., Ltd.	LED, camera module, PCB, photomask, mobile rotor, etc.	www.lginnotek.com	Jung-gu, Seoul
Pantech Inc.	Communication device, wireless communication application device, additional communication, monitoring camera, etc.	www.pantech.co.kr	Seocho-gu, Seoul
Ericsson-LG	Wired/wireless exchange equipment, transmission equipment, PBX, communication system electronic switch	www.ericssonlg.co.kr	Gangnam-gu, Seoul
SK Telesys Co., Ltd.	Optical repeater, wired/wireless transmission equipment, FEMTO, etc.	www.sktelesys.com	Jung-gu, Seoul
Elentec Co., Ltd.	Battery pack, PCB assembly, charger, motor, etc.	www.elentec.co.kr	Suwon, Gyeonggi-do
SMAC Co.,Ltd.	Touch screen, touch module, mobile module	www.s-mac.co.kr	Pyeongtaek, Gyeonggi-do
MELFAS Co. Ltd	Touch controller IC, etc.	www.melfas.com	Seongnam-si, Gyeonggi-do

Company name	Main item(s)	Website	Location
Patron, Co., Ltd.	Mobile communication antenna, dual camera, etc.	www.partron.co.kr	Hwaseong, Gyeonggi-do
Intops Co., Ltd.	Portable terminal parts such as case and antenna	www.intops.co.kr	Anyang-si, Gyeonggi-do
Nokia Solutions and Networks Korea Co., Ltd.	Communication equipment, communication system	www.nokia.com	Gangnam-gu, Seoul
DASAN Networks, Inc.	Switch, router, switch, server, communication equipment, etc.	www.dasannetworks.com	Seongnam-si, Gyeonggi-do
Jahwa Electronics Co., Ltd.	Portable vibration motors, electron tubes, magnets, etc.	www.jahwa.co.kr	Cheongju, Chungcheongbuk-do
Ace Technologies Corp.	Manufacture antenna for terminal and base station	www.aceteq.co.kr	Yeonsu-gu, Incheon
KMW Inc.	Wired/wireless communication device, mobile communication parts, communication repeater, module for communication base station, etc.	www.kmw.co.kr	Hwaseong, Gyeonggi-do
OPTIMECH Co., Ltd.	Mobile phone connector, communication equipment manufacturing, etc.	www.optimech.co.kr	Hwaseong, Gyeonggi-do
SOLiD, Inc.	Optical communication repeater, optical communication equipment, wireless communication equipment, etc.	www.solid.com	Seongnam-si, Gyeonggi-do
UBIQUOSS INC	Switch, FTTH, wired and wireless networking solution	www.ubiquoss.com	Seongnam-si, Gyeonggi-do
CammSys Corp.	Mobile phone camera module, semiconductor production equipment, etc.	www.cammsys.net	Yeonsu-gu, Incheon
S-Connect Co., Ltd.	Inside and exterior parts of mobile phone	www.s-connect.co.kr	Gwangju, Gyeonggi-do
SJTECH Co.,Ltd.	Wireless communication device (mobile phone parts)	www.sjtech87.co.kr	Dalseo-gu Daegu
UIL Co., Ltd.	Keypads, switches, etc. for mobile phones	www.e-uil.com	Paju, Gyeonggi-do
RFTech Co., Ltd.	Mobile terminal, charger, electronic parts, etc.	www.rftech.co.kr	Yongin, Gyeonggi-do
FRTEK CO., LTD.	Mobile communication repeater	www.frtek.co.kr	Anyang-si, Gyeonggi-do
JangWonTech Co., Ltd.	Smartphone, Tablet PC Bracket, etc.	www.jangwontech.co.kr	Gyeongsangbuk-do Gumi
NANOS CO., LTD.	Mobile phone camera module parts (optical filter), hall sensor, etc.	www.nanosm.com	Hwaseong, Gyeonggi-do
Namuga Co., Ltd.	Smartphone camera module, communication equipment, etc.	www.namuga.co.kr	Seongnam-si, Gyeonggi-do

