Artificial Intelligence South Korea

Market Intelligence Report

Department for International Trade
Report prepared by Intralink Limited

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TECHNOLOGY IS GREAT
BRITAIN & NORTHERN IRELAND

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Our mission is to make companies' growth in overseas markets fast, easy and cost effective.

We have 80 multilingual employees, a 28-year track record and offices in London, Silicon Valley, Boston, Shanghai, Tokyo, Seoul and Taipei. We enable Western companies to expand in Asia, and Asian companies to expand in the West.

We do this by providing the in-country expertise to identify a company's market opportunity, secure sales and drive its business growth. Our teams are immersed in the business practices, cultures and customs of their local markets.

And we are different from other consultancies as we do not just develop market expansion strategies for our clients – we play a hands-on role in building their businesses.

Through our Surrogate Sales Program™, we close deals, generate revenues and, when a client is ready, help them set up a permanent in-country presence through a local subsidiary, partnership or acquisition.

We also offer a range of additional services including market opportunity assessments, distributor and supplier searches, investment co-ordination and local representation.

Our clients are companies from start-ups to multinationals in the automotive, energy, healthcare, electronics, telecoms and other high-growth sectors. We also work with governments and economic development agencies to promote exports and attract foreign direct investment.

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1. Introduction

South Korea's (Korea) tech industry, led by its local consumer electronics giants, Samsung and LG, has been experimenting with artificial intelligence (AI) since the 1990s — with mixed commercial results. However, a sense of urgency took hold in 2016 when AlphaGo, an AI programme developed by UK-based DeepMind Technologies, defeated Korean national, Lee Sae-Dol, at the traditional Chinese board game of Go in Seoul. This event captivated the nation and led to an explosion of interest in AI, with the government scrambling to set up AI research institutes and outline a national AI strategy, while private companies established or greatly expanded their in-house AI divisions.

With the more optimistic numbers reporting an AI market worth GBP 4.4 billion in 2016 and over 6,000 AI-related patents filed over the past 12 years, the AI market in Korea is booming. The next several years will see an increase in the commercialisation of AI products and services in both the domestic marketplace and in consumer goods developed in Korea for international markets. Despite this flurry of activity, Korea is still estimated to be two to three years behind other technologically-advanced countries in terms of core AI technology and many large domestic players continue to rely on imported AI technologies.

To bridge this capability gap, the large Korean conglomerates are investing heavily in AI research and increasingly taking equity stakes in AI firms. Samsung Electronics, the fourth largest investor in start-ups globally, recently announced that every product the company makes will have baked-in artificial intelligence by 2020 and is in the process of establishing multiple new AI labs around the world. Similarly, Naver, which owns and operates Korea's largest internet search engine, has invested around GBP 100 million in its AI subsidiary, Naver Labs, and created a GBP 90 million fund with a view to investing in promising AI start-ups in Europe.

Since President Moon Jae-In came to power in May 2017, his administration has sharpened its focus on AI by pledging to increase investment in the area, create an open and facilitating ecosystem and enact business-friendly legislation. AI is one of the four pillars of the Moon administration's policy plan for the so-called Fourth Industrial Revolution. The administration is placing particular emphasis on application areas in the public domain such as healthcare, transport and security. The new government has also identified the country's strict laws regarding personal data as a key stumbling block for innovation within AI and is drawing up policies to overcome these hurdles.

All of this has created fertile ground for overseas AI companies to find eager local partners. Key opportunity areas for UK AI companies include autonomous vehicles (e.g. V2X, LiDAR sensors, ADAS, etc.), digital healthcare (e.g. visual recognition, smart diagnostics, hardware, etc.), AI-based financial services (e.g. robo-advisors and fraud detection) and AI assistants. Further, there is a growing awareness among the country's tech community that the UK is a world leader in the field of AI, so British companies with the right go-to-market strategy should find a warm reception among potential Korean customers and partners.

2. Korea – An Overview

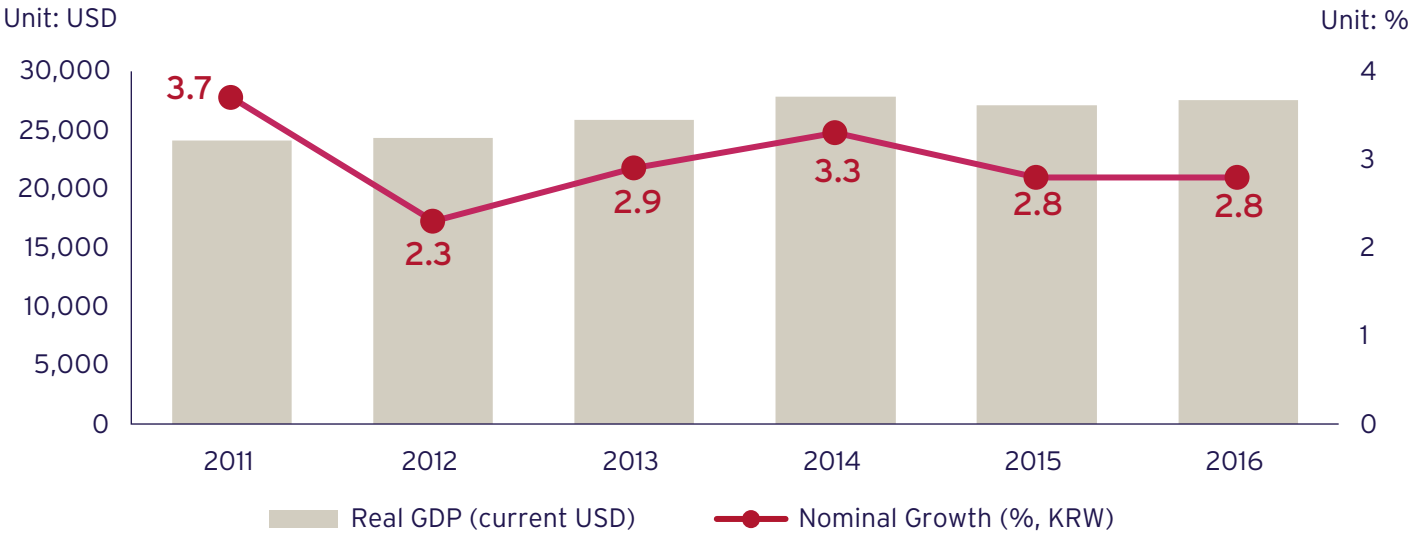
KEY POINTS

- Korea has climbed out of poverty to become a technology powerhouse over the last 60 years
- The country is the world's 11th largest economy with a GDP of just over GBP 1 trillion
- It has maintained an annual GDP growth rate of around 3% in recent years

