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SOUTH KOREAN MARKET INTELLIGENCE REPORT 2022

INTERNET OF THINGS (IOT)

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01 INTRODUCTION

South Korea (Korea) is a nation renowned for its hyper-connected population and super-fast networks. Having topped the rankings for high-speed internet adoption and smartphone ownership, Korea is racing towards integrating new telecommunications technologies such as the 5G network and the Internet of Things (IoT) into its economy. Indeed, thanks to the combined efforts of government, telecommunication companies and world-class electronics manufacturers like Samsung, Korea became the first country to roll out a commercial 5G network and maintains some of the fastest download speeds in the world. Perhaps even more remarkable is the fact that Korea has been entirely covered by LPWAN IoT networks since 2016, and now has fully-functioning nationwide IoT platforms in place – an exceptional feat.

Korea's IoT market was worth £6.7bn (KRW 10.9 trillion) in 2020 and is expected to grow at a rate of 12.6% a year to reach £7.6bn (KRW 12.2 trillion) by 2023. While there is a strong foundation of small and medium-sized enterprises (SMEs) active in the sector, the three telecommunications giants, SK Telecom, KT and LG U+, dominate the ecosystem. SK Telecom was the first telecommunications company to develop an IoT-specific network, based on the LoRa Alliance standard, which was completed in 2016 and a further 5G network in 2019. KT and LG U+ completed their NB-IoT and 5G networks shortly therefafter and, in an attempt to gain an edge over SK Telecom, formed an alliance to drive the adoption of the NB-IoT standard.

Despite its rapid roll-out of the necessary infrastructure, Korea still lags some of its peers in terms of core IoT technologies. The government is determined to close this gap and has made large sums available to support the research, development and commercialisation of IoT technologies and foster the emergence of a strong ecosystem in Korea. As part of the Digital New Deal announced in 2020, the government earmarked £35bn (KRW 58 trillion) to accelerate the transition towards a digital economy, integration of IoT, the 5G network and AI into the economy by 2024. The government is also focusing on deregulation by enabling additional frequency bands for telco and non-telco companies to promote further 5G network deployments.

This situation has created fertile ground for British companies seeking opportunities in Korea. In terms of specific application areas for IoT products and services, there are opportunities in areas such as Smart City – smart transportation, smart resource management, smart healthcare, digital twin city etc.; Smart Factory – automation, efficiency, monitoring, etc.; and Smart Home – automation, voice control, smart metering, entertainment, security, etc. In addition, IoT solutions designed to mitigate natural disasters and to aid in the upkeep and repair of civil infrastructure, such as those designed to monitor weather conditions or to detect cracks in buildings and bridges, are increasingly sought after.

Korea's highly developed ICT infrastructure and its explicit aim to lead the world in the so-called Fourth Industrial Revolution has created an environment that is conducive to the rapid integration of IoT solutions and offers an attractive potential testbed for global expansion. In this sense, the large and growing Korean market offers British companies both an attractive opportunity in itself and a potential springboard to expand into East Asia and beyond.

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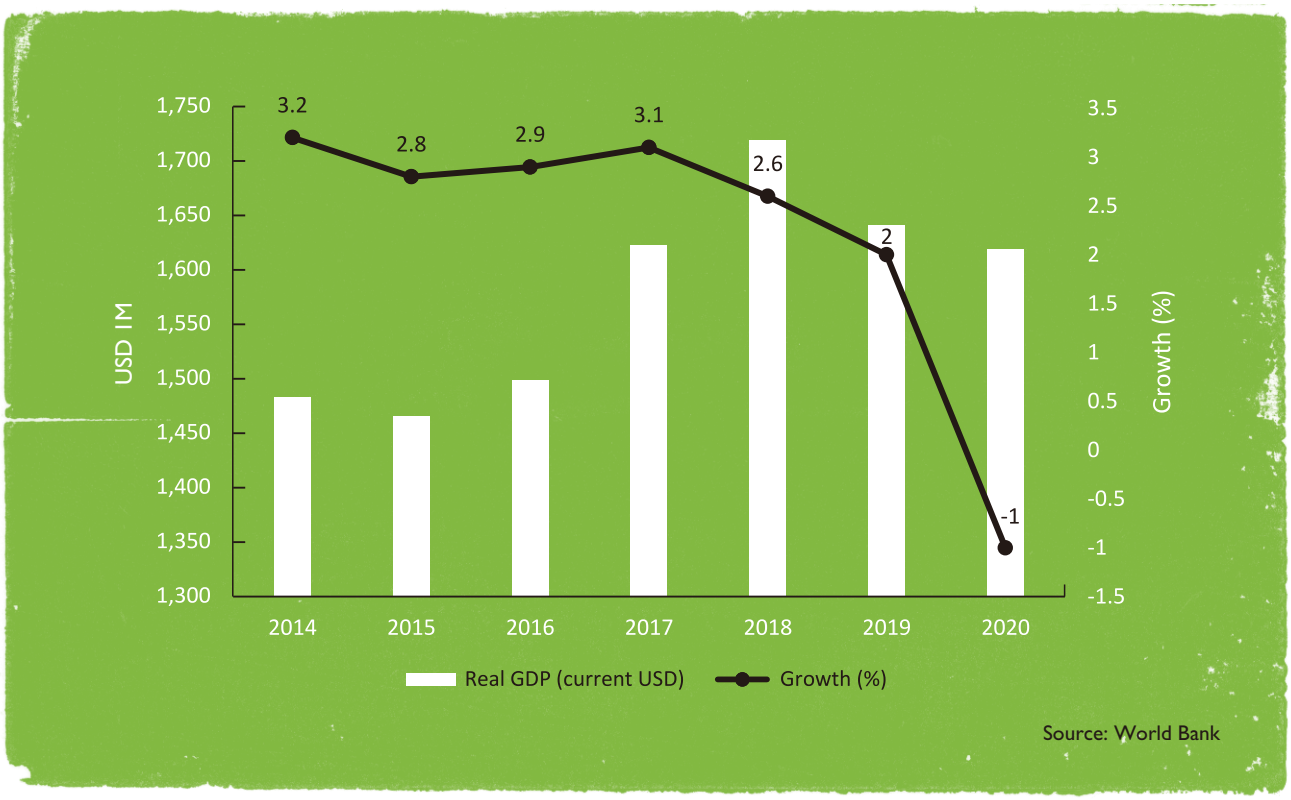
KOREA: AN OVERVIEW

In the space of just 60 years, Korea has transitioned from an agricultural economy to one driven by high value industries such as automotive, shipbuilding and advanced manufacturing. Perhaps most remarkable of all is the country's success in the area of information communications technology where the country has become world class in terms of semiconductor, consumer electronics and ICT infrastructure.