Company name	Main item(s)	Website	Location
OPTRONTEC Inc.	Dual cameras, optical components, semiconductor devices, etc.	www.optrontec.com	Changwon, Gyeongsangnam-do
Innowave Co., Ltd.	Wired/wireless optical communication parts (optical thin film filter)	www.inno-wave.co.kr	Osan, Gyeonggi-do
Crucialtec Co., Ltd.	Optical trackpad, LED flash module	www.crucialtec.com	Seongnam-si, Gyeonggi-do
Dream Tech Co., Ltd.	Electronic parts, bluetooth, mobile phone charger	www.idreamtech.co.kr	Seongnam-si, Gyeonggi-do
GigaLane Co., Ltd	RF communication parts, semiconductor equipment, etc.	www.gigalane.com	Hwaseong, Gyeonggi-do
WiSoL CO.,LTD.	Filter, RF chip, vibration motor, filter bank, etc.	www.wisol.co.kr	Osan, Gyeonggi-do
Ericsson LG Enterprise Co., Ltd.	Electronic exchanger, IP telephone, communication equipment, etc.	www.ericssonlg-enterprise.co.kr/	Geumcheon-gu, Seoul
DASAN Network Solutions, Inc.	Network equipment, backhaul equipment, solutions	www.dasans.com	Seongnam-si, Gyeonggi-do
COMMAX CO.,LTD	Video phone, amplifier, speaker, interphone, door phone, exchanger, etc.	www.commax.com	Seongnam-si, Gyeonggi-do
MERCURY CORPORATION	Access, exchanger, gateway equipment, transmission satellite equipment, optical cable	www.mercury.co.kr	Seo-gu, Incheon
Telit Wireless Solutions Co., Ltd.	Wireless communication device, IoT module, software, etc.	www.telit.com	Yeongdeungpo-gu, Seoul
MOBASE Co.,Ltd.	Cell phone case etc.	www.mobase.com	Hwaseong, Gyeonggi-do
DAYOU PLUS CO.,LTD	Wired and wireless communication equipment, optical communication equipment, etc.	www.dayouplus.co.kr	Gwangsan-gu, Gwangju
FINEDIGITAL Inc.	Navigation, black box, mobile communication equipment, etc.	www.finedigital.com	Seongnam-si, Gyeonggi-do
ILYA CO., LTD.	Mobile phone parts, molds, etc.	www.ilya.co.kr	Namdong-gu, Incheon
PEOPLEWORKS, INC.	Mobile communication power amplifier, repeater, communication parts module etc.	www.peopleworks.co.kr	Gyeongsangbuk-do Gumi
HFR, Inc.	Wireless access RF equipment such as repeater, wireless communication quality management system, optical transmission system, etc.	www.hfrnet.com	Seongnam-si, Gyeonggi-do
COMUNICATION WEAVER CO.,LTD.	Subscriber-only circuit device, optical transmission equipment, wired communication equipment, etc.	www.coweaver.co.kr	Gangseo-gu, Seoul
Samkwang Win Tech Co., Ltd.	Cell phone case etc.	www.samkwang.com	Gyeongsan, Gyeongsangbuk-do