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 areas of electronics and information communications. As well as dominating the global semiconductor industry, Korea has leap-frogged its peers in terms of ICT infrastructure (smartphone penetration rate, broadband speed, etc.) and this fact, coupled with a demanding and technology-embracing population, means Korea is becoming an economy driven by creativity and innovation.

With a population of 51 million people, Korea boasts the 11th largest economy in the world, a GDP of GBP 1.11 trillion in 2017 and a per capita GDP of GBP 22,218 in the same year. Whilst not experiencing the growth witnessed in China, the country has maintained strong annual growth for a developed economy of around 3% in recent years, outpacing its regional rival, Japan. Korea's trade dependency ratio is extremely high at over 80% and its economic performance is heavily affected by the economies of China, the US and Japan. Trade and investment flows between Korea and the EU are growing as a result of the FTA that came into effect in 2011. Trade between Korea and the UK specifically has grown rapidly over that period and both countries have expressed a strong desire to conclude a trade deal once the UK leaves the EU.

Figure 1: Korean GDP per Capita (2012 – 2017)



Source: World Bank

3. The AI Industry in Korea

KEY POINTS

- The Korean conglomerates or chaebol started experimenting with AI as early as the 1990s
- The Korean AI market lags the US and Japan but is expected to double to GBP 7.6bn by 2020
- Key players include Samsung Electronics, Hyundai Motors, SK Telecom, KT, LGU+, Naver and Kakao
- The relative strengths of Korea's AI industry include voice/image recognition, machine and deep learning and high-performance computing
- There are a number of ongoing, government-supported AI projects in the automotive, medical and consumer electronics fields as well as other areas

While the AI industry in Korea is developing at a remarkable pace, estimates of the AI market size show great discrepancy due to undefined market boundaries and overlap with other markets (e.g. IoT and Big Data). Using relatively inclusive metrics, the Ministry of Science and ICT estimated the value of the Korean AI market at GBP 4.4bn in 2016. Judging from the nearly 6,000 AI-related patents that have been filed by Korean companies over the past 12 years (over 3,000 of which were registered by Samsung Electronics alone) the AI market in Korea is flourishing. The billions of dollars invested in AI-focused R&D and acquisitions by big Korean conglomerates such as Samsung Electronics and SK Telecom, as well as IT giants Naver and Kakao, also illustrate the strong growth the Korean AI sector is experiencing.

The Korean AI market nevertheless still lags the leading nations in the field. According to the Institute for Information & Communications Technology Promotion (IITP), Korea's AI technology is 2.6 years behind its technologically-advanced peers and its AI technology stands at 79.3% of the development level of the US. In 2015, AI-related start-up companies in Korea accounted for as little as 2.5% of global AI-related start-up companies. By comparison, Korea's ICT industry enjoys a 10% market share of the global ICT market. Further, a recent study by the Korean Institute of Intellectual Property asserts that Korea's AI software technology is only at 75.1% of the development level of the US, a fact that underscores the country's relative weakness in software in contrast to its world-class hardware capabilities.

Figure 2: Comparison in AI Technology

(US = 100)

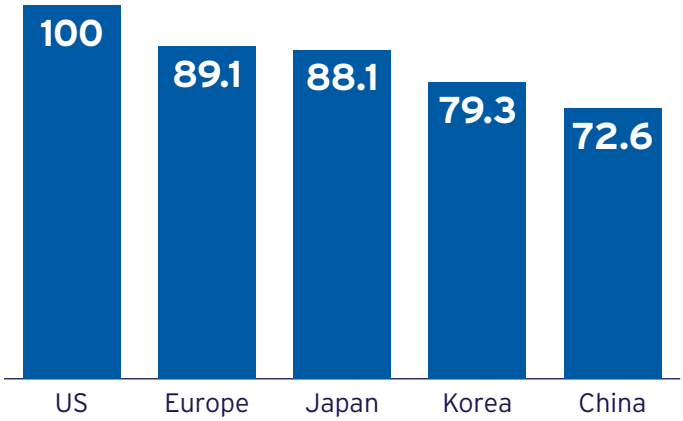
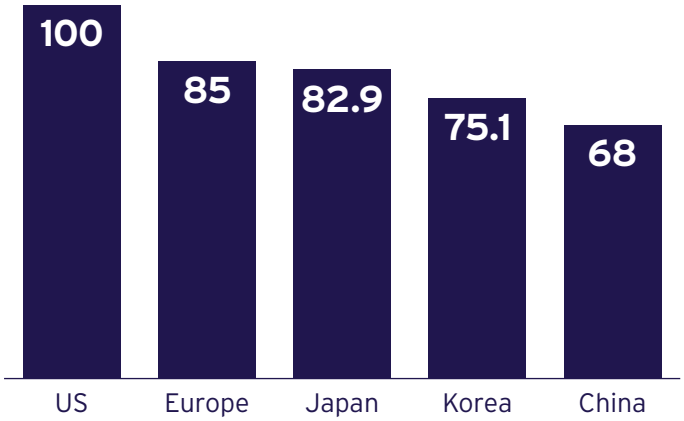


Figure 3: Comparison in Intelligent Software

(US = 100)



Source: Institute for Information & communications Technology (IITP)

Industry Insider's Thoughts

The Korean government often emphasises the importance of AI in the Fourth Industrial Revolution. In Korea, the Fourth Industrial Revolution is often even referred to as the 'Intelligence Revolution'.