With a population of 51 million people, Korea boasts the 10th largest economy in the world, a GDP of £1.21 trillion ($1.63 trillion) in 2020 and a per capita GDP of £23,300 ($31,500) that same year. Whilst no longer experiencing the dizzying growth rates that characterised its early growth phase in the second half of the twentieth century, Korea has maintained strong growth for a developed economy of close to 3% in the years prior to the outbreak of the COVID-19 pandemic.

Total trade (exports and imports) between the UK and Korea was £13bn in the four quarters to the end of Q2 2021, an increase of 6.1% or £749m over the preceeding 12-month period. Of this, UK exports to Korea totalled £7.5bn while its imports from Korea came to £5.5bn. Korea is the UK's 22nd largest trading partner and accounts for 1.1% of total UK trade. The UK and Korea signed a continuity free trade agreement in 2019 which largely replicated the EU-Korea agreement.

Figure 1: GDP and Growth Rates (2014-2020)



03

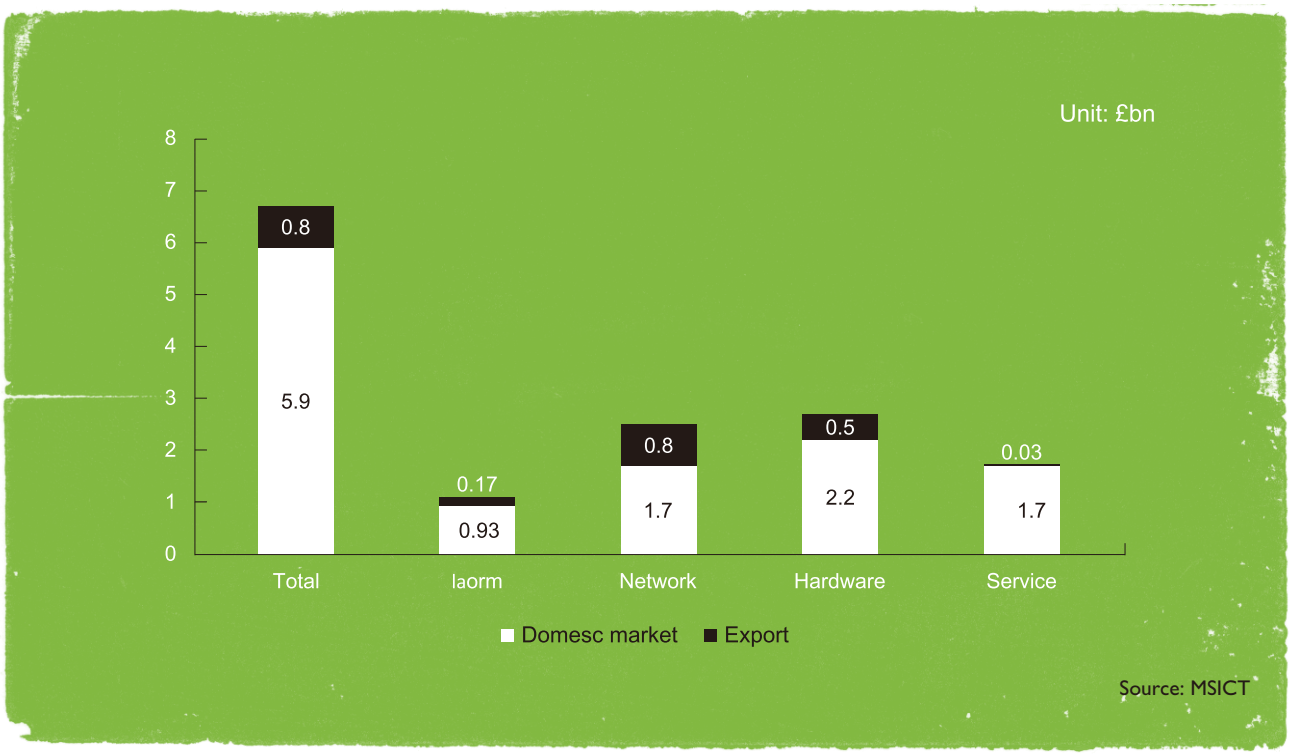
THE IOT INDUSTRY IN KOREA

Korea's IoT market is characterised by mature telecommunication infrastructure and advanced network coverage. The country has 43 million internet users and the share of its population with internet access is around 83%. Korea was the first country in the world to launch commercial 5G internet in April 2019 and currently has 5G network coverage across its 85 cities. According to the Ministry of Science and ICT (MSICT), nearly 30% of mobile subscriptions in Korea were on 5G networks at the end of 2021.

The IoT industry can be divided into four broad sub-sectors in Korea which include platform, network, hardware and services. The network and platform sector is heavily influenced by the major Korean telecommunications and multinational companies that seek to integrate solutions of smaller enterprises into their ecosystems. Since 2015, the Korean IoT market has grown by more than 100% with an annual average growth rate of 23.7%.

In 2020, the market size reached £6.7bn (KRW 10.9 trillion), increasing by 16.2% over the previous year and is expected to grow further at a rate of 12.6% a year to reach £7.6bn (KRW 12.2 trillion) by 2023. By business areas, hardware accounted for the largest portion at 41% although the sales growth rate from the previous year was the highest in the network sector at 25.2%, followed by the platform sector at 19.8%. Industry experts believe that the increase in network sales was largely contributed by the commercialisation of 5G mobile communication services.

Figure 2: IoT revenue by sub-sectors (2020)



According to MSICT, the number of IoT businesses in Korea was 2,313 in 2020, which doubled from 1,212 in 2015 with an average annual growth rate of 17.5%. By business field, the service sector had the largest number with 1,226 companies (53%), followed by product devices (525 companies), platforms (431 companies), and networks (131 companies).