Company name	Main item(s)	Website	Location
Samji Electronics,co.ltd	Wireless communication device, wireless meter reading system chip	www.samji.com	Hwaseong, Gyeonggi-do
Innowireless Co., Ltd.	Testing tool for wireless communication	www.innowireless.co.kr	Seongnam-si, Gyeonggi-do
ANTS Co., Ltd.	Wireless communication device manufacturing, software, etc.	www.ants.co.kr	Anyang-si, Gyeonggi-do
MoimStone Co., Ltd.	Internet phone, tablet, software, etc.	www.moimstone.com	Seocho-gu, Seoul
INFOMARK Co., Ltd	Wearable device, mobile router, etc.	www.infomark.co.kr	Seongnam-si, Gyeonggi-do
Samhwa Communication Industry Co., Ltd.	Broadband digital transmission, BDCS, WDCS, connectors, etc.	www.samhwa.net	Geumcheon-gu, Seoul
CS CORPORATION.	Micro repeater, integrated repeater, variable repeater, RF dispersion repeater, personal repeater, etc.	www.cs-holdings.co.kr	Seongnam-si, Gyeonggi-do
Alti Electronics Co., Ltd.	Manufacture of communication parts and semiconductor parts (LED)	www.alti-e.co.kr	Gyeongsangbuk-do Gumi
WooriNet, Inc	Optical transmission equipment, exchange equipment, etc.	www.woori-net.com	Anyang-si, Gyeonggi-do
Sungwoo Electronics Co., Ltd.	Mobile phone parts, wireless communication device parts, etc.	www.swei.co.kr	Ansan-si, Gyeonggi-do
RFHIC Corporation	Broadband transceiver module (RF module, RF component, power amplifier), etc.	www.rfhic.com	Anyang-si, Gyeonggi-do
EMW Co.,Ltd.	Mobile phone terminal antenna, car antenna, etc.	www.emw.co.kr	Namdong-gu, Incheon
Kisan Telecom, co,.ltd	Optical module, PCS repeater, WLL system, etc.	www.kisantel.co.kr	Songpa-gu, Seoul
Teletron Inc.	Network equipment such as switches and rotors, high-speed Internet infrastructure system, etc.	www.teletron.co.kr	Anyang-si, Gyeonggi-do
PEOPLE & TELECOMMUNICATION INC.	Cell phone case etc.	www.pntel.co.kr	Yeongdeungpo-gu, Seoul
FO&T INC.	Optical communication parts, transmission device, data transmission device, wired and wireless communication device, etc.	www.fo-t.com	Gunpo, Gyeonggi-do
Telefield, Inc	Micro optical transmitter, software, etc.	www.telefield.com	Seongnam-si, Gyeonggi-do
Telaum co., Ltd.	Broadcasting communication network equipment	www.telaum.com	Bucheon-si, Gyeonggi-do

Company name	Main item(s)	Website	Location
Wintek System Co., Ltd.	High speed data transmission equipment, optical transmission equipment, etc.	www.wintek.co.kr	Uiwang-si, Gyeonggi-do
OPTICIS Co.,Ltd.	Optical link module parts, optical semiconductor elements, etc.	www.opticis.com	Seongnam-si, Gyeonggi-do
Wave Electronics Co., Ltd.	Power amplifier, mobile communication repeater, RRH, etc.	www.wavetc.com	Suwon, Gyeonggi-do
Gamma Nu, Inc.	Radio base station antenna, repeater antenna, etc.	www.gammanu.com	Hwaseong, Gyeonggi-do
OE Solutions Co., Ltd.	Optical transceivers (transmission and reception modules)	www.oesolution.com	Gwangju Buk-gu
LIGHTRON INC.	Optical transmitter and receiver for optical subscriber, optical parts, etc.	www.lightron.co.kr	Daedeok-gu, Daejeon
WOORIRO Co., Ltd.	Optical splitter, photodiode, etc.	www.wooriro.com	Gwangsan-gu, Gwangju
TAIHAN FIBER OPTICS CO., LTD	Optical fiber, optical cable, etc.	www.tfo.co.kr	Ansan-si, Gyeonggi-do
RFHIC Corporation	Communication equipment, broadcasting equipment, etc.	www.rfhic.com	Anyang-si, Gyeonggi-do
Skymoons technology, Inc.	Wireless telephone repeater, communication materials	www.skymoonstech.com	Anyang-si, Gyeonggi-do