Director – ICT Policy Planning Team – Institute of Information & communications Technology (IITP)

3.1 AI Ecosystem and Key Players

Although the Korean government plays a relatively active role in shaping the overall direction of AI research efforts, the chaebol – Korean conglomerates often involved in numerous disparate sectors and businesses – are the key players in the field. In recent years, many conglomerates have established AI research centres, either in-house or as separate "lab" structures designed to afford a degree of autonomy away from the day-to-day operations of the company.

Samsung Electronics, the fourth largest investor in start-ups globally, recently announced that every product the company makes will have baked-in artificial intelligence by 2020. To this end, Samsung founded new centres for AI and Big Data within the Video Display Business unit of Samsung Electronics and will open three AI R&D labs in the UK, Canada and Russia in 2018. Similarly, Naver, which owns and operates Korea's largest internet search engine, in early 2017 reorganised the AI team established in 2012, Naver Labs, as a separate subsidiary in order to develop new technology based on ambient intelligence. Naver has initially invested around GBP 100 million in the subsidiary on top of an injection of roughly GBP 90 million in a fund meant for investments in promising AI start-ups in Europe.

Along with rearranging their internal organisations, the key players are also attempting to recruit professional researchers to staff their newly formed AI teams and divisions. However, due to the dramatic surge in demand for personnel with AI experience, Korean companies are struggling to recruit skilled engineers. AI professionals in each company interviewed for this report implied that the pool of candidates with sufficient knowledge of AI technology is limited and attracting and retaining key talent is a challenge.

Table 1: Key Players and Reorganisation Plans

Company	Industry	Reorganisation and New Recruitment
Samsung Electronics	Electronics	Created lab in Video Display Business Unit on top of three overseas R&D centres
Hyundai Motors Group	Automotive	Established an autonomous vehicle safety research centre "Intelligence Artificial" with a centre head who has a background in GM
SK Telecom	Telecom	Established an "AI tech centre" under the direct supervision of the CEO
KT	Telecom	Appointed key personnel for "eBrain" from MIT
LG U+	Telecom	Created "AI service business unit" and dispatched 80 personnel to this unit
Naver	IT	Established R&D subsidiary "Naver Labs" which focuses its research on AI, robotics, and autonomous driving
Kakao	IT	Established AI subsidiary "Kakao Brain" headed directly by a former Kakao Chairperson
SK Planet	Platform	Is boosting its AI capabilities in part by recruiting AI experts from Kakao and Naver

Source: Chosun BIZ

Another sign of the AI boom in Korea is that even large, established companies are eager to cooperate not only with foreign AI-related companies, but also with domestic start-ups. As a result, large companies are anxious to acquire or form partnerships with start-ups with promising technology in order to reduce the technological gap with countries that have more advanced AI expertise.

For instance, Samsung Ventures has already invested in several start-ups globally and is planning to establish a billion-dollar fund to acquire and take equity in promising AI-related start-ups. At the Consumer Electronics Show (CES) in 2017, LG Electronics confirmed that it had established partnerships with Amazon related to Amazon's Alexa voice assistant product. Under the partnership, Amazon's Alexa technology will be embedded into LG home appliances and will be operated by the SmartThinkQ hub which connects LG's home appliances through the internet. Also, SK C&C, an IT systems integrator affiliated with the third-largest conglomerate in Korea, SK Group, completed a deal with IBM Watson to commercialise "Aibril", a Korean version of Watson.

Industry Insider's Thoughts

Samsung Ventures invests in many AI-related areas – voice interfacing and graphics for photo and face recognition are the main verticals at the moment. We're looking at more general AI-platforms, though we're a bit more sceptical about this. We're also looking at AI-accelerator chips and next-gen hardware. Our London office is active in investing in AI.