The Korean government has been promoting ICT technologies and encouraging their integration into Korean cities and households, however, despite these positive trends, there are numerous challenges faced by IoT operators and users. MSICT conducted a survey among IoT operators and users in 2020 and found that the lack of funds for IoT integration projects was the most frequently mentioned difficulty at 21.2%. In addition, the Ministry found that the lack of government policy support (19.2%), uncertain marketability (13.7%), lack of technological standardisation (11.8%), and business model (10.6%) were the biggest challenges industry players were facing.

These challenges were reflected in Korea's global competitiveness figures in terms of IoT technology. According to World Economic Forum (WEF) report published in 2019, Korean IoT competitiveness was weaker compared to that of the US, Japan and China. Korea scored 47.7 points in the WEF report which puts the country in the fourth place after the US, Japan and China. The US, which ranked first, received 67.7 points, followed by Japan and China with 57.1 and 55.8 points respectively.

The Korean telecommunications landscape is dominated by the three main operators: KT, SK Telecom and LG U+. KT was the first operator in Korea and was established in 1981. Despite KT being the country's first telecommunications company, the top position in the mobile market belongs to SK Telecom, which controls around 41% of the market. LG U+, Korea's third telecommunications operator, was introduced in 2009 to break the duopoly and has a mobile market share of around 20%.

The three telecommunications companies together account for 85% of the market. The remaining 15% belongs to minor Mobile Virtual Network Operators (MVNOs) that do not own wireless network infrastructure but rather rent bandwidth from the main three, although many of the MVNOs are subsidiaries of the large telecommunications companies. SK Telecom was the first to complete an IoT-specific network, based on the LoRa Alliance standard, in Korea in 2016. In July 2017, KT and LG U+ also announced that they had finished developing their NB-IoT networks.

Table 1: Korean Telecommunications Landscape (2020)

	SK Telecom	KT	LG U+	MVNO
Date of establishment	1984	1981	2009	2010
Number of subscribers (mobile + internet)	29.3m	17.4m	14.7m	9.1m
Market share	41%	24%	20%	15%

Source: Digital Daily newspaper

Considering IoT's growth potential, the Korean government has adopted a set of measures in an attempt to encourage Korean companies to enter the IoT market including the opening of several frequency bands for IoT and easing regulations related to the broadcasting of radio waves in 2016. MSICT is the body responsible for regulatory procedures related to telecommunications and, consequently, IoT. The Ministry considers IoT an important future growth engine and one in which smaller companies may be able to succeed in an economy that is otherwise dominated by the large conglomerates. Because most of the companies in the IoT industry are small compared to traditional telecommunications companies, the Ministry has initiated a simplification of the procedures required for IoT operators to broadcast on LPWAN networks with a view to encouraging SMEs to play a major role in this area and tackling the dominance of the larger players in the economy more generally.

Figure 3: Korea's IoT Ecosystem (2021)

Source: Intralink research

IOT-DEDICATED NETWORKS

SK Telecom: LTE-M, LoRa, DID, LTE Cat.M1, 5G

Initially, SK Telecom focused on developing a network leveraging its existing fourth generation infrastructure. The company upgraded its LTE network to LTE-M in March 2016. In parallel, SK Telecom initiated the construction of a dedicated IoT network in cooperation with the LoRa Alliance. SK Telecom finalised the construction of a Low-Power Wide Area Network (LPWAN) nationwide employing the LoRa standard, using the unlicensed 920MHz frequency band in 2018. LPWAN remains to be one of the main IoT networks of SK Telecom and is still widely used in the company's various IoT services. For example, SK Telecom launched 'Distributed Identification of Things (DID)' service in 2021 that applies LPWAN and blockchain technologies to check unique IDs of buildings and perform safety diagnosis of potentially dangerous structures.

SK Telecom has successfully commercialised nationwide coverage of LTE Cat.M1 system in 2018. LTE Cat.M1 is based on 3GPP release 13 that also gave birth to NB-IoT. The network's main purpose is to fill the gap between LoRa, mainly focusing on small data payloads, and LTE-M (Cat 1) focusing on larger data payloads. For example, while pictures can be sent through LTE Cat-M1, sensors sending a small amount of data several times per day will be sending this through the LoRa network. The network was completed with the help of Qualcomm and Ericsson. LTE Cat.M1 supports low-power mode, allowing devices to be connected for years rather than days on LTE-M. The deployment of the network was done quickly as the investment needed only consists in upgrading the existing LTE Network, which is already fully deployed with 100% coverage in Korea.

SK Telecom was first to launch a 5G network in Korea partnering with Ericsson in April 2019, and the company has about 10 million 5G subscribers as of December 2021. Ericsson supports 5G network through the deployment of cloud-native dual-mode 5G Core on its Cloud Native Infrastructure (CNIS) and SK Telecom provides communications services to end-users. In February 2022, SK Telecom and LG U+ initiated the allocation of 40MHz of spectrum in the frequencies above 3.7GHz with a view to securing additional 5G frequencies.

To support this initiative, MSICT plans to auction 20MHz of 3.4GHz spectrum in March 2022. SK Telecom's 5G subscribers are found to be using media services, which generally require greater speeds and bandwidths, much more actively than LTE subscribers. As of February 2020, 5G commercial subscribers were using 7 times more IoT services, 3.6 times more video steaming services and 2.7 times more game apps than LTE subscribers.

KT & LG U+: LTE-M, NB-IoT Alliance, 5G

KT and LG U+ commercialised their LTE-M IoT solution based on Third Generation Partnership Project (3GPP) global standards in 2016. The companies use 3GPP release 8 devices (CAT-1) but also include part of the 3GPP release 13 (aka PSM, or Power Saving

Mode), a feature usually associated with LPWAN. Although LTE network helps to avoid the types of interference that is likely to be found in unlicensed bands such as LoRa, LTE-M cannot sustain long battery lifetime, an important requirement in the IoT field. Therefore, despite its easy implementation, LTE-M acted as a temporary IoT solution.