List of Major Companies Related to Mobile Communication Service

Company name	Main item	Website	Location
SK Telecom	Wired and wireless communication industry, mobile communication service, IoT, etc.	www.sktelecom.com	Jung-gu, Seoul
KT	Wired and wireless communication industry, mobile communication service, IoT, etc.	www.kt.co.kr	Seongnam-si, Gyeonggi-do
LGU +	Wired and wireless communication industry, mobile communication service, IoT, etc.	www.uplus.co.kr	Yongsan-gu, Seoul
Merchand Korea	Mobile communication resale business (MVNO service), etc.	www.mymvno.co.kr	Geumcheon-gu, Seoul
SK Telink Co.,Ltd	Mobile communication resale business (MVNO service), etc.	www.sktelink.com	Jung-gu, Seoul
Tbroad Co.,Ltd	Comprehensive cable broadcasting, VOD, affordable phone, etc.	www.tbroad.com	Suwon, Gyeonggi-do

Company name	Main item	Website	Location
Annextelecom	Mobile communication resale business (MVNO service), etc.	www.annextele.com	Gangnam-gu, Seoul
Code mobile	Mobile communication resale business (MVNO service), etc.	www.egmobile.co.kr	Gangnam-gu, Seoul
FreeTelecom Co.,Ltd	Mobile communication resale business (MVNO service), etc.	www.freec.co.kr	Seongdong-gu, Seoul
Korea Cable Telecom	Mobile communication resale business (MVNO service), etc.	www.kcttel.com	Jung-gu, Seoul
CJ Hello	Mobile communication resale business (MVNO service), etc.	www.cjhello.com	Mapo-gu, Seoul
YL land	Mobile communication resale business (MVNO service), etc.	ylland.net	Seongnam-si, Gyeonggi-do
Smartel	Mobile communication resale business (MVNO service), etc.	www.smartel.co.kr	Gangnam-gu, Seoul
Eyes vision	Mobile communication resale business (MVNO service), etc.	www.eyesvision.com	Yeongdeungpo-gu, Seoul
UNICOMZ.	Mobile communication resale business (MVNO service), etc.	www.mobing.co.kr	Gunpo, Gyeonggi-do
Kt M mobile	Mobile communication resale business (MVNO service), etc.	www.ktmmobile.com	Gangnam-gu, Seoul
Dream Line	Mobile communication resale business (MVNO service), etc.	www.dreamline.co.kr	Guro-gu, Seoul
CNcom	Mobile communication resale business (MVNO service), etc.	okcnc.com/	Gangnam-gu, Seoul
NRCommunication	Mobile communication resale business (MVNO service), etc.	www.nrcom.com	Suwon, Gyeonggi-do
Sejong Telecom	Mobile communication resale business (MVNO service), etc.	www.sejongtelecom.net	Gangdong-gu, Seoul
Winnerstel	Mobile communication resale business (MVNO service), etc.	www.idowell.co.kr	Geumcheon-gu, Seoul
Media log	Mobile communication resale business (MVNO service), etc.	www.medialog.co.kr	Mapo-gu, Seoul
Great Human Software	Mobile communication resale business (MVNO service), etc.	www.ghs.co.kr	Guro-gu, Seoul
INSCOBEE	Mobile communication resale business (MVNO service), etc.	www.inscobee.com	Geumcheon-gu, Seoul

4.2 Related Associations & Organizations

List of Major Cooperation Organizations

Name of institution	Website	Major role
Korea Electronics Association	www.gokea.org	- Response to various regulations such as patent disputes, environmental regulations and trade regulations, system improvement and international trade issues such as FTA - IT statistics survey and trend analysis, international standardization support, professional manpower support, KES held, overseas marketing activities - Support for the establishment of future growth engine industries, planning and implementation of government policy projects, cooperation with relevant Korean and foreign organizations and build networks
Korea Association for ICT Promotion	www.kait.or.kr	- Policy support for the growth of the broadcasting and telecommunications industry, promotion of broadcasting and telecommunications convergence and foundation for growth - Advancement of broadcasting network, support for next-generation infrastructure, development of broadcasting services and creation of user protection environments - IT statistics research and trend analysis
National IT Industry Promotion Agency	www.nipa.kr	- Policy research and policy establishment support in the information and communication industry - Foundation development project for fostering and developing the information and communication industry and fostering professional manpower - Activation of distribution market and marketing support for the development of information and communication industry - Promotion of businesses related to convergence and utilization of information and communication technology - International exchange, cooperation and overseas expansion support related to the information and communication industry
Institute of Information & Communications Technology Planning & Evaluation	www.iitp.kr	- ICT R&D Technology Development Strategy and Technology Planning - ICT R&D policy research, information research analysis and service - Evaluation and support of information and communication technology development business agreement - Promotion of ICT R&D performance, technology transfer and technology commercialization - Training of information and communication professionals and establishment of research bases