Director – Samsung Ventures

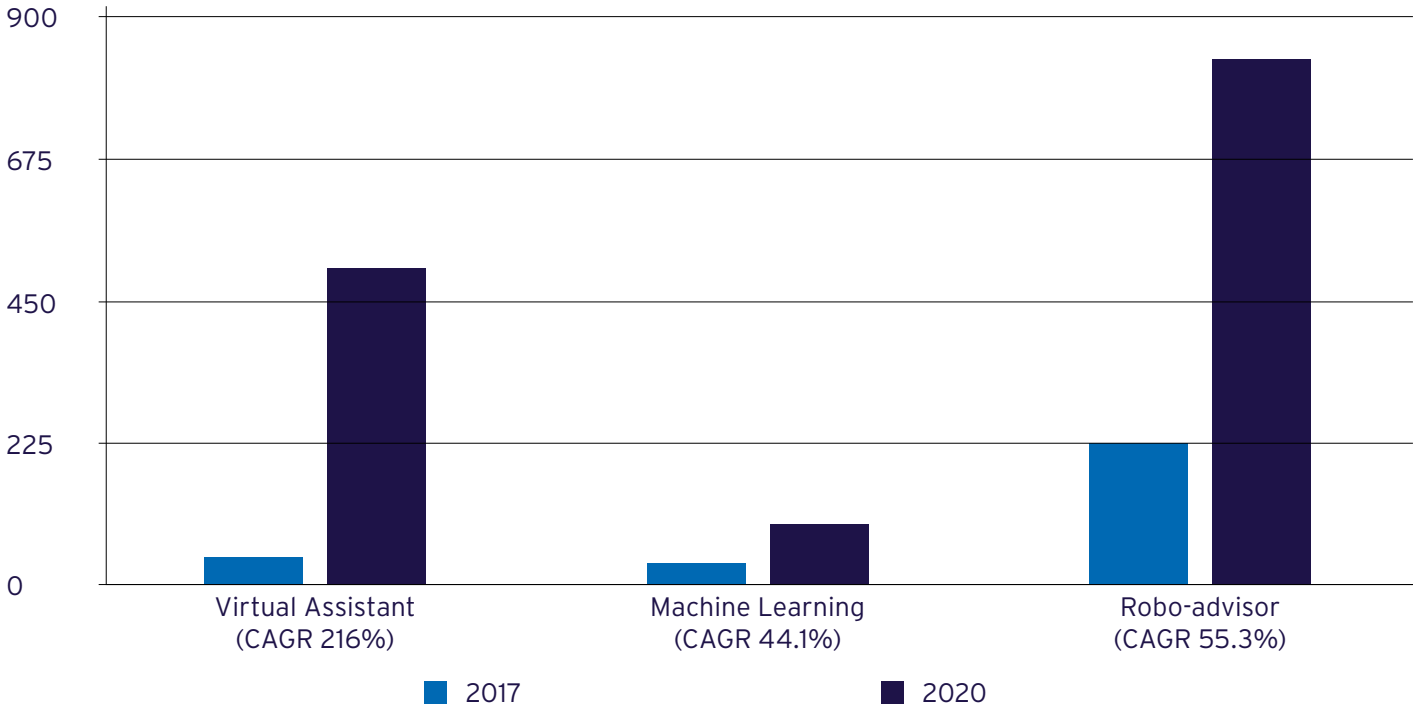
Figure 4: AI Ecosystem

3.2 Korea's Areas of Strength

Korea takes great pride in its ICT infrastructure and high connectivity. The recent successful testing of a 5G network during the Pyeongchang Winter Olympics was an example of Korea's strength in this area. The world-class ICT infrastructure has created a wave of hyper-connectivity throughout the country which has resulted in a sharp increase in AI-based virtual assistants on the market. KT's GiGa Genie and SK Telecom's Nugu dominated domestic sales in 2017 with 400,000 and 350,000 units sold respectively. Together with the launch of Samsung's Bixby, this meant a 658% increase in market size as compared to 2016. This trend is forecast to continue with a CAGR of 216% projected for the period 2015-2020.

Fintech was another area that witnessed rapid growth in 2017, with the Korean cryptocurrency craze generating global headlines. Another fintech-related, AI-based technology that is starting to gain traction in Korea is the robo-advisor, a technology that is mainly used as a wealth management tool. The robo-advisor market in Korea increased 55% year-on-year to GBP 225.7 million in 2017. This growth is expected to continue, resulting in a market worth GBP 845 million by 2020.

The underlying natural language processing (NLP) and machine learning technologies are part of the reason the virtual assistant and robo-advisor markets have such positive outlooks. Although the technologies generate less revenue than the end-products they are integrated into, the technologies themselves make for a considerable market opportunity. According to the Korea Institute of Science and Technology Information (KISTI), the machine learning market in Korea was GBP 32.4 million in 2017 and is forecast to grow at 44.1% year on year to GBP 96.7 million by 2020. The NLP market is estimated to be worth GBP 370 million by the same year.



Source: Korea Institute of Science and Technology Information (KISTI)

4. Government Initiatives

KEY POINTS

- The Korean government has assumed a leading role in promoting Industry 4.0 and funding AI research
- Government-funded projects pose opportunities for foreign AI-tech companies
- Korea is seeking to commercialise AI in areas including machinery, robotics, medical devices, cybersecurity and semiconductors
- The Moon Jae-In administration is working on regulatory and ethical frameworks to support the industry. One key roadblock is complicated personal information protection laws

4.1 Government Policy on AI

When President Moon Jae-In took office in May 2017, two of his main campaign promises were the creation of jobs and an economic policy based on 'innovative growth'. As his government policy started taking shape over the course of 2017 and early 2018, it became clear that the fourth industrial revolution will take a central place in achieving these two goals, especially after Moon established the Presidential Committee on the Fourth Industrial Revolution and the Ministry of SMEs and Start-ups.

Artificial intelligence is one of the four concrete goals of the Moon administration's science and technology policy plan for the fourth industrial revolution. The administration gives priority to businesses that are active in the public domain such as healthcare, transport and security. The policy directive mentions a strategic expansion of AI's core technology and the creation of a co-operative ecosystem. Vision and voice recognition and natural language processing were explicitly mentioned as the main drivers of AI technology and therefore a focus for the policy initiative. Another focus is the creation of supercomputing hardware and software.

The Ministry of Science and ICT recently made public its plans to increase R&D investment in AI. Plans include the opening of an AI Open innovation hub with machine learning, open APIs and computing options to stimulate open and co-operative AI development. Another directive is to shift R&D focus to mid to long-term research with a timeline of over 10 years becoming the average instead of the current three. The Ministry of Trade, Industry and Energy (MOTIE) policy plans place a focus on AI with respect to digital health (e.g. medical devices), autonomous vehicles (e.g. machine and deep learning algorithms) and energy (accurate estimates of renewable energy generation). Finally, the Ministry of Land, Infrastructure and Transport's plans will focus on developing AI to facilitate the development of autonomous vehicles, drones and smart cities.

4.2 The Government Investment Plan

As AI continues to become a more important component of the government's overall industrial policy, investment amounts are increasing rapidly and the specific areas for investment are changing. In 2017, the government announced it would increase its total AI R&D budget for that year from GBP 74.7 million to GBP 110 million, which represents a 47% increase over the 2016 budget. The government plans to invest GBP 42.7 million in core technologies such as natural language processing, neuro networks and machine and deep learning, while investing GBP 49.9 million in AI software and GBP 17.4 million in AI-related hardware (Table 2). Two long-term projects that have been ongoing for around five years will be explained in this sub-section, as well as the application and commercialisation of AI in government demonstration projects (Table 3).