To compete with SK Telecom, LG U+ and KT announced an 'NB-IoT Alliance' in November 2016. The alliance aimed to build a fully functional IoT-specific network based on NB-IoT technology as a counter to SK Telecom's LoRa Network. In July 2017, LG U+ and KT announced that the national NB-IoT network was complete and covered more than 80 cities throughout Korea. On this network, the companies provide services such as remote control and monitoring of electricity and gas, transport tracking and asset management. Developers can test their product in LG U+'s and KT's 'NB-IoT Open Labs' located in Sangam-dong (Seoul) and Pangyo (Gyeonggi Province) respectively.

Due to the rapid growth in data usage, 5G network is increasingly replacing LTE as an IoT network. Although both KT and LG U+ launched 5G internet one month later than SK Telecom in May 2019, KT announced the launch of a pure end-to-end 5G service in July 2021, becoming the first mobile carrier in Korea to commercialise a 5G standalone network. Standalone refers to the network being pure 5G from end-to-end, without occasional transitioning to 4G LTE networks.

Since launching 5G network services, LG U+ exceeded its 4G market share in just 6 months reaching 6% in late 2019. According to IHS Markit, LG U+ is reported to offer the fastest average speed of 476.5 Mbps 5G network in Korea thanks to the company's cloud-based network and a growing signal footprint. Through leveraging the existing NB-IoT Alliance with KT, LG U+ is planning to secure mass connectivity in 5G network for smart metering, the monitoring of public utility services such as water and gas meters, Geo-IoT devices for asset and logistic tracking, and Industrial IoT for maintenance services by 2024.

Industry Insider's Thoughts

Based on leadership of NB-IoT technologies, we are going to seek to coexist with small and medium-sized Korean companies and are planning to actively support these companies to enter global markets

Director of IoT Business, LG U+

Other Network Providers

The big three telecommunications companies in Korea own the networks and therefore largely have the ability to shape the domestic IoT market. These companies function as a one-stop channel for SME IoT businesses to purchase chipsets, data plans, and to build applications using software development kits (SDK) provided by the telecommunications companies and it is extremely difficult for other protocols to emerge.

With SK Telecom having adopted LoRa, and with KT and LG U+ having formed an alliance to develop an NB-IoT network, the market has reached the point where introducing new protocols is difficult. However, there is one player, Sigfox, that made inroads into the Korean market with another protocol. In 2019, Sigfox announced partnership with AMO-Snet, exclusive operator for Sigfox in Korea, to provide network based on Ultra Narrow Band (UNB) technology as a service for IoT. Sigfox, however, filed for bankruptcy in January 2022 and it is currently unclear how this will affect the French company's business in Korea.

Table 2: IoT Network Landscape (2021)

Network	NB-IoT	LoRa	Sigfox	LTE Cat.M1	LTE-M	5G
Operator	LG U+, KT	SK Telecom	AMO-Snet	SK Telecom	LG U+, KT, SK Telecom	LG U+, KT, SK Telecom
Completion	2017	2016	2019	2018	2016	2019
Frequency	Fixed to 180kHz of LTE band	Unlicensed spectrum 8 channels of 125kHz	Unlicensed spectrum in 920,8-923.4Mhz	Variable up to 1.08MHz of LTE band	Variable up to 20 MHz of LTE band	Variable to 2,600 MHz. 28 GHz and sub-6 GHz spectrum to be available in 2022
Speed	Up to 250kbps	Up to 5.4kbps	<1kbps	Up to 1Mbps	Up to 10Mbps	Up to 808Mbps
Applications	Small data	Small data	Small data	Data, voice and photo	Data, voice and videos	Data, voice and video
Battery Life	Years	Years	Years	Years	Months*	Years

* Based on PSM function integration

Source: Intralink research

Closer Look

For the initial rollout of 5G frequencies in 2018, the Korean government held an auction, with only three eligible telcos: SK Telecom, KT and LG U+. In January 2022, MSICT announced the roll-out of additional frequency bands for telco and non-telcos in order to promote further 5G deployment.

- **The wireless spectrums to be provided are 600MHz block of 28GHz frequency band and another 100MHz block of 4.7GHz**
- **The government will divide the 28GHz band into 12 blocks, and the 4.7GHz band into 10 blocks for the frequency rollout and companies or institutions seeking to acquire the frequencies can decide on the number of blocks they want**
- **Special non-telecom companies will also be eligible i.e. Samsung Electronics for the establishment of a smart factory**
- **Interested organisations should apply for purchase by October 2022. The allotment will be provided for use of up to five years, and will be announced in November 2022**

DEVELOPMENT PLATFORMS

KT: The GiGA IoT Alliance, Giga Genie

KT was the first operator to develop a one-stop support centre, both online and offline, for SMEs that wish to develop IoT solutions. The GiGA IoT Alliance (www.gigaiot.kt.com) is focused on "creating a cooperative system that develops qualified business models with partners at home and abroad in various fields across the entire IoT industry, such as chipsets/modules, devices, solutions, etc." The GiGA IoT Alliance does not limit its scope to Korean companies and partners with organisations all over the world, including Nokia, China Mobile and Microsoft. The main mission of the GiGA IoT Alliance is to provide educational and financial support, as well as access to infrastructure owned by KT, for companies to commercialise their solutions.

'IoT Makers' (www.iotmaker.kt.com), partly sponsored by MSICT, is the online platform of the GiGA IoT Alliance. Solutions, APIs and educational materials are available online, along with a community where participants can propose business projects. The platform allows developers to connect their devices to the platform and manage and analyse the collected data. IoT Makers supports a wide range of business areas such as smart home, smart city, smart metering, smart factory and others.

In 2018, KT launched 'Giga Genie', Korea's first virtual reality-based 3D fitting service for home shopping channels, through tyhe IoT Makers platform. KT's GiGa Genie speaker and Olleh TV UHD enable customers to experience the service by choosing 3D content on the IPTV menu. The service has been further enhanced with the introduction of 5G network and KT launched GiGA Live VR service that allows viewers to experience VR live programs via KT's Olleh TV.

SK Telecom: ThingPlug, Nugu

SK Telecom released its one-stop community for IoT developers called ThingPlug (www.sanbox.skiot.com). ThingPlug is an open IoT platform, jointly developed by SK Telecom and the Korean IoT service platform DaliWorks, where developers can register devices, download APIs, and register for events. APIs are provided based on international standards (e.g. oneM2M, ETSI, etc.).