Name of institution	Website	Major role
Korea Mobile Alliance	www.koreamobile.org	- Investigation of the status of mobile-based industry and environment and support for local infrastructure and facility equipment - Promotion of Korean and international pilot projects, business development and support for overseas expansion of mobile HW, SW and solutions - Establishment of mobile convergence technology development and service roadmaps, training of professionals, etc.
KOREA MOBILE INTERNET BUSINESS ASSOCIATION	www.moiba.or.kr	- Mobile industry exchange and policy development - Smart Content Enterprise Support & Win-Win Cooperation Support - Mobile Content User Protection
DAEGU TECHNOPARK Mobile Technology Convergence Center	www.mtcc.or.kr	- Global Competitiveness Reinforcement Project for Mobile Convergence New Industry - International standard conformity test and certification of mobile terminal (international certified certification business) - Mobile terminal research and development business, technical support business, marketing support business
Korea Intelligent IoT Association	www.kiot.or.kr	- Support for technology convergence and business cooperation such as IoT, 5G, data and AI - Environment improvement and industrial foundation for convergence projects such as regulatory improvement and standard development support - Promotion and provision of information for service expansion and market activation
Korea Association of Smart Home	www.kashi.or.kr	- Improvement of legal system, standardization, intelligent home national standard research group - Promotion of the use of smart home services such as smart home exhibition and service discovery - Investigation research including development of industrial statistical indicators and statistical survey - Overseas market model development and market diversification strategy
Korea Electronics and Telecommunications Research Institute	www.etri.re.kr	Development and dissemination of industrial source technologies in the fields of convergence technology related to information, communication, electronics, broadcasting and performance
Korea Electronics Technology Institute	www.keti.re.kr	Technical development research and support for parts materials, energy display, system semiconductor, information and communication media, convergence industry
Korea Information Society Development Institute	www.kisdi.re.kr	ICT strategy, communication propagation, future convergence, broadcasting and radio policy research, ICT statistics, etc.

List of Major Cooperation Organizations Related to Mobile Communication

Name of institution	Website	Major role
Telecommunications Technology Association	www.tta.or.kr	- Enactment, revision, and distribution of Korea's ICT standards such as communication network, ICT convergence, information protection, SW, broadcasting, wireless/mobile communication - Korean and international test certification and test standard development for ICT products - International cooperation activities related to ICT standardization and test certification - Training of experts for ICT standardization and test certification - Support activities to strengthen SME competitiveness
Korea Communications Agency	www.kca.kr	- Broadcast content such as program production support. Activating the media - Wireless network infrastructure establishment through wireless station inspection - Disclosure of radio wave information such as frequency distribution and supply and demand - National technical qualification test and training of personnel in the field of broadcasting and communication
Korea Telecommunications Operators Association	www.ktoa.or.kr	- Improvement of policies and institutions for the business environment of the telecommunication service provider - International cooperation and exchange activities - Establishment of cooperation and fair competition between telecommunication operators - Telecommunication service user reporting activity - Research on ICT policy issues and public relations activities
KMVNO	www.kmvno.or.kr	- Improvement of policies and institutions for the Korean wireless resale market - Government consignment business related to wireless resale - Provision of public communication service and enhancing convenience - Investigation and research projects on the development direction of communication business - Business partnerships and joint projects with organizations and research institutes related to the telecommunications industry

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