Exobrain

Exobrain is the Korean equivalent of IBM Watson, with the goal to develop AI software for natural language processing that enables human-machine communication. The Electronics and Telecommunications Research Institute (ETRI), a non-profit government-funded research organisation, is in charge of developing the AI. The government plans to invest approximately GBP 74 million and, by 2023, hopes to develop the Exobrain technology so it is capable of performing tasks such as responding to requests at call centres, working as an advanced computer and assisting drivers with navigation.

The Exobrain project has already resulted in technology that is capable of understanding natural language and providing correct answers on a contextual basis. In Nov ember 2016, Exobrain proved its capability by defeating four human champions in a famous quiz-show, "Janghak Quiz," on Educational Broadcasting System (EBS) in Korea. In 2018, the first phase of the project was completed and the moving targets for the project are being reassessed before commencing the second stage.

Deep View

Deep View is a computer vision project started in 2014 and due to be completed in 2024 at a total cost of GBP 74 million. It is led by ETRI and supported by university research centres. The goal of the project is to analyse large-scale data from both still images and video footage to understand multi-dimensional and time series changes in urban scale. Once fully developed, Deep View will be able to replace humans in a variety of applications such as industrial quality inspection, medical diagnosis, intelligent CCTV, online video platforms, autonomous vehicles and intelligent robots.

Table 2: AI R&D Budget Comparison – 2017 vs 2016 (GBP: million)

Research Field	2016 (A)	2017 (B)	Increase (A-B)	Rate of increase %
AI Software	27.5	49.9	22.4	81.5
AI Hardware	12.9	17.4	4.5	34.9
Base Technology	34.3	42.7	8.4	24.5
Total	74.7	110	35.3	47.2

Source: Ministry of Science, ICT and Future Planning

Table 3: Application and Commercialisation of AI in Government Demonstration Projects

Field	Sector	Content
AI Area of Demand	Machinery	Three projects including 1) smart construction 2) autonomous agricultural equipment and 3) artificial in-line injection moulding systems that can operate alongside workers in agriculture and production facilities
	Robots	Robot with social intelligence characteristics that can use autonomous judgment in unstructured situations, to be applied for efficient execution of existing repetitive tasks in logistics and manufacturing
	Ship-building	Development of augmented-reality based remote control systems capable of recognising and responding to maritime environment – for use in large merchant ships
	Drones	Development of unmanned aerial vehicle system capable of automatic return and self-diagnosis during wireless disconnection through image recognition and obstacle avoidance systems
	Medical devices	AI-based decision support systems utilising digestive and cardiovascular images; Development of diagnostic assistive system using bi-directional capsule endoscope
	Security systems	Development of a security system that utilises mobile robots, drones and image recognition etc
	Smart factories	Utilising Big Data and Deep Learning to accurately diagnose the health of production facilities and to develop productivity-enhancing management solutions
Base Technology	Semiconductor	Development of AI Systems-on-chip (SoC) semiconductors for server system that can process learning and judgment at high speed in real time
	Cyber Security	Deep learning-based cyber security technology with self-learning function to protect smart factories and service robots by detecting malicious software and hacking attempts

Source: Ministry of Commerce, Industry and Energy, "Artificial Intelligence Application Industrial Forum" Attached document, 2016.

4.3 AI-related Legislation

Personal information protection laws are strict in Korea, following a high-profile case in 2004 in which a massive amount of personal information from credit card companies was leaked. This has resulted in companies in Korea experiencing difficulties in obtaining sufficient data to develop AI technology. For instance, SKT, which has developed a voice-controlled AI service known as Nugu, cannot store information from users' voice input due to the stipulations of the Personal Information Protection Act. Without the ability to store data, the Nugu voice assistant cannot improve its predictive ability over time, unlike competitors in other countries. However, as AI continues to grow in importance, companies whose businesses depend on AI adaptation are lobbying for more business-friendly legislation. This primarily entails the shift from positive legislation, where technologies are only allowed if they are permitted by law, to negative legislation, where everything is allowed unless forbidden by law.

Industry Insider's Thoughts

Even domestic card companies cannot share user information because of confidentiality issues. When discussing with foreign companies, it's even more difficult. We once held discussions with a US company regarding collaboration on our card business, but due to differences in the regulations, the talks failed to produce any tangible results even though there was interest on both sides.

Manager – Samsung Card

The Moon administration is therefore seeking to strike a balance between ensuring adequate consumer protection and providing businesses the necessary freedom to innovate. As a result, the government intends to install a regulatory sandbox for new innovative industries, including AI. The introduction of such flexible regulation was formally announced in January 2018, with a Fintech sandbox launched in March. The sandbox entails an exemption from certain regulatory requirements for 'innovative' businesses, although the standards for determining which companies are considered 'innovative' are as yet unclear.

Closer Look

In 2016, a prominent Korean NGO sued Google over a case of non-identifiable personal information that had been revealed by WikiLeaks. A local court ruled partially in favor of the plaintiff, and requested that Google and Google Korea reveal what users' personal information had been passed on to third parties, such as the CIA in the US. Foreign companies were surprised by this ruling as it set a precedent that even local branch offices of foreign companies can be held accountable for actions that occurred entirely outside of Korea.