The ThingPlug lab is located near Seoul, and is the main centre for the development of LoRa-based applications in Korea. The centre is open to developers seeking to test their applications. Over 560 companies have partnered with the ThingPlug platform to develop LoRa-based solutions. While most of the companies are Korean, ThingPlug is open to overseas companies as well. Most of the non-Korean companies that partner with ThingPlug at the moment are Chinese and Taiwanese hardware manufacturers looking to combine their hardware with in-house developed software and commercialise these solutions in Korea. There are very few European companies currently working with the ThingPlug platform.

In 2016, through ThingPlug platform, SK Telecom launched Korean-speaking AI assistant service 'Nugu' which has been applied to various services such as Smart Home, TMAP, Btv, Kids Phone, and T Phone. The service showed a constant growth reaching 10 million monthly subscribers in September 2021. Leveraging the early success of the Nugu service, SK Telecom launched 'Nugu Developers' open platform in 2018 in order to enable developers to build new capabilities for the AI system. Korean convenience store chain CU and Vista Walkerhill Seoul Hotel have already demonstrated how the Nugu AI platform can be customised for their businesses using a beta version of the open platform released in 2018.

LG U+: NB-IoT Open Lab, U+ IoT Partners

LG U+ partners with LG Innotek, a module maker, and LG Electronics (all three are LG Group subsidiaries) to conceive and commercialise IoT applications. In July 2017, LG U+ announced the creation of a joint open platform with KT as part of the NB-IoT alliance and launched "NB-IoT Open Lab" (www.openlab.uplus.co.kr) to act as a support centre for developers. In particular, the centre provides developers with an IoT communication module that can be used for the development of smart phone applications. In order to receive the module, a company should submit its development plan and an IoT project proposal to the NB-IoT Open Lab.

In 2021, LG U+ launched a new U+ IoT Partners (www.iotportal.uplus.co.kr) platform that works with domestic IoT device and solution companies to help them boost their growth. LG U+ laid out their five strategies for the platform: communication module support, technology support, commercialisation support, idea discovery support, and information exchange support. As part of its communication module support strategy, LG U+ is planning to donate one million LPWAN communication modules to SMEs.

Industry Insider's Thoughts

The launch of ThingPlug is significant as it allows anyone to develop an IoT service, leading to the creation of a rich IoT ecosystem that brings value and convenience to developers across the globe.

SK Telecom CTO

The company aims to help the domestic businesses that are struggling with the supply and demand problems that arose out of the semiconductor crisis began in early 2020 through cutting down the module unit price by more than 30%. The technologies and equipment necessary for the initial development of 5G high-positioning service such as communications module, terminal (router) and antenna will be provided by LG U+ as part of the U+ IoT Partners service package. In addition, the associated academy which is called the U+ Partners Academy will begin operation from November 2022. Moreover, the programme will also help SMEs to develop a DX (Digital Transformation for all X) platform dedicated to IoT network authentication.

LG CNS: INFioT

In 2018, LG CNS, an IT services arm of LG Group, launched its IoT platform, 'INFioT'. The platform enables collecting, transferring, and managing large amounts of sensing data in real time with consideration for various devices and IoT environments. The platform supports the communication protocols needed to collect and forward data from devices and stores and manages safe data that has undergone device authentication. The collected data is linked to LG CNS's AI and big data platform, DAP, and cloud services to enable the user to check the real-time data status with a data monitoring function. With such features, INFioT can be applied to Smart Homes, Smart Buildinutigs, Smart Energy, Smart Factories, and Smart Cities.

Utilising INFioT, LG CNS launched Orott, a robot service platform in 2019. Orrot provides a new robot service by linking IT systems in airports, shopping malls, and distribution centers with various robots such as guide robots, security robots, and cleaning robots. LG CNS first applied Orrot to Airstar, the guide robot in Incheon International Airport. Orrot controls 14 robots in total, eight at the first passenger terminal and six at the second passenger terminal. Orrot, with the help of INFioT platform, controls several robots and provides various services such as analysing the congestion status of the departure and arrival halls after receiving information from the airport. The robots then guide airport users towards less crowded routes if it senses such congestion.

04

GOVERNMENT INITIATIVES

The Korean government has taken an active lead in policy making related to industries included in the so-called 'Fourth Industrial Revolution', including IoT. It is important for overseas companies that seek to do business in Korea to pay careful attention to government-run projects as they can become a focal point for establishing priorities and the direction of research funds for firms in the private sector as well.

In July 2020, the Korean government announced a KRW 160 trillion (£98bn) package of investments in economic, environmental, and social reforms, targeting digitalisation and green technologies, called the Korean New Deal. The Digital New Deal is the term used to describe projects aimed at the integration of digital technologies into the economy and IoT plays a key role in this. As part of the Digital New Deal, the government earmarked KRW 58 trillion (£35bn) to accelerate the transition towards a digital economy, integration of IoT, 5G network and AI into the economy by 2024.

Under the New Deal policy, each municipality such as city and provincial government is entitled to apply for a project budget from central government. According to the Ministry of Economy and Finance (MOEF), regional governments got approval for 158 Digital New Deal projects in 2021 and the ministry has allocated KRW 13 trillion (£8bn) in total as project budget.

Table 3: Digital New Deal projects (2020)

Project	Tasks
Data dam	Increase big data platforms across industries, open public data, and promote industrial convergence between digital contents and 5G
AI government	Adopt 5G and blockchain technologies to public service sector to make public services 100% digital
Smart healthcare	Invest in 18 hospitals to equip with 5G and IoT so that they provide real time monitoring and cooperation between medical institutions, and develop softwares to diagnose 12 diseases, such as lung cancer, diabetes etc.
Digital twins	Create high-resolution 3D maps for the country and build smart management systems for old underground public utility facilities
Digital SOC	Adopt C-ITS to major routes, install IoT sensors on railroads and build fourth generation wireless networks for railway

Source: MSICT news release

05

OPPORTUNITY AREAS FOR BRITISH COMPANIES

This section identifies three opportunity areas for British companies in the Korean IoT sector: smart cities, smart homes and smart factories. The Korean government has highlighted these three as focus areas and emphasised IoT as an area that could foster growth for smaller firms and therefore contribute to sustainable economic development. In interviews conducted for this report, representatives from the large conglomerates have acknowledged that they expect SMEs and foreign firms to play a large role in the sector and indicated that they look forward to welcoming foreign businesses on their IoT platforms as well.

IOT IN SMART CITIES

The Korean smart city sector can be divided into three subsectors: smart transport, smart resource management and smart healthcare which are ultimately controlled through digital twin city platforms. In these subsectors, there is a natural synergy between (local) government, conglomerates and SMEs. The (local) government coordinates, the conglomerates deliver the necessary network and platforms, and the SMEs often develop the hardware and software.

Table 4: Subsectors and Application Areas for Smart Cities

Smart Transport	Smart Resources	Smart Healthcare
Intelligent transportation & Smart Parking	Smart grid	Remote health infrastructure
Congestion solution	Energy/water consumption visualisation	Fitness applications
Public transport system information	Smart water meters	Chronic disease management
Transport sharing	Water/energy distribution network control	Maternity care

Source: MSICT news release

Smart Transport

In October 2017, the Korean government opened K-City. K-City is a town built to test the performance of autonomous vehicles in real-life environments. The town is comprised of motorways, downtown areas, city outskirts, and communal areas over an area of over 300km2. The test site recreates an environment with 35 different traffic situations through which the self-driving cars can be tested, including toll gates, pedestrian and train-track crossings and even has potholes and construction sites. In February 2018, SK Telecom announced it had successfully completed a test of vehicle-to-vehicle communication over K-City's 5G network. One test that was conducted had a model child run onto the road. A CCTV system installed on a street light sensed the child and immediately sent warning signals to vehicles in the area, bringing them to an immediate stop. It took the cars merely 0.001s to react after being alerted.

Smart Resource Management

Advanced Metering Infrastructure (AMI), also referred to as smart metering, is also a burgeoning field in Korea. There have been a number of delays due to technical, financial and patent-related issues, but 8.8 million smart meters were distributed in Korea as of 2019. Although comprehensive nationwide smart metering network coverage was targeted for 2022, experts advised resetting the goal reflecting realistic smart meter installations to date which have fallen behind the initial targets.

The AMI sector represents numerous opportunities for British companies looking to enter the Korean market. However, it should be noted that utility companies are sensitive to both the frequency on which the data is sent and the pathway through which the data travels. Korea Electric Power Corporation (KEPCO), Korea's national electric utility company, stated that it maintains an absolute requirement to transmit data over licensed bands with data remaining at all times within the Korean territory. This means that only LoRa or NB-IoT are suitable for smart metering applications. Currently, the biggest players ranked by revenue in the field of AMI are LS Electric, Nuri Telecom, OmniSystem and PS Tec for AMI hardware, and KEPCO KDN (a subsidiary of KEPCO), LS Electric, and SK Telecom for AMI systems.

Apart from smart metering, smart grid, energy distribution network control and consumption visualisation are all areas that have been designated as points of focus by the Korean government. As such, these areas are expected to attract strong investment and so also hold potential for British IoT companies.

Smart Healthcare

IoT solutions for both patients and hospital staff are already being used and show great potential for future growth. One representative case for the Korean smart healthcare sector is a connected hospital service in Daegu Fatima Hospital. A medical examination – from making an appointment to making payments for prescribed medicine – can be completed through a smart healthcare platform the hospital calls 'M-care'.

IoT solutions that have started appearing in the smart healthcare sector for hospital staff are solutions such as patient treatment monitoring, management of important equipment and tracking of equipment usage through sensors. Daegu city government is also focusing on the infectious desease response as part of Digital New Deal. As the initial COVID-19 cluster infections began in Daegu in Korea, the city government is planning to build two new hospitals with medical big data platform for rapid response to future infectious diseases.

Smart healthcare is another area that shows promise because of Korea's strong ICT infrastructure and its ageing and technology-embracing population. Further, although the sector is expected to grow rapidly over the coming years, the smart healthcare sector in Korea is still relatively underdeveloped meaning there are chances for British companies that can offer superior technologies or solutions.

The Digital Twin City

The concept of digital twin city was introduced in Korea in 2018 by LX, Korea's cadastral and spatial information agency. In partnership with LX, Jeonju city, the capital of North Jeolla Province, is planning to implement Korea's first Digital Twin City project by 2024. The project includes making an up-to-date 3D building models and comprehensive Geographic Information Systems (GIS) data, along with Building Information Modelling (BIM) data combined to create a digital twin of Jeonju. In effect, this converts a real world spaxce or facility into an exact digital replica to facilitate the smart analysis, planning and management of the facilities. Jeonju city is facilitating the project under the Digital New Deal and MOEF allocated £1.8m (KRW 3bn) of project budget in 2021 to build the 3D Digital Twin model of the city.

British companies have been fairly successful in the digital twin technology especially in the engineering space as seen in the digital twin engine technology of Rolls-Royce used to examine, understand and predict how an engine would react in varied contexts, including extreme conditions. As several organisations in the UK such as Centre for Digital Built Britain under the University of Cambridge are already conducting R&D on National Digital Twins that connects the digital twins together, this area offers promising opportunities for collaboration between the UK and Korea.

Table 5: Case Studies – Smart City

EPS EnE	
Website	www.eps-ene.co.kr
Application area	Smart resource management
Key Technologies	Sewer monitoring system, sewerage facility management system, sewer pipe interpretation system, water supply facility management system
Platform	Technical details not disclosed
Overview	EPS EnE specialises in water and wastewater monitoring and control systems. Sewer Optimal Operation Management System (OMAS) is one of the company's products and allows customers to evaluate sewer pipe operations. The company also develops water supply network management, diagnosis, analysis and management solutions. The data is collected through various devices such as flow meter, water gauge and water quality meter. Collected data is then analysed and sent to the terminal server, which forwards it to management facilities (for example, environmental control agency) and the citizens. To implement its smart water management solution in smart cities projects, EPS EnE has partnered with local governments including the governments of Gwangju, Incheon and Daejeon. LG Electronics, POSCO, GS Neotek, Hanwha S&C and other major Korean companies are among EPS EnE's clients.