The government takes an active role in leading the growth of AI-related businesses and services in Korea. Although the conglomerates develop their own technologies, they shape their plans to align with the government's strategic objectives and vice-versa. Paying close attention to government plans is a useful way to decipher the AI market trends in Korea and companies can get updates on government bids from the following websites:

- Korea On-Line E-Procurement System: The Korean government uploads its projects to seek competitive bidding from interested parties. http://www.g2b.go.kr (Only available in Korean)
- A matching service system, operated by PPS (central procurement agency in Korea), on behalf of foreign buyers and Korean firms. http://www.globalkoreamarket.go.kr (Available in English)

5. Opportunity Areas for British Companies

KEY POINTS

- The Korean chaebol are becoming increasingly active in adopting an 'open innovation' approach and are keen to understand what foreign companies might have to offer
- Key opportunity areas in Korea for UK AI companies are autonomous vehicles, digital health, financial services and AI assistants
- R&D and commercialisation of technologies in these areas is supported by conglomerates, the government, academic institutions, start-ups and venture capitalists alike
- While home-grown solutions are treated preferentially, British companies that offer complete solutions can compete in the market

British AI companies have the opportunity to seek strategic partnerships that go beyond reselling their products in the Korean market. For instance, Samsung has been actively pursuing investment in foreign technology companies as a pragmatic way to maintain their competitiveness as a global player. Samsung aims to invest at different stages after identifying relevant start-ups. SKT and KT, Korea's top two telecommunication companies, are also looking to invest and form partnerships with foreign AI firms, especially in natural language processing.

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Industry Insider's Thoughts

Our CEO will soon visit the UK and other European countries to scout for new technology. Our team thinks the UK, Germany and the US are the three most attractive countries. We have announced that we will integrate AI technology into our existing network across the following five platforms: media, smart energy, financial transactions, disaster safety and enterprise public value.

Team Leader of AI Tech Center & Service – KT

This section identifies four opportunity areas for British companies in the AI sector: autonomous vehicles, digital health, virtual assistants and AI-based financial services. Whilst the latter two have already been mentioned earlier in this report due to their relatively large market size, autonomous vehicles and digital health also represent good opportunities due to their high CAGR (65.6% and 70.4% respectively), their inclusion in government development plans and the strong traditional markets to which they belong.

5.1 Autonomous Vehicles

Korea ranked 10th in KPMG's 2018 autonomous vehicle (AV) readiness index, ranking well in infrastructure (4th) and technology (9th), but less so in consumer acceptance (11th) and policy and legislation (14th). Nonetheless, Korea is planning on commercialising level 3 autonomous vehicles by 2019, making it a large potential market for UK businesses. Currently, 40 cars produced by 17 organisations have been permitted to be tested on public roads in Korea, including most recently Audi's A8 as the first foreign autonomous car. Korea is particularly strong in high connectivity areas with 5G networks being tested for vehicle-to-vehicle communication and the opening of the world's largest AV test ground (over 300 km2), called K-city.

Many large Korean conglomerates are active in the self-driving sector, including Hyundai Motors, Samsung Electronics and Naver. Hyundai Motors' flagship model is the fuel cell-based NEXO which successfully drove from Seoul to Pyeongchang completely autonomously during the Olympics. Hyundai aims to deliver level 4 autonomous cars by 2021 in partnership with US start-up Aurora. Samsung Electronics, on the other hand, focuses on the platform side of autonomous vehicles and established the Samsung Automotive Innovation Fund, which manages GBP 211.6 million for connected car development. Samsung also acquired Harman International in 2017 to develop infotainment systems. Naver was Korea's first IT company to get involved in the self-driving car business as early as 2012 and has put a lot of effort in developing in-vehicle information systems. It has also invested in domestic and overseas sensor and mapping technology start-ups.

Rather than fully produced products, Korea's strength in autonomous vehicles lies in the technology, components and software that make up the end products. Although competition is increasing, areas such as V2X (considering the high connectivity in Korea), LiDAR sensors (especially price competitive ones), digital mapping and domain control units represent good opportunities for UK companies looking to enter the Korean market. The ADAS development level has risen in Korea due to some major acquisitions by Korean conglomerates but remains an area where Korea is playing catch-up with the world's best.

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Industry Insider's Thoughts

At Naver, we are focused on "ambient intelligence". By this, we mean being able to provide relevant services and information even before a user becomes accustomed to the environment. Cars are just the tools that help us move from point A to point B. We don't want to focus so much on the tools, but rather on in-vehicle information (IVI) systems that provide real-time information to make the passenger's journey more comfortable and meaningful.

Team Leader – Naver Labs

5.1.1 Case studies – Autonomous Vehicles

SNUver / SNUver 2	
Website	**www.snu.ac.kr**
Problem	Develop a system to deliver useful road information to autonomous car users
Key Technology	Cameras and sensors
Outcome	Korea's first certified autonomous car, drove 20,000 km without accident
Developed by	Seoul National University Intelligent Vehicle IT Research Center
Overview	SNUver is an urban self-driving vehicle software and SNUvi is the name of the car. SNUver was developed by the Intelligent Vehicle IT Research Center at Seoul National University (SNU). SNUver 2 is an updated version of SNUVer. During a two-year development period, SNUver and SNUver2 proved the performance by demonstrating a track record of 20,000 km of accident-free driving. In March 2017, SNUver2 received a special licence plate from the Ministry of Land, Infrastructure and Transport (MOLIT) that acknowledged it as the first autonomous car in Korea. Last year, SNUver secured level 3 highway driving support technology (HDA3 - based on the US National Highway Traffic Safety Administration's guidelines).

Naver Labs	
Website	www.naverlabs.com
Problem	Compete with global IT companies in the autonomous drive market
Key Technology	Cameras and deep learning
Outcome	Korea's first IT autonomous vehicle developed by a private IT company
Developed by	Naver Labs
Overview	Naver Labs, established in January 2017, is an R&D subsidiary of Korea's largest internet portal and search engine operator – Naver Corp. The division was formed in 2012 within Naver, but was later re-established as a separate company, like Google X, to allow for greater independence. Naver Labs' autonomous vehicle has achieved an automation capability of Level 3 based on the US standards of Society of Automotive Engineers (SAE). Level 3 refers to conditional automation with near self-driving capability backed by sensors and cameras. In 2018, Naver Labs is planning to secure Level 4 technology, regarded as full automation.