Safe Mate	
Website	www.kt.com
Application area	Smart security
Key Technologies	Voice recognition
Platform	KT GIGA IoT
Overview	Safe Mate is an abnormal voice recognition technology that is being used to detect unusual sounds such as screaming, assaults, beating, glass breaking etc., and was co-developed by KT and Ives Technology, a company specialising in intelligent video surveillance. When voice recognition devices record an unusual sound, it immediately sends the data via KT communication network to the police command station. The system allows police to react to the threat immediately and is more effective for crime prevention and investigation compared to CCTV. Safe Mate system is currently being installed in women's public restrooms in Seoul.

Industry Insider's Thoughts

We aim to keep installing our Safe Mate service in potentially dangerous areas such as public restrooms and underground parking lots in cooperation with metropolitan municipalities and provincial police agencies. KT will keep developing a variety of IoT-based public safety services to fulfil its responsibility as a public company.

KT GiGA IoT Project Manager

IOT IN SMART FACTORIES

The advancement of the Korean ICT industry is apparent when it comes to Industrial IoT, or IIoT. The government has encouraged the installation of smart factory solutions in smaller-sized factories by providing subsidies for SME manufacturers. This has spurred demand in the SME factory sector and, along with the strong demand from the largest manufacturers in the country, means the Korean IIoT market is dynamic across the whole spectrum of manufacturing.

Korean multinational companies have been applying smart solutions, such as sensor predictive analytics and real-time monitoring, since around 2012, when advances in technology allowed for data from the cloud to be analysed in real time. Companies such as Samsung Electronics and LG Electronics are active adopters of smart factory solutions but are heavily reliant on non-Korean ICT technologies as they remain the most complete solutions to date.

Korea is home to two of the world's largest semiconductor manufacturers, Samsung Electronics and SK Hynix, that together control 3.6% of the global DRAM market. Semiconductor manufacturing requires a high degree of precision, which makes it a natural environment for the development and deployment of IIoT solutions. Most smart factories in Korea belong to the electronics, automotive and steel industries, although the government has set a goal to expand this to start incorporating the energy and textile industries.

The adoption of smart solutions has been slower for Korean SMEs, a price-sensitive category of IIoT consumers. This category of Korean businesses has been supported by the Ministry of Trade, Industry and Energy (MOTIE), Ministry of SMEs and Startups (MSS) and organisations such as the Korea Smart Factory Foundation (KOSF). According to the MSS, a total of 19,799 SMEs have implemented or were in the process of implementing smart factory solutions with government support in 2021.

Industry Insider's Thoughts

The government will give its full support to have more than 30,000 smart factories by 2025 in order for the country to become a leader in the fourth industrial revolution.

Korean Minister of Trade, Industry and Energy

The market for IIoT solutions in Korea has long been dominated by European and American firms like Siemens, Rockwell Automation and GE Brilliant Factory which used to be the only providers of such solutions. However, due to significant market growth, home-grown solutions are being developed and commercialised both for the domestic and for the global IIoT market. There are local systems integrators and value-added resellers that are looking for strong foregin IIoT solutions, especially in light of the need for further information on and reduction of emissions from factory processes.

With the government looking to dramatically increase IIoT penetration through subsidies to smaller factories, these will be good potential customers for British companies. These companies have simpler needs, the number of platforms available to them is limited, and the solutions are usually custom-made by systems integrators such as POSCO ICT, Hyosung IS or LG CNS. These integrators are looking for new options and new technologies to integrate into their existing product offerings. Sources at several of these companies confirmed that they are scouting for and evaluating overseas technologies.

Table 6: Case Studies – Smart Factory

ulalaLAB	
Website	www.ulalalab.com
Application area	Smart factory
Key Technologies	Sensors, cloud and machine learning
Platform	Mainly 3G/Wi-Fi
Overview	Founded in 2011, ulalaLABS is one of the key domestic players in smart factory solutions for small-sized enterprises. UlalaLABs's solution, WIMFactory, is a Smart Factory IoT platform comprised of sensors, a cloud server and a machine learning algorithm, offering multi-device support. The platform enables line managers to get instant feedback from the equipment about the status of the production line. The sensors are installed in strategic locations along with gateways (WiFi, 3/4G, BLE), and are connected to the cloud. The WIMFactory platform is a small-scale solution that is cheaper compared to similar systems made by Siemens, ABB or LS IS. Because most factories in Korea are owned by small and medium sized companies, ulalaLABS has been well received and has been adopted in factories in China and Southeast Asia.

LiveCare	
Website	www.livecare.kr
Application area	Livestock Healthcare System
Key Technologies	"Bio-capsule" sensor and LTE
Platform	LoRa
Overview	uLikeKorea is a Korean start-up that launched "LiveCare", a solution for livestock health monitoring that measures fluctuations in a cow's body temperature. Ruminant animals are sensitive to temperature changes and a fluctuation of as little as 1–2°C may indicate illness. LiveCare is a bio-capsule which is placed within the cow's rumen to collect data about its body temperature, physical activity and physical health. Data is transmitted to the Data Collection Box through an LTE link.

IOT IN SMART HOMES

The smart home sector is a rapidly developing sector in Korea. It has been designated by the MOTIE as one of the five innovative business sectors on which the Ministry will focus. According to the latest numbers from the Smart Home Association, the Korean smart home market reached £48bn (KRW 78 trillion) in 2020 and is expected to exceed £61.5bn (KRW 100 trillion) by 2023. The COVID-19 pandemic has positively contributed to the increase of spending on smart home solutions in the 2019-2021 period and this trend is expected to continue in the future. According to MSICT, sales of smart home appliances increased by 18.5% in 2020 and further 24.8% in Q1, 2021.

Since the release of smart home assistant platforms by Samsung Electronics, LG Electronics, LG U+, SK Telecom and KT in 2016 and 2017, the market has been dominated by these companies. As of January 2021, the market is led by Samsung's smart home platform, 'SmartThings', with 5.31 million of users followed by LG U+'s 'U+SmartHome' with 460,000 users, LG Electronics' 'SmartThinQ' with 436,000 users, and SK Telecom's 'Nugu' platform with 316,000 users. Other IT giants such as Kakao and Naver also introduced their 'Kakao I' and 'Naver Clova' smart home platforms in 2018, but failed to gain popularity due to consumer preference towards the early market entrants.