5.2 Digital Healthcare

The Korean healthcare system is unique in that, while hospitals in Korea are categorised as non-profit organisations, they are run more like companies. This means they compete to attract patients and are highly receptive to new technologies. The industry is dominated by a handful of large players which operate networks of branch hospitals. Over 80% of outpatients visit the top five hospitals: Seoul Asan Hospital, Samsung Seoul Hospital, Seoul National University, Severance Hospital and St Mary's Hospital. The dominance of a small number of large hospitals, coupled with Korea's advanced ICT infrastructure, facilitates the integration of new technology and makes the country an excellent test bed for new applications.

The Korean digital health sector is most developed in terms of visual recognition. Samsung started the domestic digital health trend with its affiliate, Samsung Medison in 2014. The company specialises in diagnostic ultrasound systems, with its breast cancer diagnosis system 'S-detect' being its most prestigious system until now. Korean start-ups in the visual recognition field have also started receiving global attention with Lunit posing the most representative case. Lunit has developed data-driven imaging biomarker (DIB) technology that is derived from large-scale medical image data. This deep learning technology defines important diagnostic features without guidance from previously established medical criteria, expanding diagnostics beyond the current status quo. Apart from visual recognition, Korean hospitals have mainly adopted foreign technologies such as the medical data analytics technology, 'IBM for Oncology'.

Industry Insider's Thoughts

Korean companies' weakness is managing innovation – they won't finance projects unless they are ready for the market. Between "innovation" and "advanced development", creativity is important.

CEO – Neurocontrols

With domestic companies focusing on visual recognition technologies and IBM Watson growing its presence in the data-driven diagnostics spectrum, opportunities for UK businesses lie in areas that complement these technologies and solutions, such as hardware and machine and deep learning algorithms. Moreover, underdeveloped areas such as AI-assisted medicine development and personal health management pose opportunities for UK businesses that have built up expertise in these fields – even more so since they have been designated as priority areas by multiple government agencies.

Table 4: Current AI Developments in Hospitals

Hospital Name	Current Status of Development in AI Technology
Seoul National University	Plans to develop a new hospital information system
Yonsei University	Plans to develop disease prediction service based on big data
Seoul Asan Hospital	Plans to open a business group focused on analysing medical images
St. Mary's Hospital	Developing radiation cancer treatment technology with Stanford University
Ajou University Hospital	Developing solutions to predict the number of emergency patients in ICU

Source: Yonhap News

Industry Insider's Thoughts

Implementing AI in the health care industry, especially in Korea, would be very useful, where the after-care service for patients is weak. Since it is expensive to monitor all patients after medical treatment, managing records of diagnosis and medicines through AI would help in tracking patients' health.

CEO - Healthcare Chatbot Inc.

5.2.1 Case studies – Healthcare

Neurocontrols (NC)	
Website	www.neurocontrols.com
Key Technology	"Cognitive sensors" that are intelligent enough to act as filters
Outcome	Neuromorphic sensor solutions for medical applications
Developed by	Neurocontrols
Overview	Neurocontrols is a German-Korean AI system integrator that provides cognitive sensors and cognitive computing for sound, vision, motion and data. Rather than processing most data in cloud solutions, Neurocontrols is using "cognitive sensors" to minimise the amount of data that needs to be sent to the cloud. In Europe, the company is active in the automotive and aerospace industries, while in Korea, the company is focusing specifically on the medical industry. The company notes several important reasons for this focus: • The medical industry is an excellent field for AI and cognitive sensors in particular with many "simple" applications, such as cell classifications • Korea is one of the best markets for medical products and devices worldwide as hospitals are in constant competition to showcase their latest technology as a means of attracting patients • Korean data privacy laws are strict. Performing as much analysis as possible at the sensor level helps ensure compliance with regulations

Gacheon University Gil Medical Center	
Website	www.gilhospital.com
Key Technology	IBM Watson
Outcome	Provide more efficient and reliable diagnoses and treatment plans
Developed by	Gil Hospital and IBM Korea
Overview	Gacheon University's Gil Medical Center is ranked in the top three research hospitals in Korea. In December 2016, the hospital decided to adopt IBM Watson for Oncology to suggest treatment options automatically based on multiple criteria related to the patient's condition. IBM Watson has helped set Gil Medical Center apart from its peers. Watson's implementation caused an increase in the number of patients visiting Gil Medical Center, with many patients proving receptive to following treatment options recommended by Watson rather than by human doctors. One year after its implementation, around 300 cancer patients had used the Watson system.

5.3 AI-based Financial Services

Although Korean financial service institutions have a reputation for taking a conservative approach to business, they cannot escape the impact of AI and are now building their own AI-based ecosystems. Customer-facing AI-based solutions have been implemented actively across the banking, securities, credit card and insurance industries to provide customer consultation services for their respective products. A survey conducted by the Korean Ministry of Science and ICT showed 28% of large companies in the finance sector have either integrated AI technologies or are looking to integrate them in the near future.

According to the head of the Korean Advanced Institute of Science and Technology (KAIST) Center for Wealth Management Technologies, as the market for retirement pensions expands due to an aging society, more people are becoming interested in receiving financial advisory services in Korea. Also, due to historically low interest rates, more investors want access to alternative asset management services and so-called "robo-advisors" are expected to gain a strong following. Until recently, investment advisory services were exclusively available to investors with a minimum net worth of GBP 70,000. However, as start-up fintech companies enter the market in the discretionary service sector, small investors with as little as GBP 3,500 in assets are now eligible to employ advisory services.

The ecosystem and regulations have been adapting to keep pace with the rapidly expanding market. Starting from September 2016, a test bed of around 30 robo-advisors was allowed to begin operating, overseen by the Financial Services Commission. In parallel, changes to the Financial Investment Services and Capital Markets Act granted more leew ay to robo-advisors, allowing them to operate autonomously as long as certain qualifications are met. These changes were made possible by the relaxation of personal data-related policies.

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Industry Insider's Thoughts

Until recently people were not interested in data. However, this changed suddenly and 90% of financial data in Korea has been accumulated in the last two years. This data enables us to predict users' financial behaviour. By training the data, we produce prediction functions and models which provide insights into the future. Better prediction equals less risk.

Co-founder - Solidware

Considering the growing consumer and financial sector acceptance of the concept, UK businesses active in the robo-advisor sector could have considerable opportunity in Korea. In particular, wealth management solutions for personal finances, stocks, and savings could burgeon in Korea. Another opportunity area for UK businesses is fraud detection. This area is underdeveloped in Korea compared with global competitors and could prove to be a profitable opportunity.

5.3.1 Case studies – Financial Services

KakaoBank	
Website	www.kakaobank.com
Problem	Reduce hassle of personal banking and provide 24/7 service via mobile
Key Technology	Robo-advisor and big data
Outcome	Personal finance platform with automated customer service
Developed by	Kakao Corp. (KakaoBank and KakaoTalk)
Overview	Traditional Korean banks have a reputation of being bottom-heavy – with large numbers of brick-and-mortar branches and clerical staff – and not up-to-date with the latest IT trends in banking. In 2015, the government announced a plan to launch Korea's first online-only banking service and invited the tech and finance communities in Korea to participate in a tender. Kakao Corp was one of the two initial companies to be awarded a licence to operate such a business. KakaoBank launched in July 2017. The business model was to attract customers via Kakao Corp's flagship product – the KakaoTalk messenger application, which enjoys an overwhelming 95% of the Korean mobile messenger market. KakaoBank offers services similar to those of commercial banks but the services are only available via mobile app and online. By January 2018, 165 days after its launch, people had opened over 5 million accounts.

Shinhan Bank Fan Paybot	
Website	www.shinhan.com
Problem	Give users more control over card usage and use their spending patterns to promote tailored financial product offerings
Key Technology	Robo-advisor and big data
Outcome	AI "personal secretary" service providing advice on credit/debit card spending
Developed by	Shinhan Bank and Shinhan Data System
Overview	Shinhan Card is the first card company to apply AI algorithms to its app, allowing customers to track and manage their spending habits. The "Fan Paybot" product takes the role of a "personal secretary." Once users have accumulated three months of card usage records, an AI-algorithm automatically analyses the data and categorises spending so that customers can keep track of expenditures. In early 2017, Shinhan Card established a new business unit, AI Lab, to continue developing the functions of the Fan Paybot.

5.4 AI Assistants

As previously mentioned, the virtual assistant market currently represents one of the largest AI markets in Korea. Although the market size in 2017 was only just over GBP 40 million, the anticipated CAGR from 2015 to 2020 is an astonishing 216%. Chatbots, which rely on natural language processing and machine learning, also show a promising expected CAGR of 51% over the same period. Key players in the telecoms (KT and SK Telecom), electronics (Samsung Electronics) and IT (Naver and Kakao) industries have all developed their own virtual assistant and see this as the foundation to their future AI strategies.

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Industry Insider’s Thoughts

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Co-founder - Solidware

Korean messaging services, including KakaoTalk from Kakao Corp and Line from Naver, incorporated AI technology into their existing messaging services. In addition, Naver, the largest portal service in Korea, created APIs for its “AMICA” chatbot platform which it plans to open to the public to allow other companies to utilise Naver’s natural language understanding (NLU) technology. The shift of focus in 2017 from text to voice bots has also created interest from Korea’s top two telecommunications companies, SKT and KT.

Korean companies enjoy a relative strength in chat and voice bots for the domestic markets, as such services are highly dependent on language-specific insights and technology. At the same time, this specificity is a limitation for Korean companies seeking to enter international markets, where global players such as IBM or Amazon can operate on an entirely different scale. Korean companies are highly aware of the need to engage with partners abroad in order to grow their international capabilities.

5.4.1 Case studies – AI Assistants

GiGA Genie	
Website	gigagenie.olleh.com
Problem	Allow users to "smartly" control their home and entertainment using voice
Key Technology	Smart assistant / chatbot
Outcome	"World's first" AI-based Internet TV service
Developed by	Korea Telecom (KT) and ETRI
Overview	In January 2017, KT unveiled its AI-based set-top box dubbed "GiGA Genie", which allows users to interact with the device through natural conversation. KT has formed partnerships with leading construction companies in Korea to integrate Genie services into newly-constructed apartment buildings. For example, through voice commands, residents will be able to call a lift before stepping out of their apartments, thereby minimising waiting times.

Nugu	
Website	www.nugu.co.kr
Problem	Allow users to "smartly" control their home and entertainment using voice
Key Technology	Smart assistant / chatbot
Outcome	AI-powered speaker / assistant
Developed by	SK Telecom
Overview	In September 2016, SK Telecom unveiled its AI-based assistant, "Nugu". Through voice commands, users can play music, get weather and traffic information, search the internet and shop online. Furthermore, SK has established partnerships with local construction companies to embed Nugu in newly-constructed apartment buildings.

6. Market Entry Strategies

KEY POINTS

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

Korea offers many opportunities for UK businesses, with most Korean conglomerates actively investing in AI-focused R&D and start-ups. The country hosts a rapidly-developing local AI market and a highly-developed ICT infrastructure, which creates a solid foundation for foreign businesses to test and introduce their AI technology. However, UK businesses looking to engage in a strategic partnership or 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 AI 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 companies tend to be particularly demanding of their partners. This can be mitigated by using a local agent or business development consultancy, such as Intralink, 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

Appointing a Reseller or Distributor

A more common way tot 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, perhaps a systems integrator (SI), can provide services such as pre-sales, sales, consulting, installation, technical training, service maintenance, technical support and system integration 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

In conclusion, the Korean AI market offers strong opportunities to UK companies but, whichever option a UK company selects to enter the market, these and other business and cultural considerations must be addressed, and local support often proves invaluable in the market entry process.

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