The smart home market includes a wide range of convergence products and services and has diverse stakeholders including construction companies, appliance manufacturers, security companies, network providers and others. Because solutions from different providers need to be integrated into one system, the Korean IoT market is experiencing increased collaboration between companies in different fields. One broad form of cooperation is between the government, conglomerates and SMEs in the IoT sector. This cooperation entails an alliance in which SMEs can develop product and solutions on the foundation of conglomerates' IoT platforms. Currently, this initiative driven by MSICT, has over 1,000 members and one of the main projects under the initiative is the 10,000 smart homes project, mentioned earlier in this report.

Industry Insider's Thoughts

For SK Telecom, NUGU is a large-scale experiment. We are carefully watching consumers' response to this new, exciting technology that increases the efficiency of household appliance management.

Director, Global Business Development, SK Telecom

Table 7: Case Studies – Smart Home

Hyundai E&C and SK Telecom	
Website	www.hdec.kr
Application area	Smart home / smart apartment building
Key Technologies	Sensors, voice control and machine learning
Platform	LoRa
Overview	OverviewConstruction companies are naturally in the best position to implement smart home IoT solutions in new apartments and office buildings. One of the biggest Korean construction companies, Hyundai Engineering & Construction (E&C) partnered with SK Telecom to launch the "Intelligent Smart Home". The project covers 2,000 Hillstate apartments located in and around Seoul. The "Intelligent Smart Home" combines IoT and machine learning technologies and features voice recognition technology with an accuracy of 95% according to SK Telecom. The system allows residents to control light and energy consumption and provides a smartphone app that helps residents manage connected appliances.

KD Navien	
Website	www.kdnavien.com
Application area	Smart heating / smart energy
Key Technologies	Remote energy control
Platform	Wi-Fi
Overview	OverviewKD Navien, the largest Korean boiler manufacturer, recently launched "Navien Home IoT" hub, which enables customers to control their boiler remotely via a smartphone application. The hub also allows users to connect and control lighting, switches and video systems. The data is aggregated from various devices which are all connected to a "wall pad" via Wi-Fi. By monitoring consumption patterns in real time and comparing it to periodic data, users can manage their resource usage more effectively. Energy used for heating and hot water account for over 70% of household energy consumption which can be reduced through this solution.

06

MARKET ENTRY STRATEGIES

Key Points

- Partnering with local distributors or resellers is strongly advised for foreign companies
- Using a sales team based outside of Korea is difficult due to language and cultural barriers and high expectations of after-sales support
- Foreign companies can apply to participate in government-led projects but there are barriers:
  - Culture, language, business environment, etc.
  - Preference for local businesses adding at least some value to products or services

Korea offers strong opportunities for UK companies across the IoT industry including for applications such as smart cities, smart factories and smart homes. UK companies looking to introduce their technology to Korea should take into account both business-related and cultural factors. UK businesses can approach the Korean market through direct sales from the UK, by appointing a partner or by setting up an office in Korea.

Direct Sales from the UK

The simplest market entry option is for UK companies to sell or license a particular smart city technology directly to Korean end-users. The main downside of a direct sales approach is the lack of local language and time-zone support, as Korean customers tend to be particularly demanding of their suppliers. This can be mitigated by using a local agent or business development consultancy capable of bridging time-zone, language and cultural gaps without the long-term commitment of local incorporation and hiring. Market-specific factors to consider include:

- Do we have a strong differentiator – something that sets us apart from our competitors in the market?
- Do we have a strong track record in other major markets? Korean companies are not easily convinced to use a new, disruptive technology as a first-mover without case studies
- Are we willing to localise the product for the market and/or for local regulations, if necessary?
- Are we ready to provide a Proof of Concept (PoC) at little or no cost to the customer? Korean companies will look to drive the price down and will not commit before proving the value through testing
- How do we provide after-sales support? Korean customers expect high-quality, local-language support
- Do we understand the local regulations, particularly in relation to data? Do we need to adjust our business model to adapt?

Appointing a Reseller or Distributor

A more common way to approach the market is to seek a partnership with an established local company which complements your product, has experience in the target sector and can help navigate the legal environment. A local channel partner can provide services such as certification, registration, pre-sales, sales, consulting, installation, technical training, service maintenance and technical support in the Korean market. Even large multinationals take this route in the early stages of market entry. Market specific factors to consider when seeking a partner include:

- Does the partner already serve the type of customer that we do?
- Does the partner have a good understanding of the market in general and my particular application?
- Does the partner already offer solutions similar or complementary to our offering?
- Is the partner focused on short-term wins or will they be able to drive our business in the long run?
- Does the partner have specific experience with public sector projects?
- Are we comfortable communicating with the local partner and are they transparent with us?

Establishing a Local Presence

There are broadly three ways of establishing a local presence: (1) a liaison office, (2) a branch office or (3) a local corporation through foreign direct investment (FDI). Setting up a liaison office is a simple process; but a liaison office can only perform non-profit generating activities in Korea such as market surveys, research and development and quality assurance. Setting up a branch office can be a complicated process that requires documentation to be translated, but it allows for sales activities and the exchange of revenues with the head office. The most common process for an overseas company to open a branch office in Korea is through FDI, where an initial investment exceeding approximately GBP 68,000 is made by the head office, which in return owns stock in the branch. The local corporation leads independent activities and is authorised to perform direct transactions. Market-specific factors to consider when establishing a local presence in Korea include:

- Is our business generating enough revenue in Korea to consider a local presence? Businesses usually consider establishing a local presence after several years of sales (either direct or through a partner)
- Is Korea a strategic market for us, either in terms of securing use-cases or securing further funding?
- Do we need to engage in profit generating activities?
- Will we transfer staff from our head office or hire local staff? In Korea, visas can be difficult to secure for foreign employees and social insurance contributions and severance pay must be paid to all staff that complete one year of employment. An employer's share of these costs equates to 18% of salary
- What location shall we pick for our local presence? Scouting, negotiating, and conclusion of contracts are time-intensive processes that often are hard to conclude without local support.

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